Refleksi

elemen simbolik ekspresi Nuklear Malaysia

NUKLEAR MALAYSIA

2023

Refleksi

elemen simbolik ekspresi Nuklear Malaysia

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PRAKATA

Majalah Refleksi 2023 kali ini memuatkan 202 koleksi poster hasil gabungan idea kreatif dan berinformasi dari Agensi Nuklear Malaysia (Nuklear Malaysia). Kesemua poster ini telah dipamerkan semasa program pameran, seminar dan konvensyen di peringkat kebangsaan dan juga antarabangsa. Antara program kebangsaan yang terlibat adalah seperti Konvensyen Teknikal Nuklear Malaysia, Minggu Sains Negara dan *Technology Preview & Showcase*. Manakala program yang disertai di peringkat antarabangsa termasuklah International Nuclear Science, Technology and Engineering Conference (iNUSTEC), *International Invention, Innovation & Technology Exhibition* (ITEX) dan *Selangor International Expo* (SRIE).

Majalah Refleksi berperanan menyampaikan ilmu serta mempromosi perkhidmatan dan penyelidikan yang dilaksanakan oleh Nuklear Malaysia. Ini adalah selaras dengan matlamat kerajaan melalui Dasar Sains, Teknologi dan Inovasi Negara 2021-2030 untuk mewujudkan masyarakat yang mampan, inklusif & saintifik ke arah negara berteknologi tinggi. Diharapkan majalah ini dapat memberi manfaat kepada semua golongan terutamanya mereka yang terlibat dalam bidang penyelidikan sains nuklear. Selain itu, usaha ini secara langsung menyokong aktiviti pengurusan pengetahuan dengan memudahkan pencarian maklumat agar lebih efektif dan efisyen.

Sejuta penghargaan diucapkan kepada semua yang telah menyumbang tenaga, idea dan masa, demi merealisasikan majalah Refleksi 2023. Semoga kerjasama erat dan sokongan dari semua pihak dapat diteruskan lagi pada masa akan datang. Nuklear Malaysia berharap agar majalah Refleksi menjadi platform perkongsian ilmu yang dipercayai dan terus kekal relevan dalam era digital kini.
Sekian, terima kasih.

Sidang Editorial

INTERNATIONAL INVENTION, INNOVATION & TECHNOLOGY EXHIBITION, MALAYSIA (ITEX)

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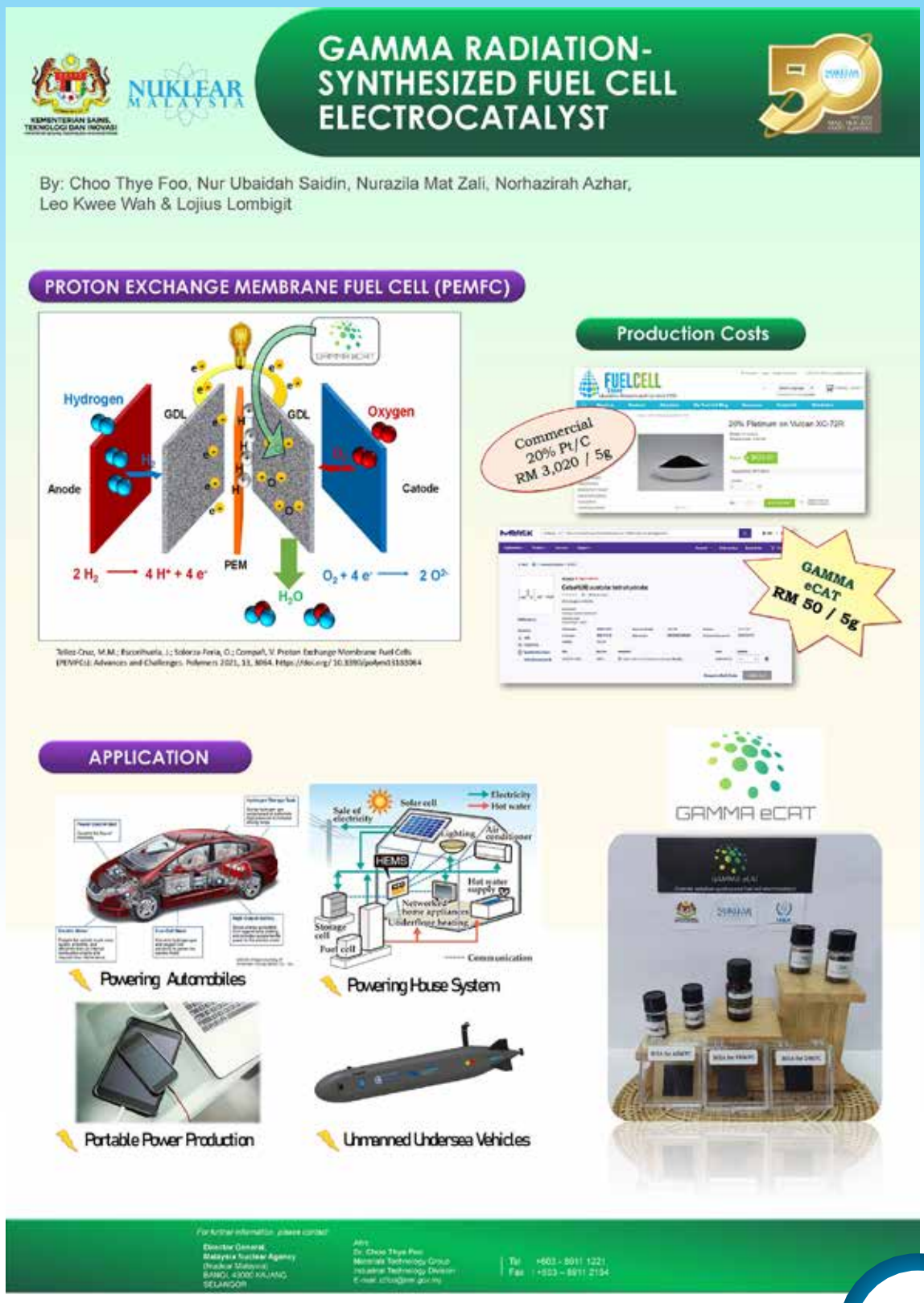

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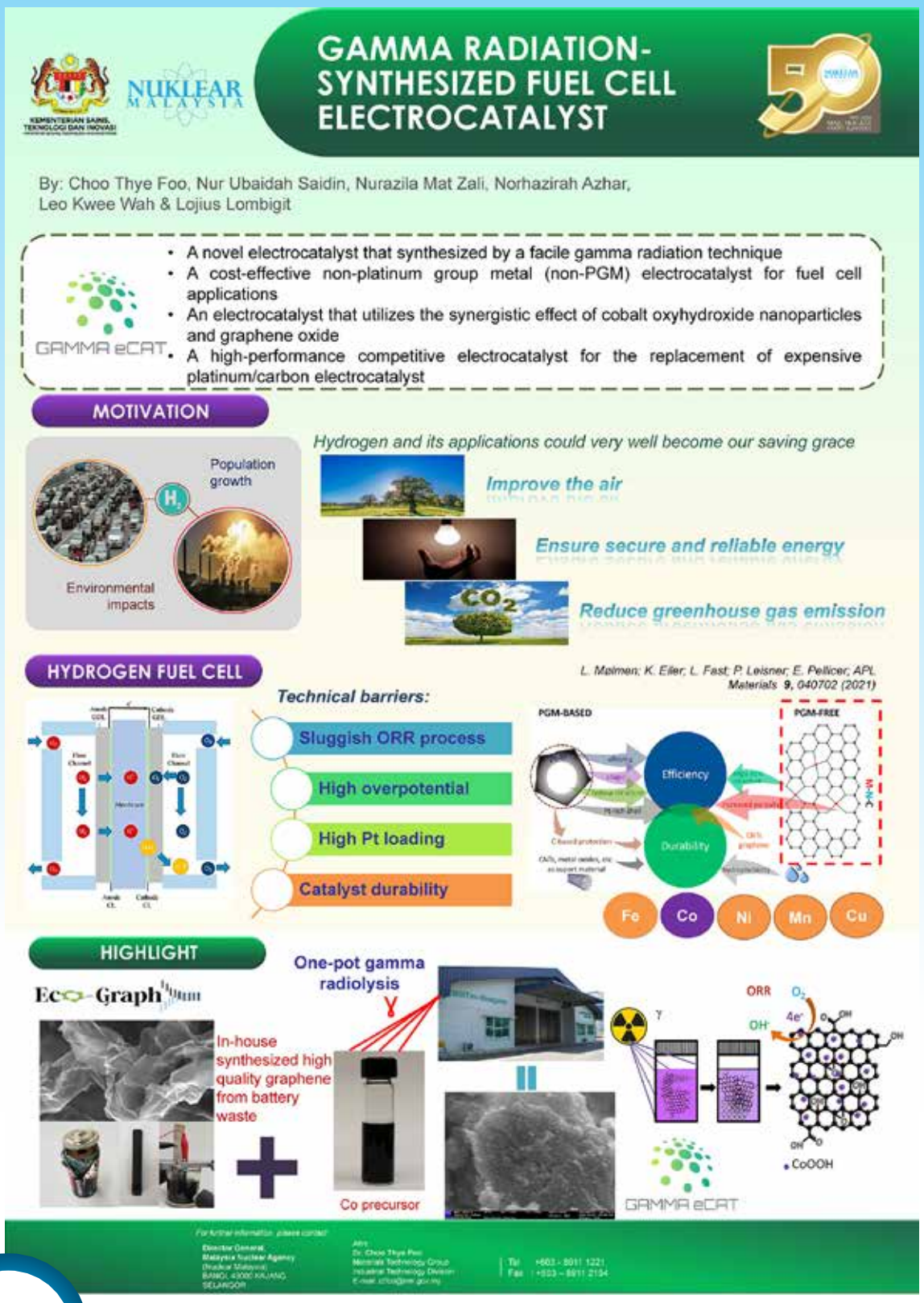

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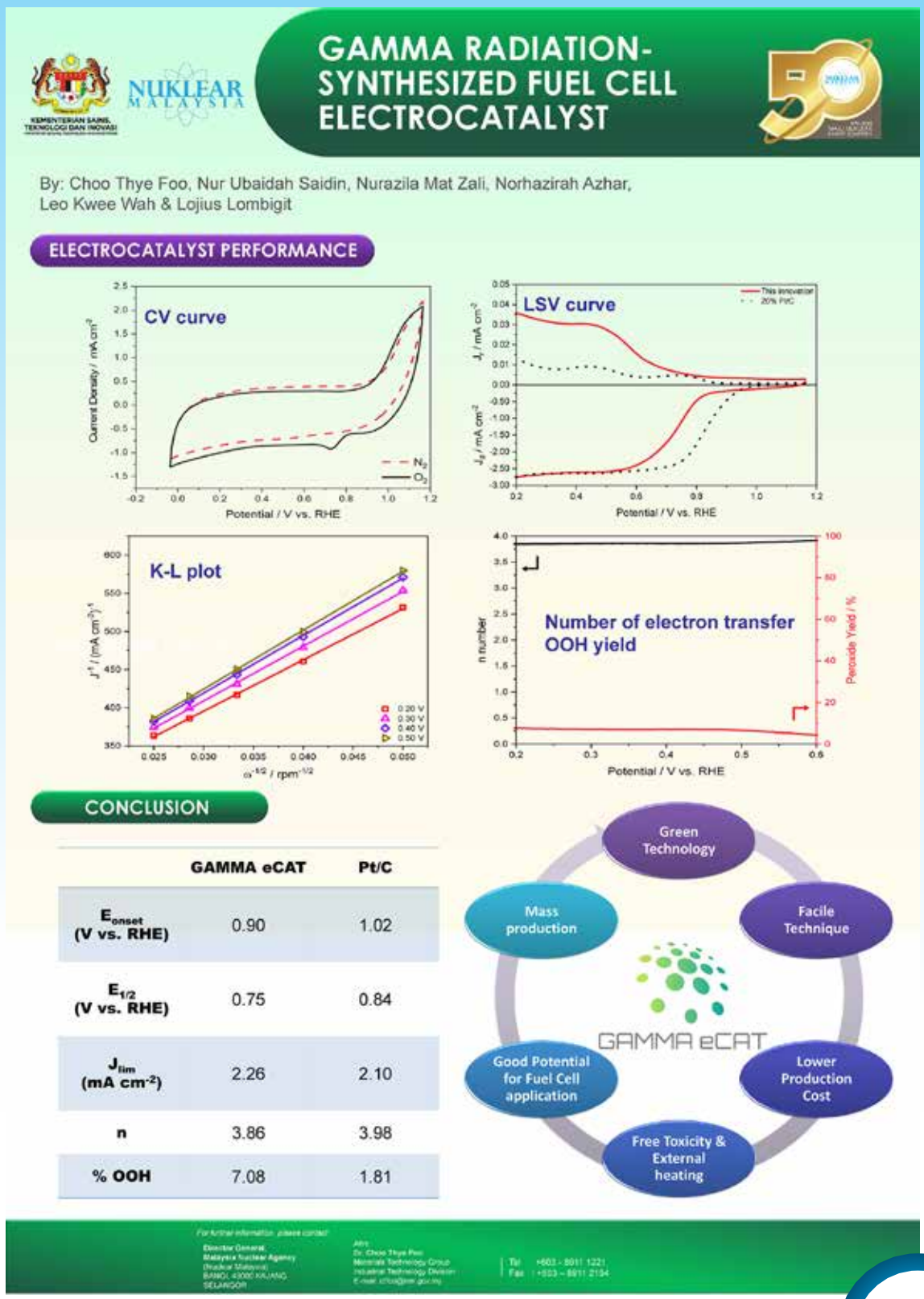

	GAMMA eCAT	Pt/C
E_{onset} (V vs. RHE)	0.90	1.02
$E_{1/2}$ (V vs. RHE)	0.75	0.84
J_{lim} (mA cm^{-2})	2.26	2.10
n	3.86	3.98
% OOH	7.08	1.81

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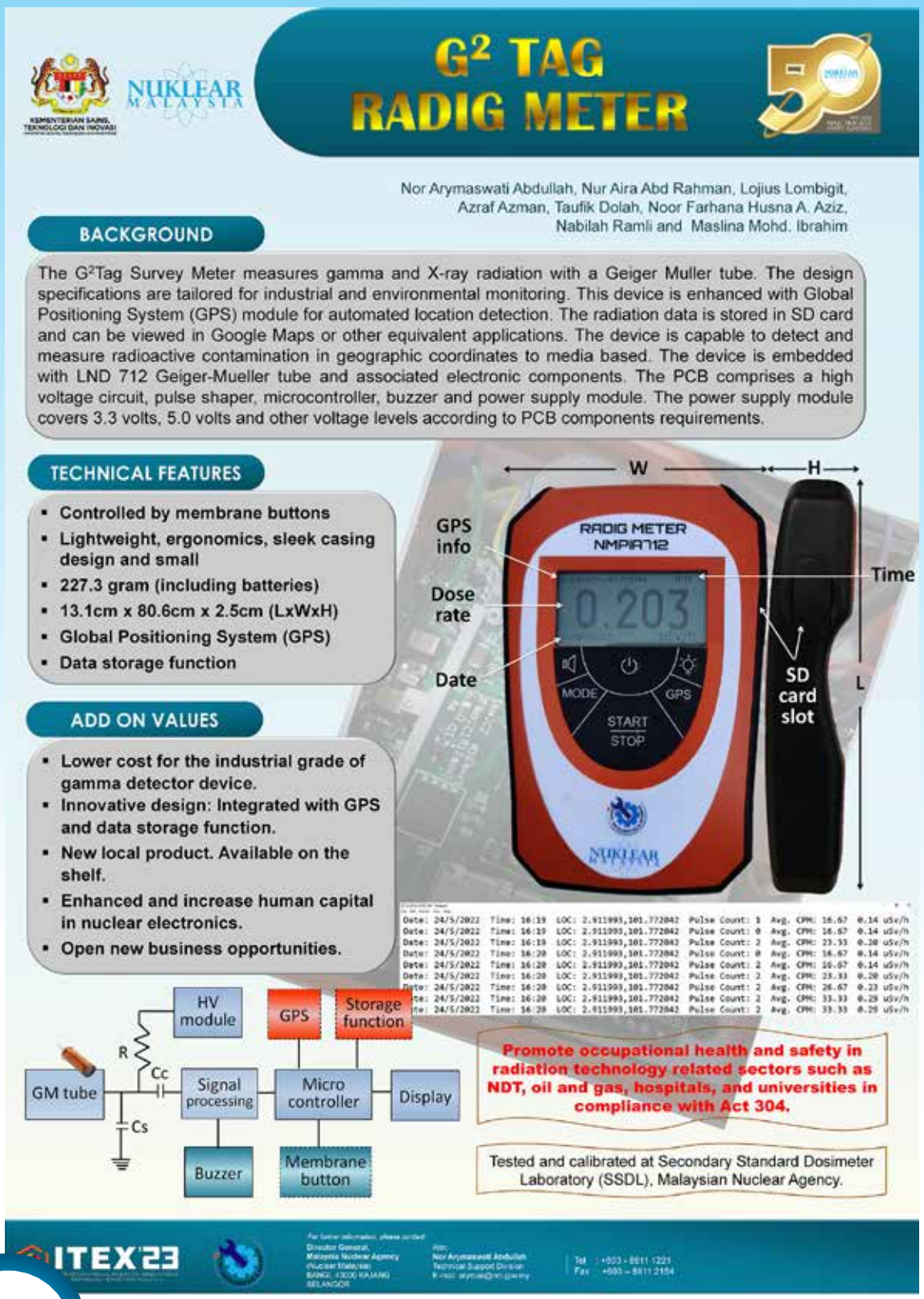

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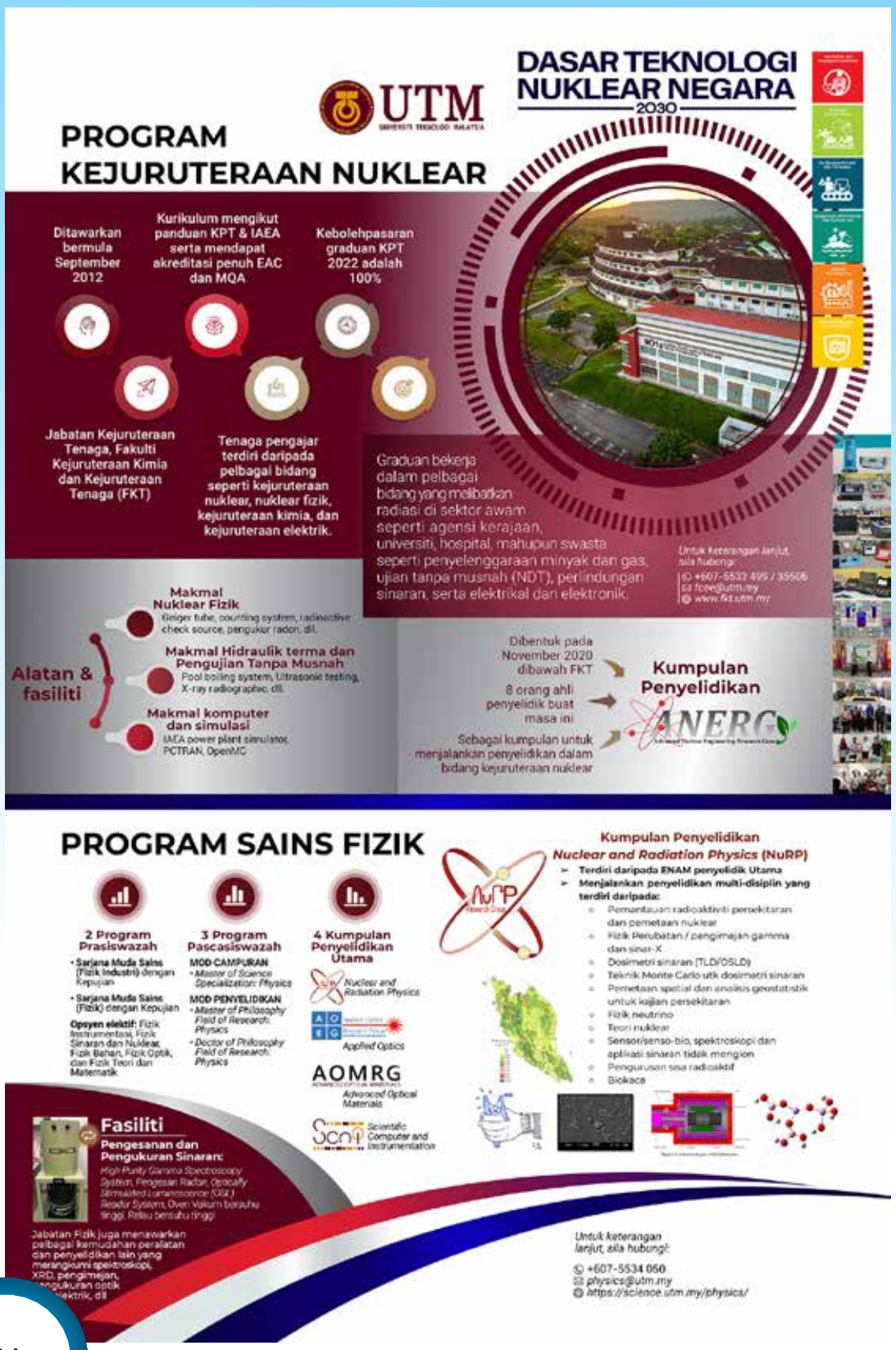

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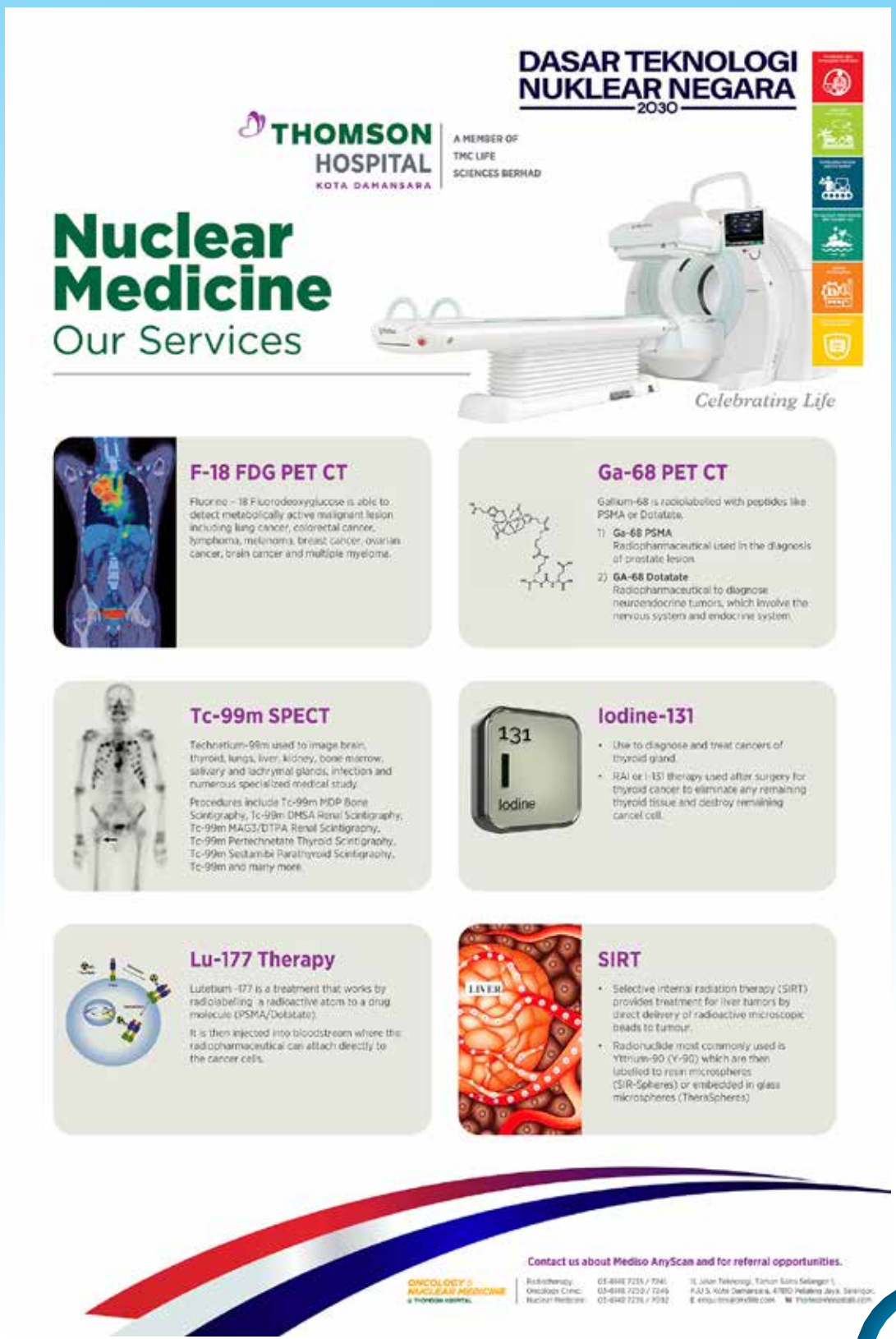

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DASAR TEKNOLOGI NUKLEAR NEGARA 2030

NUKLEAR MALAYSIA

PUSAT TEKNOLOGI REAKTOR (PTR)

Pusat Teknologi Reaktor (PTR) mengendalikan satu-satunya reaktor penyelidikan nuklear di Malaysia, Reaktor TRIGA PUSPATI (RTP) jenis TRIGA Mark II yang telah ditauliahkan pada 28 Jun 1982. Ia mempunyai kuasa nominal 1 MWatt yang direka untuk melaksanakan pelbagai bidang penyelidikan berasaskan sumber neutron, khidmat penyinaran untuk aplikasi nuklear di dalam bidang industri, perubatan, alam sekitar termasuk mengadakan pendidikan dan latihan di dalam teknologi reaktor nuklear. RTP dilengkapi dengan beberapa kemudahanpenyinaran di dalam teras, instrumentasi alur neutron dan makmal. Kemudahan penyinaran sedia ada menawarkan khidmat penyinaran neutron secara tetap dan stabil. RTP dilesenkan mengikut Akta 304 dan dikendalikan oleh Pengendali Reaktor yang bertauliah bagi menjamin keselamatan pada tahap tertinggi.

KEMUDAHAN PENYINARAN DALAM TERAS RTP

1. Jidal Tengah (CT)
2. Rak Berputar (RR)
3. Tiub Kering (DT)
4. Sistem Pemindahan Pneumatik (PTS)

KEMUDAHAN PENYINARAN INSTRUMENTASI ALUR NEUTRON

1. Radiografi Neutron (NUR)
2. Difraktometer Neutron (ND)
3. Penyerakan Neutron Bersudut Kecil (SANS)

KEMUDAHAN MAKMAL

1. Makmal Fizik Neutron
2. Makmal Simulasi Reaktor TRIGA
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Untuk keterangan lanjut, sila hubungi:

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INTERNATIONAL CONFERENCE ON X-RAYS & RELATED TECHNIQUES IN RESEARCH & INDUSTRY (ICXRI)

23-24 Ogos 2023

Optical Study on Zr-Doped TiO_2 Nanorod Thin Film

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INTRODUCTIONS

Since the 1D nanostructures array offer huge potential of applications compared to randomly distributed particles, there are strong interests in synthesis of 1-D TiO2 nanostructures, particularly nanorods [1-5]. This is because, nanorod arrays provide better and directional pathway for transportation of carriers and thus meriting great attention for their applications in solar cells, OLEDs, sensors and photocatalysis.

TiO_2 photocatalyst is effective only in the ultraviolet region due to its large band gap of 3.2 eV (anatase), corresponding to wavelengths shorter than 388 nm. This means that TiO_2 could make use of only 5% of solar energy. To use solar energy more effectively, more attention has been given to the synthesis of the novel photocatalysts with a visible light response. Doping of TiO_2 with various transition metals has been extensively investigated because these elements produce crystal defects and surface modifications, which can change the photocatalytic properties of TiO_2. Zirconium ions, which act as a kind of dopant in TiO_2, have been found to modify the photocatalytic activity and stabilization of anatase phase at high temperatures. Huang and co-workers successfully demonstrated that Zr^{4+} ions can be incorporated into the anatase TiO_2 lattice in the substitutional mode because Zr^{4+} ions share same valence shell structure and valence state as Ti^{4+} ions [6]. Regardless the morphology of the final product, the common finding among these reports is that anatase TiO_2 was the most easy crystal structure to form. The Zr doping is expected to suppress the recombination of electrons and positive holes by their trapping.

OBJECTIVE

To investigate the effect of Zr doping on optical properties for application as a photocatalyst.

MATERIALS & METHODS

RESULTS & DISCUSSIONS

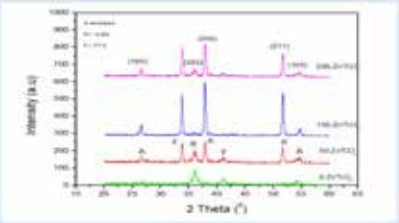

Fig. 1 XRD diffractogram
XRD patterns of the prepared TiO_2 with different concentrations of Zr doping. Five significant lattices were found to be related to anatase (26°,36° and 54°) & rutile (36° and 52°). The diffractogram shows pure TiO_2 phase without any trace of Zr compound.

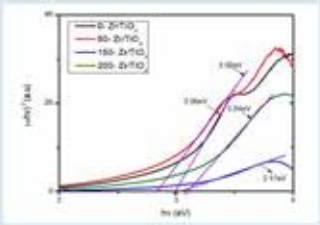

Fig. 2 UV Vis Spectrum
When the doping concentration of Zr is increased, there are two shifts that occur namely hypsochromic and bathochromic shifts. This shift will affect the value of the band gap energy and directly increase the charge carrier concentration in the TiO_2 matrix. Direct band gap of TiO_2 pristine (3.0 eV) was significantly increased to 3.17 and 3.24 eV for 150-Zr/TiO_2 & 200-Zr/TiO_2 respectively. This phenomenon called Burstein-Moss effect.

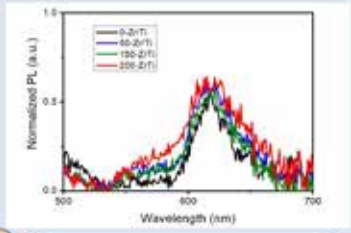

Fig. 3 Deconvulated PL spectrum
The emission around 540 nm- 570 nm is often caused by the incorporation of electrons and holes trapped at the site of Ti voids (Ti vacancies, V_{Ti}) . While the emission around 580-640 nm is caused by OH- group. The intensity for Zr doped TiO_2 gives higher value than undoped samples, which will affect the photocatalytic performance.

CONCLUSION

The study shows that Zr doping into TiO_2 matrix gives significant changes in crystal defect and energy band gap. Future works of photocatalysis characterization will be conduct to see the degradation behaviors of acetone using Zr doped TiO_2.

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Reducing Impurities in Fe Compound via Selective Precipitation and Heat Treatment

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Abstract

Ilmenite ($FeTiO_3$) from alluvial tin mining can provide titanium dioxide (TiO_2) and iron oxide (Fe_2O_3 or Fe_3O_4). Alkaline fusion and acid leaching were introduced to ilmenite sample to separate TiO_2 and iron oxide individually. Then, selective precipitation was carried out to recover Fe from leachate. However, without any control to the experiment, TiO_2 (more than 10%) and manganese content (more than 6%) were quite high in Fe precipitate in order to obtain high purity Fe_2O_3. In this paper, we discussed in detail on the method to prevent TiO_2 and manganese from co-precipitate with Fe_2O_3 through filtration process and selective precipitation. Fe_2O_3 mostly start to precipitate at pH4, whereas Manganese start to precipitate at pH6. Therefore, in order to recover high yield Fe_2O_3, precipitation must be done nearly pH 6.

Introduction

- The recovery of Titanium dioxide (TiO_2) from unconventional sources such as ilmenite from the mid-stream mineral processing industries have potential to be sustainable source for nano-materials.
- There are several companies involving with the down-stream processing of ilmenite and produced radioactive iron oxide waste.
- In particularly, Malaysian rare earth processing industries have experience that radioactive waste issue is the major obstacle in the industry operation.
- Thermal process has great potential in breaking up ilmenite compared to presently chemical route.
- The purpose of this project in the first stage mainly focusses to increase Fe_2O_3 (>90%) via alkaline fusion, selective leaching and precipitation.

Method

Ilmenite ore → Alkaline Fusion → Selective Acid Leaching → Solid/ Liquid Separation → Leachate → Selective precipitation → Heat treatment

Results and Discussion

Table 1 Elemental content of ilmenite, ferric chloride solution and different batch of Fe precipitation.

Element	Elemental Content (weight %)			
	Raw Ilmenite	Ferric Chloride Solution	1st batch	2nd batch
Fe	30.35	26.50	54.36	77.43
Ti	52.48	0.31	32.03	2.26
Mn	2.48	0.69	4.43	5.65
Cl	ND	68.20	0.08	12.22

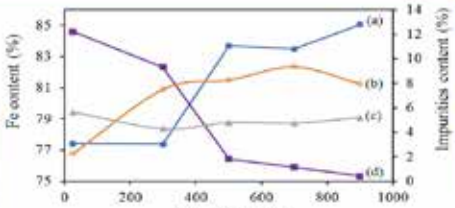

Fig. 2 Composition of (a) Fe, (b) Ti, (c) Mn and (d) Cl in precipitated Fe samples.

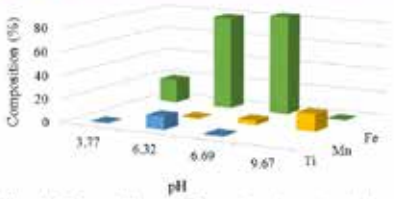

Fig. 1 Composition of 3 major element during selective precipitation (pH variation).

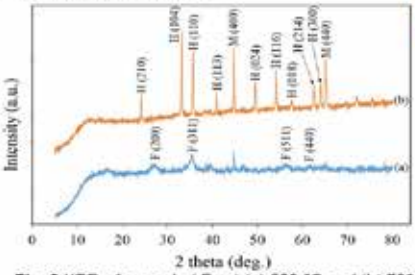

Fig. 3 XRD of annealed Fe at (a) 500 °C and (b) 700 °C.

Acknowledgement

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Conclusions

A technological selective leaching and precipitation of Fe and TiO_2 recovery from Malaysian ilmenite has been formulated. With some control to the experiment, more than 10% and 6% of TiO_2 and manganese were removed respectively, in order to obtain high purity Fe_2O_3 (93%). In this study, we discussed in detail on the method to prevent TiO_2 and manganese from co-precipitate with Fe_2O_3 through filtration process and selective precipitation by pH variation. Fe_2O_3 mostly start to precipitate at pH4, whereas Manganese start to precipitate at pH6. Therefore, in order to recover high yield Fe_2O_3, precipitation must be done nearly pH 6. The results of this study provided knowhow evidence to recover Fe_2O_3 which could be useful in various of applications.

References

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Separation of Cerium from Rare Earth Hydroxide Concentrate using Oxidation Method.

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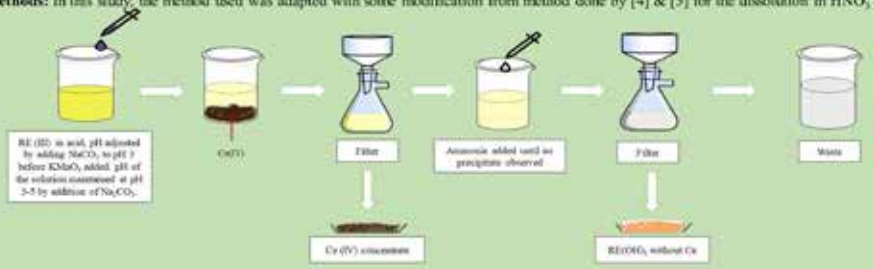
Introduction: Separation of rare earth elements (REEs) is needed before extraction and purification can be done. The purpose was to concentrate the targeted elements in a group of elements at certain concentration with fewer elements than in the initial state. Monazite contain light rare earth elements (LREE), cerium (Ce), neodymium (Nd), lanthanum (La), and neodymium (Nd) and also thorium. This first separation in alkali digestion of monazite process was to separated thorium from the REEs using selective precipitation method. The LREEs obtained was used for this study. Most REEs has the oxidation state of +3 except Ce that can form +4 oxidation state due to the capacity to lose the outermost four electrons in the 6s and 4f orbital. This ability can be used to separate Ce from other REEs by conducting oxidization of Ce (III) to Ce (IV). The process for Ce (III) oxidation was as shown in Equation 1. It can be done by using oxidants such as potassium permanganate ($KMnO_4$), hydrogen peroxide (H_2O_2), and sodium hydroxide (NaOCl) [1,2]. Removing Ce from other REEs is very important before the extraction of the other REEs because of the presence of Ce will interfere with the purity of the end result [3].

$3Ce^{3+} + MnO_4^- + 10H_2O \leftrightarrow 3Ce(OH)_4\,(s) + MnO_2\,(s) + 8H^+\,(aq)$ ..... Equation 1

Objective: This study aims to demonstrate the separation of Ce from mixed $RE(OH)_3$ by using two different acidic media, that is nitric acid (HNO_3) and hydrochloric acid (HCl)

Materials : Mixed RE_2OH, 37% HCl, 2 M HNO_3, $KMnO_4$ solution, Na_2CO_3 solution & ammonia solution

Methods: In this study, the method used was adapted with some modification from method done by [4] & [5] for the dissolution in HNO_3 & HCl.



Results:

Element	Concentration in Ce (IV) concentrate	concentration in other RE concentrate
Ce	45.5%	43.9%
Nd	13.7%	18.8%
La	8.4%	20.3%
Pr	3.6%	4.3%
Mn	18.5%	n.d.
Others	9.3%	12.6%

Table 1: $RE(OH)_3$ dissolved in HNO_3 shows that Ce was not successfully separated through oxidation. Mn was found in the Ce(IV) concentrate as the result of reduction of MnO_4^- ions.

Elements	2 M HCl acid		37 %(v/v) HCl	
	(Ce (IV) concentrate)	(other REE concentrate)	(Ce (IV) concentrate)	(other REE concentrate)
Ce	71.2%	n.d.	70.6%	n.d.
Nd	15.2%	37.6%	15.2%	30.9%
Mn	7.7%	n.d.	7.5%	n.d.
La	n.d.	31.1%	n.d.	22.1%
Pr	n.d.	12.6%	n.d.	10.2%
Cl	4.2%	11.6%	3.2%	26.5%
Other REEs	0.8%	6.8%	1.0%	9.8%
Other elements	0.7%	0.3%	2.5%	0.6%

Table 2: $RE(OH)_3$ dissolved in HCl showed that oxidation of Ce (III) was able to separate Ce from other REEs with the presence of Mn. 2M HCl was sufficient to dissolve mixed $RE(OH)_3$ which suggests, using concentrated HCl was unnecessary.

Conclusion

Oxidation of Ce (III) using $KMnO_4$ contains MnO_2 as the impurities along with Nd and other elements. It can be used to separate Ce from $RE(OH)_3$. However, more information needs to be studied and applied for oxidation in nitric acid medium such as the concentration of HNO_3 that can be used rather than using the concentrated acid, suitable pH for oxidation process to occur and when is the right time to stop adding KMnO4. As for the process conducted using HCl, it can be summarised that 2 M HCl is sufficient for the dissolution of RE(OH)3 and the optimisation of the suitable pH for Ce (IV) precipitation need to be done to minimise the co-precipitation of other elements, especially the REEs.

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Transfer Efficiency and Morphology of Different Concentrations Catalyst Ink in Fuel Cell Electrode Preparation

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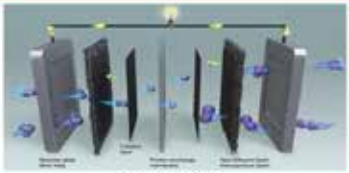
ABSTRACT

In the fabrication of fuel cell electrodes, applying catalyst ink onto a substrate is crucial. The performance of the proton exchange membrane fuel cell (PEMFC) is subsequently impacted by how the catalyst is applied onto substrate as well as in terms of its resulting morphology. In this study, a direct catalyst ink spraying approach was done in order to investigate transfer efficiency and surface morphology for different concentrations of ink. The concentration of catalyst ink used in the spraying process are 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 mg/ml with fixed loading of 1.0 mg/cm². The transfer efficiency of the catalyst inks was calculated. The ink loss during spraying were calculated and catalyst layer distribution were analyzed via Field Emission – Scanning Electron Microscope (FESEM).

Keywords: *Spray, ink, concentration, distribution, PEMFC*

INTRODUCTION



Li et al., 2022 [1]

Several types of fuel cells includes solid oxide fuel cells, direct liquid fuel cells, proton exchange membrane fuel cells and bio fuel cells. The heart of a fuel cell is the membrane electrode assembly (MEA), which includes the membrane, the catalyst layer, and gas diffusion layer (GDL). MEA manufacturing processes are mainly divided into the catalyst-coated membrane (CCM) and the catalyst-coated substrate (CCS) methods.

In this work, performance of CCS where the catalyst layer was sprayed onto the GDL has been studied. Spraying is a straightforward but some ink loss might resulted from this technique, either into the air or out of the targeted areas. Through this work, the effect of catalyst ink concentration on the loss will be studied. The ink loss was measured via weight different of the substrate before and after being applied.

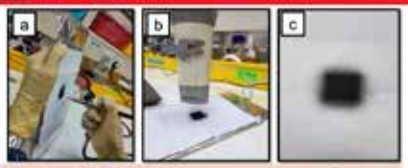
OBJECTIVE

To study the effect of catalyst ink concentration on ink loss due to spraying and the catalysts distribution.

MATERIALS & METHODS

Catalyst ink component : Graphite powder + Nafion + isopropyl alcohol + deionized water
Catalyst loading : 1.0 mg/cm²
Catalyst ink concentration : 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 mg/ml
Electrode area : 6.25 cm²

(1) Catalyst ink component was sonicated for 20 minutes until the powder dispersed homogenously.
(2) The initial mass of GDL was weighted and recorded.
(3) The catalyst ink was sprayed at constant pressure. A distance between substrate and the gun's tip was approximately 20 mm (Figure a).
(4) The ink was allowed to dry before spraying another layer (Figure b).
(5) The prepared catalyst layer was annealed at 60°C for 60 minutes and cool down to room temperature (Figure c).
(6) Prepared electrode was weighted and recorded.
(7) The ink loss was calculated using Equation 1 and Equation 2.



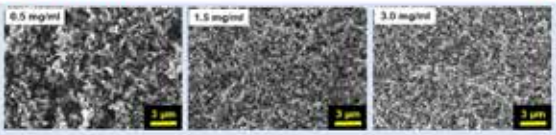
$$Gp_t = Cp_a - Cp_b \quad \text{(Equation 1)}$$

$$\text{Ink Loss (\%)} = \frac{Gp_t - Gp_r}{Gp_t} \times 100 \quad \text{(Equation 2)}$$

Gp_t = Actual weight of graphite powder used, Cp_b = Weight of carbon paper before spraying.
Gp_r = Weight of graphite powder on carbon paper, Cp_a = Weight of carbon paper after spraying.

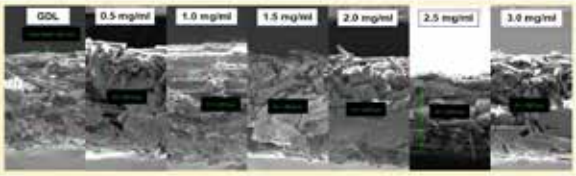
RESULTS AND DISCUSSION

LEFT: Ink loss (%) shows that at 0.5 mg/ml ink concentration resulted in the least ink (59.98%) followed by 1.0 (69.39%), 2.0 (70.57%), 1.5 (77.45%), 3.0 (79.77%) and 2.5 mg/ml (83.81%). The trend shows increasing percent of ink loss as the concentration of ink increased.



TOP: FESEM morphology shows spreading appears homogenous at 0.5, 1.5 and 3.0 mg/ml of ink concentrations. This shows no significant effect of concentration towards spreading of ink on the substrate. However, losses still occurs might resulting in loss into the air.

RIGHT: FESEM images of cross section prepared catalyst layer shows the thickness of the catalyst layer increase with catalyst ink concentration. 0.5 and 1.0mg/ml CCS with lowest ink loss show thicker deposit of catalyst layer. 2.5 and 3.0mg/ml gives highest ink loss resulted in thinner catalyst layer. Higher ink loading successfully deposited onto the substrate when using 0.5mg/ml ink concentration. The graphite powder appeared smashed this resulted as they hit the substrate at high spraying velocity [2].



CONCLUSIONS

The best concentration for catalyst ink of loading 1.0 mg/cm² is at 0.5mg/ml which resulted in 59.98% of ink loss and proven with the thickness increase via FESEM analysis. The spreading of ink particles on GDL appears homogenous for every concentrations. Further studies can be done to study the ink loss effect on different types and different loadings of catalysts.

ACKNOWLEDGEMENT

This work was supported by the International Atomic Energy Agency (IAEA) through the Coordinated Research project (IAEA-CRP-R23130). I would like to thanks fellow researcher of Malaysian Nuclear Agency in helping throughout this study.

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Effect of Heating Temperature of Titanium dioxide (TiO_2) Nanoparticles

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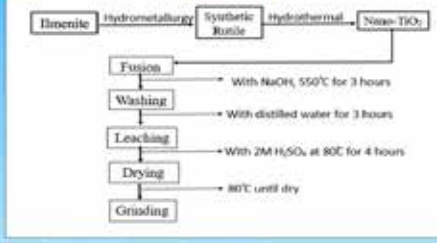
INTRODUCTION

Titanium dioxide nanoparticles, TiO_2 is an n-type semiconductor materials with particles size less than 100 nm. These materials also have thermal stability, low cost materials, high photo reactive and sensitivity. Because of this special properties this materials have the attention many researcher and are widely used in many applications and various field in industries such as sensors, photocatalysts, electronic, medical, antimicrobial activity, self-cleaning, water purification, degradation of pollutant, dielectric properties, optical, solar cell and electrical properties.[1,2,3] Titanium dioxide nanoparticles produced from the more common methods such as sol-gel method (widely used commercially), the hydrothermal, chemical precipitation and solvothermal methods. [4,5,6]. It has three main polymorphs like anatase, rutile and brookite [1,4]. The crystalline structure of anatase and rutile are tetragonal. The anatase is metastable with the suitable photocatalytic activity, and will convert to rutile phase at high temperature heating. The most stable phase is rutile. At this work, we will study the effect of heating temperature on structural or physical properties of the materials.

OBJECTIVES

To study the effect of heating with different temperature on physicals properties of the materials.

MATERIALS AND METHODS



RESULTS

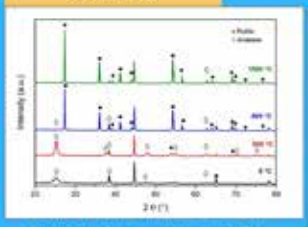


FIGURE 1: X-Ray diffraction pattern of TiO_2 nanoparticles at various temperatures

Fig. 1 shows the XRD patterns of all the samples TiO_2 powders treated at different temperatures.
The diffraction peak with three sharp peak at 25.34°, 38.42° and 47.92° which corresponding to (011), (004) and (020) (ICSD code: 98-009-4632) for anatase and peaks at 27.44°, 36.06°, 41.22°, 44.03°, 54.30° and 56.61° and which corresponding to (110), (011), (111), (120), (121) and (220) (ICSD code: 98-009-4409) for rutile, respectively.
Both anatase and rutile phase with tetragonal geometry.
Transformation phase from anatase to rutile due to increase the temperature [7].

Sample	2 theta (°) (004)	FWHM	Phase (%) Anatase	Rutile
TiO_2-R °C	38.45	0.1299	75	25
TiO_2-600 °C	38.42	0.1299	83	17
TiO_2-800 °C	38.42	0.1624	2	98
TiO_2-1000 °C	38.40	0.1948	21	79

TABLE 1: Phase composition and crystal lattice data at various temperature

Tab. 1 obtained the results from the Rietveld refinements.
Base on observation, the Full Width Half-Maximum (FWHM) have been increase as the increase of heating temperature. Indicating crystallite size is decrease.

Fig.2 shows at the different heating temperatures at 800°C and 1000°C the peaks belonging to rutile crystals at 144, 449 and 613 cm−1 which are belonging to B1g, Eg and A1g rutile active modes.
The other four bands at 144, 399, 516 and 639 cm−1, at 600°C are observed in the spectra of anatase phase are assigned as Eg, B1g, A1g and Eg. [2,8,9]
The band at 240 cm−1,are the multiple-photon scattering processes which is also considered as a characteristic Raman peak of rutile type TiO_2. [8].

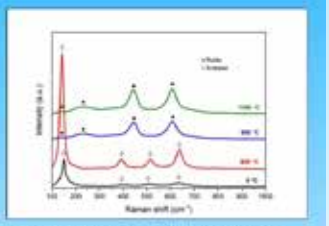


FIGURE 2: Raman spectrum of TiO_2 nanoparticles at (a) 0°C (b) 600 °C (c) 800 °C and (d) 1000 °C

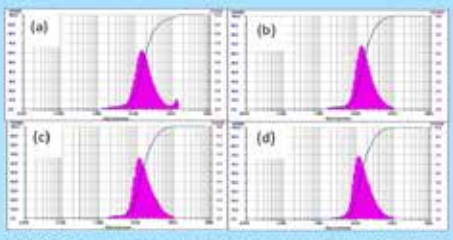


FIGURE 3 The particles size distribution of TiO_2 nanoparticles at (a) 0°C (b) 600°C (c) 800°C and (d) 1000°C

Fig.3 shows the particle size distribution of TiO_2 nanoparticles with different heating temperature include with 0°C as a control (a, b, c and d). The mean particle size, d50 for each sample are 17.31µm, 15.31µm, 14.31µm and 14.03µm respectively. The heating temperature increase while the average particles decreases.

CONCLUSION

In conclusion, this work has shown how the heating with different temperatures influences the crystalline phase composition, a chemical-structure characteristic and particles size of titanium dioxide, TiO_2 nanoparticles which produced by hydrothermal method via alkaline fusion. The synthesized nanoparticles were characterized by X-ray Diffraction (XRD), Raman Spectra and Particles Size Analyzer, PSA. The obtained results have shown that the increase of temperature causes the phase transformation from anatase to rutile.

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NUKLEAR MALAYSIA

Effect of Eu2+ on the structural and optical properties of BaBrX(X= Cl, I) synthesized via hydrothermal method

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Abstract

Barium halide activated with Eu is a typical phosphor material applied as an imaging plate for computed radiography applications. In this study, BaBrX:Eu (X = Cl, I) were synthesized via the hydrothermal technique. The aim of this study is to determine the effect of the Eu2+ ion on the structural and optical properties of BaBrX (X = Cl, I). X-ray diffraction (XRD) technique was used to determine the crystallinity of the prepared samples, while optical properties were observed using photoluminescence (PL) spectroscopy. The sharp, narrow, and high-intensity peaks in the XRD diffractogram showed that all samples have good crystallinity. The PL spectrum indicated that the emission of all samples corresponds to the blue range. Furthermore, the addition of the Eu2+ ion as an activator resulted in a blue-shift of the main emission peak, and these results were comparable with the phosphor material in commercial imaging plates. This study demonstrated that the addition of the Eu2+ ion to the host materials changed the structural properties and significantly improved the optical properties of the prepared samples. Additionally, the hydrothermal technique, which offers lower temperatures and shorter heating periods compared to conventional methods, is a new approach introduced in this study.

Keywords: phosphor material, Eu2+ activator, structural properties, optical properties, hydrothermal method

Introduction

1. IMAGING PLATE

Definition:
A plat used in computed radiography (CR) to construct an image.
Replacement of conventional film.
Advantage: reusable, flexible

2. IMAGING PLATE LAYER

imaging plat layer

3. MOTIVATION

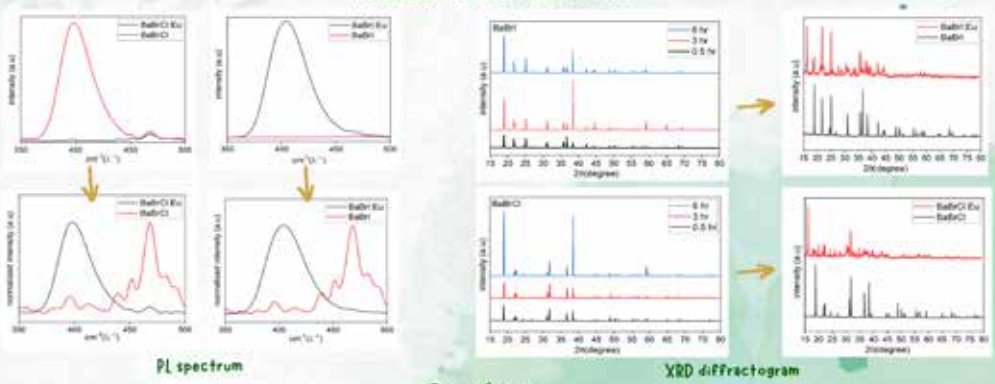
Experimental method

Raw material:
1) Dilute in distilled water: Ba(NO3)2, NH4Br, NH4Cl & NH4I
2) Dilute in acid: Eu2O3

→ Mixed + Stirred solutions → Heat in autoclave → Dry in Furnace → Characterization: XRD & PL →

Prepared samples:
- BaBrCl
- BaBrI
- BaBrCl:Eu
- BaBrI:Eu

Result & Discussion



PL spectrum

XRD diffractogram

Conclusion

In conclusion, the addition of the Eu2+ ion into the host materials altered the structural properties and enhanced the optical properties of the prepared samples. This outcome also demonstrated the success of the hydrothermal method to synthesis the phosphor materials.

Acknowledgement

This work was supported by Malaysian Nuclear Agency internal grant (PQRD NM-R&D-21-76).

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INTERNATIONAL CONFERENCE ON X-RAYS & RELATED TECHNIQUES IN RESEARCH AND INDUSTRY

ICXRI2023

Physicochemical Characterizations of Imidazolium-Based Ionic Liquid Functionalized on Mesoporous SBA-15

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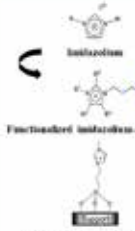
INTRODUCTION



- **Physicochemical properties**[1]: low viscosities, negligible vapor pressure and thermally stable up to 200 °C.
- As homogeneous catalysts or co-catalysts in the catalytic processes.

Advantages

High catalytic activity and selectivity, good thermal stability

Problems

Large amount of waste materials, unendurable viscosity, high solubility in most solvents and difficult catalyst recovery

Solutions

- Functionalization of imidazolium-based ILs on solid support
- Act as chemical linker between an inorganic solid support and metal-active complexes.

Unique properties of Mesoporous SBA-15[2,3]

- High specific surface area (>700 m^2g^{-1})
- Uniform pore size (5 to 30 nm)
- Large pores and thicker walls
- High hydrothermal stability
- Chemically-modified surface
- High concentration of silanol (Si-OH) groups

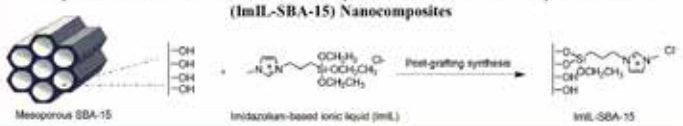
SBA-15 was the chosen support for the functionalization with the imidazolium-based ILs

OBJECTIVES

- ☐ To synthesize imidazolium-based ionic liquid (ImIL) functionalized on mesoporous SBA-15 (ImIL-SBA-15) nanocomposites.
- ☐ To characterize the physicochemical properties of the ImIL-SBA-15 nanocomposites.

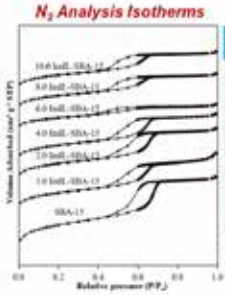
EXPERIMENTAL

Preparation of Imidazolium-Based Ionic Liquids Functionalized on Mesoporous SBA-15 (ImIL-SBA-15) Nanocomposites



RESULTS & DISCUSSION

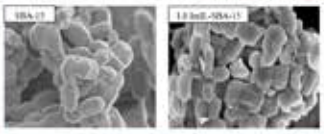
N_2 Analysis Isotherms



Samples	S_{BET} (m^2g^{-1})	S_{micro} (m^2g^{-1})	S_{meso} (m^2g^{-1})	V_{total} (cm^3g^{-1})	D_{pore} (nm)	BJH (nm)
SBA-15	708	520	218	0.67	5.24	5.41
1.0 ImIL-SBA-15	384	342	88	0.48	4.27	4.84
2.0 ImIL-SBA-15	360	291	69	0.44	4.82	5.39
4.0 ImIL-SBA-15	303	283	80	0.40	4.26	5.05
6.0 ImIL-SBA-15	311	215	96	0.24	3.79	7.55
8.0 ImIL-SBA-15	354	248	107	0.33	3.77	7.47
10.0 ImIL-SBA-15	305	201	105	0.34	3.88	7.84

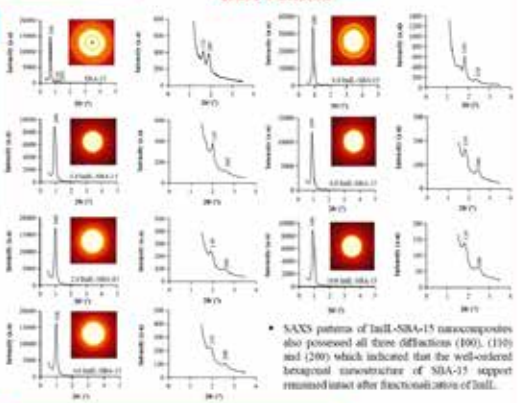
- The parent SBA-15 displayed a typical type IV isotherm based on the IUPAC classification.
- The N_2 adsorption-desorption isotherms exhibited a similar trend after the surface functionalization.
- A clear adsorption-desorption H1 hysteresis loop: well-ordered hexagonal mesoporous materials with capillary condensation in open-ended cylindrical-like pore channels.
- As the concentration of the ImIL increased from 1.0 to 10.0 mmol, the surface area decreased considerably compared to SBA-15, which is consistent with the increasing dispersion of ImIL moieties in the interior mesopore surfaces [4].
- It can be seen also that an increase in the ImIL content from 1.0 to 10.0 mmol resulted in a gradual decrease in the total pore volume (from 0.48 to 0.34 cm^3g^{-1}).
- These results strongly support the evidence that SBA-15 was successfully functionalized with ImIL.
- The parent SBA-15 sample showed a maximum PSD at 5.26 nm but it was found that the functionalization with ImIL reduced the maximum PSD of ImIL-SBA-15 nanocomposites from 4.27 to 3.88 nm.

FESEM Images



- The micrograph of SBA-15 revealed the well-defined wheat-like macrostructure, consisting of many rope-like (cylindrical) particles with a relatively uniform length of ~1 μm and ~200-500 nm in diameter [5].
- It can be clearly seen that the well-defined wheat-like macro-structure of parent SBA-15 was retained and not destroyed after the functionalization process with the ImIL.

SAXS Patterns



- SAXS patterns of ImIL-SBA-15 nanocomposites also possessed all three diffractions (100), (110) and (200) which indicated that the well-ordered hexagonal nanostructure of SBA-15 support remained intact after functionalization of ImIL.

Samples	2θ (°)	Intensity of I_{100}	d_{100} (nm)*	q_{100} (nm^{-1})	a_o (nm)*
SBA-15	0.90	14000.59	9.85	0.64	10.60
1.0 ImIL@SBA	1.00	10703.54	8.84	0.71	10.22
2.0 ImIL@SBA	1.00	17041.17	8.84	0.71	10.21
4.0 ImIL@SBA	1.00	16178.77	8.84	0.71	10.21
6.0 ImIL@SBA	0.90	14102.71	9.82	0.64	11.34
8.0 ImIL@SBA	0.90	12027.17	9.82	0.64	11.34
10.0 ImIL@SBA	0.90	8868.68	9.82	0.64	11.34

- Unit-cell parameter decreased from 10.60 nm for SBA-15 to 10.21 nm for ImIL-SBA-15 (ImIL = 1.0, 2.0 and 4.0 mmol).
- But, this trend reversed when the ImIL content was further increased up until 10.0 mmol.
- Diffraction angle 2θ and scattering vector q_{hkl} are very important parameters that may affect the pore wall thickness, pore size and the unit-cell parameter of the ImIL-SBA-15 nanocomposites.

CONCLUSIONS

- ✓ A series of ImIL-SBA-15 nanocomposites with different loading of ImIL were successfully synthesized by the post-synthesis covalent grafting method.
- ✓ The surface area, total pore volume and average pore size distribution of ImIL-

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SYNTHESIS OF PALLADIUM DECORATED GRAPHENE USING GAMMA IRRADIATION

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INTRODUCTION

Electrochemical exfoliation is a promising process for synthesizing graphene materials from graphite rod. It is a cheaper, greener and potentially capable of mass production with few layers of graphene. An applied voltage drives ionic species to intercalate into graphite lattices where they form gaseous species that expand and exfoliate into individual graphene sheets. The quality and quantity of the synthesized graphene (graphene layer numbers, O contents, lateral size, edge or sheet defects) depend on the process parameters (applied electrical potential, current, processing time, composition of electrolytes) {1}

Palladium (Pd) nanoparticles were synthesized using precipitate method and then were functionalized with graphene (exfoliated and commercial graphene (FGV) using gamma radiation. The gamma radiation synthesis has the advantages of without the use of reducing agent and Pd nanoparticles aggregated immediately upon irradiation. This method provides Pd nanoparticles in fully reduced and highly pure without any reducing agent as compared to other synthesis routes which require catalytic reaction. PVA plays a significant role as a capping agent to control the nanoparticle size.

Raman spectroscopy analysis can determine the graphene and metal quality. The spectra of graphene and metal samples has been characterized by 532 nm laser wavelength. The integral intensities and full width half maximum (FWHM) of the bands assigned to the vibrations of graphitic band (G band) and defect band (D) used to calculate the layers and its quality.

OBJECTIVES

To identify peaks Pd decorated graphene (exfoliated and FGV) using Raman Spectroscopy (Renishaw Invia Reflex Spectrometer)

MATERIALS AND METHODS

Electrolyte with 90:10 volume ratios of H_2SO_4 + KOH were prepared

Electrochemical exfoliation process was carried out in an electrolysis cell. These cells are composed of a graphite rod (anode) and a platinum plate (cathode) immersed in the electrolyte. The electrolysis cells were connected to a DC power supply.

Measurement was stated with low voltage and followed by high voltage

The sample was left to settle for 24 hours before the top part of the sample was filtered and dried overnight. During the filtration process, sample was rinsed with

PVA solution + $C_6H_8O_6$ + $PdNO_3$

Stirred for 2 hours

Added exfoliated graphene / commercial graphene (FGV)

Samples were irradiated up to 50kGy with ^{60}Co gamma rays at 50kGy

Analyze layer of graphene with Raman Spectroscopy

RESULTS

Internal morphology of graphite by Raman Spectroscopy was performed with characterize the ratio between the G and 2D peak intensities in graphitic materials. The intensity of the D peak depends on the disorder of the graphene. The G peak represents the E_{2g} phonons vibrations mode in the centre of the Brillouin Zone, is a characteristics peak of carbon material [1]. The I_D/I_G ratio is used to evaluate the defect of the graphene. The intensity ratio of I_{2D}/I_G can be used to the determine the number of graphene layers.

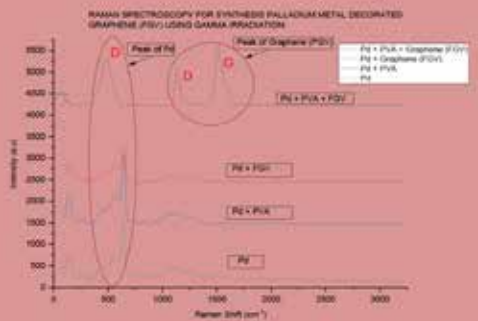

Figure 1 shows the Raman spectrum of Pd decorated graphene (FGV) using gamma radiation. The spectra shows D peak for Pd is located at ~700 cm^{-1}. From the spectrum, only Pd with PVA and FGV graphene have the D peak for graphene located at ~1300 cm^{-1}. G peak for graphene is located at ~1650 cm^{-1}. The G peak represents the E_{2g} phonons vibrations mode in the center of the Brillouin Zone and is a characteristic peak of metal. The I_D/I_G ratio value is 1.06 for sample FGV represent the amount of defect in graphene.

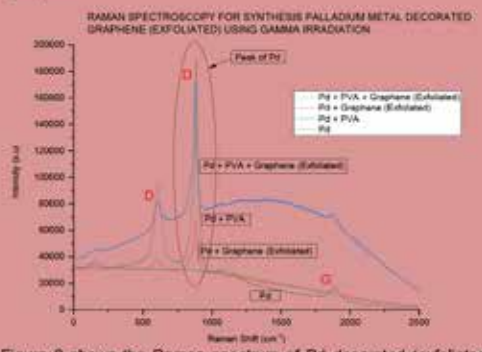

Figure 2 shows the Raman spectrum of Pd decorated (exfoliated) graphene using gamma radiation. From the spectra, D peak for palladium is located at ~700 cm-1. Only Pd with PVA and exfoliated graphene have the G peak for graphene located at ~1700 cm^{-1}. The intensity of the D peak depends on the disorder of the metal. The I_D/I_G ratio value is 0.47 for sample exfoliated graphene.

CONCLUSIONS

Raman spectroscopy is the instrument for graphene and metal quality and can differentiate layer of carbon materials.

ACKNOWLEDGEMENT

We would like to acknowledge the Malaysia Nuclear Agency for funding this work. The contribution of the Malaysian Nuclear Agency staff for irradiation facility is appreciated

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SCRUBBING STUDY ON RARE EARTH LOADED ORGANIC FROM EXTRACTION PROCESS OF YTTRIUM

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INTRODUCTION

Figure 1: Global usage of rare earth in green technology.

Rare earth element yttrium was the first to be isolated in 1794, which is an important element and in great demand nowadays. Yttrium is widely used in astronavigation, luminescence, ceramics, metallurgical industries and etc. In Malaysia, source of yttrium can be obtained from Xenotime as side mineral from tin mining industry that usually consist of 35% yttrium. According to *Akademi Sains Malaysia*, distribution of Xenotime in peninsular Malaysia is generally in the state of Perak, Selangor, Pahang and Negeri Sembilan. Thus it can prove that Malaysia have a lot of yttrium resource in form of minerals.

There are several ways of extraction system for yttrium such as using neutral phosphorus, acid phosphorus, carboxylic acid, amine and synergistic extraction system .This study however focusing on acid phosphorus extraction (DEHPA) of yttrium from rare earth oxalates that had been produced after precipitation of leached solution from Alkaline Fusion of Malaysian Xenotime. Scrubbing technique had been successfully applied to the production of rare earth elements group via tributyl phosphate extraction to produce rare earth elements. Therefore, this technique can be applied to the production of rare earth elements via di-ethylhexyl phosphoric acid extraction in Malaysia, specifically for Xenotime study.

Reference: Jorjani E., Malek S., 2012. *The production of rare earth elements group via tributyl phosphate extraction and precipitation stripping using oxalic acid.* Arabian Journal of Chemistry. 28(52).

METHODOLOGY

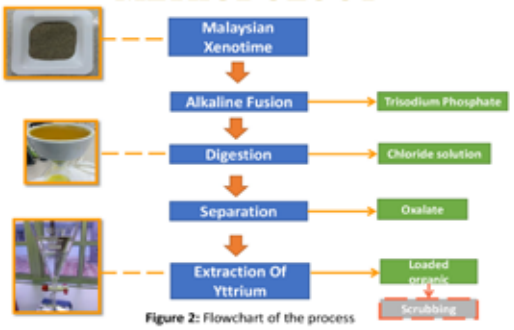

Figure 2: Flowchart of the process

CONCLUSION

Study results that inorganic element (sulfur, calcium and chlorine) can be scrubbed with three different aquoeus solution which is deionized water, nitric acid and ammonium nitrate. From this study, it is suggested that rare earth loaded organic is scrubbed with 70°C deionized water at 10 minutes with aqueous to organic ration 1:1.

OBJECTIVE

The objective of this study is to determine the optimum scrubbing parameters that affecting concentration of inorganic element in scrubbing agent such as concentration of scrubbing solution, ratio aqueous to organic and contact time.

RESULTS AND DISCUSSIONS

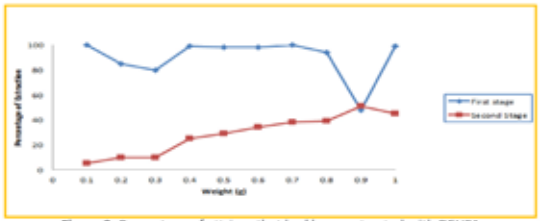

Figure 3: Percentage of yttrium that had been extracted with DEHPA

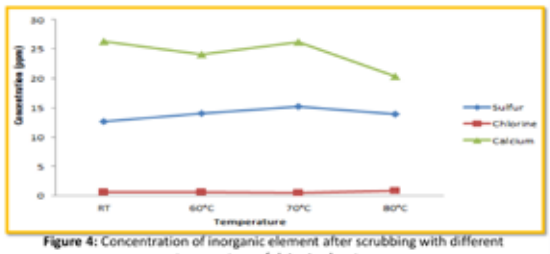

Figure 4: Concentration of inorganic element after scrubbing with different temperature of deionized water

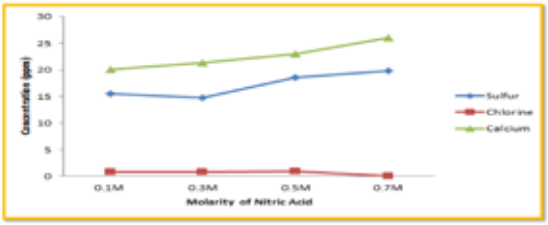

Figure 5: Concentration of inorganic element after scrubbing with different molarity of nitric acid

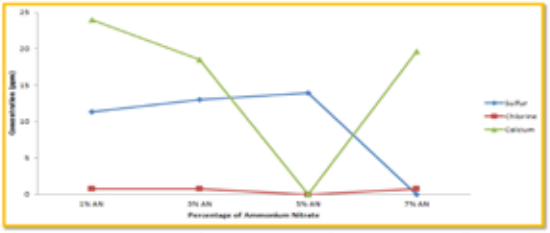

Figure 5: Concentration of inorganic element after scrubbing with different percentage of Ammonium Nitrate

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Study the Depth Dose Profile of the Low Energy Electron Accelerator

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Malaysian Nuclear Agency

ABSTRACT

This paper describes depth dose measurement of Low Energy Electron Accelerator (LEEA). This locally designed LEEA with the former energy of 140 keV will be upgraded to 300 keV. As the setup, the electron beam is energized by the electric field with the high voltage power supply, scanning and passing through the titanium foil to irradiate the sample. As the results, depth dose profile by the energetic beam mapping results have been obtained by using B3 radio chromic film and FWT-60 nylon dosimeters.

Film Dosimetry

Table 1. Specification of the B3

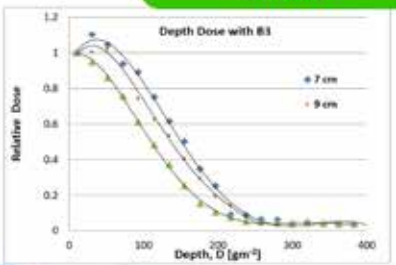
Parameters	Figure
Dose Range	1.0- 150 kGy (0.1-15 Mrad)
Thickness	18 µm
Wavelength of Interest	552 nm
Absorbed Dose Rate	> 0.01 Gy/s
Photon Energy Range	0.1 – 50 MeV
Electron Energy Range	70 keV – 50 MeV

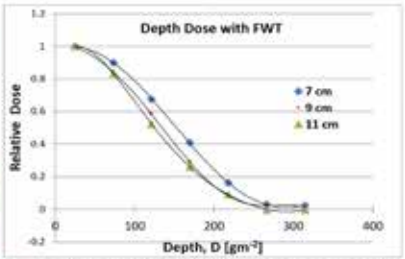
Table 2. Specification of the FWT

Parameters	Figure
Dose Range	0.5-200 kGy (0.05-20 Mrad)
Thickness	50 µm
Wavelength of Interest	510 nm and 600 or 605 nm
Colour Build Up Time	Typically, within 1 hour
Colour Change: Unirradiated	Clear
Irradiated	Deep blue

Experimental Setup

Results





Discussion

As the results, the depth dose profile with two kind of dosimetry films as B3 and FWT-60 with three different distance from window as 7 cm, 9 cm and 11 cm have been evaluated and studied. For the result as shown in figure 8 and figure 9, the depth dose profile of B3 and FWT-60 is decreasing with the increment of the thickness of the dosimeter. Both results are almost similar with the depth dose profile pattern.

Conclusion

In this paper, preliminary depth dose profile of LEEA has been obtained and evaluated. In near future, the

Evaluation of Elemental Pollution in Soil Samples from Klang Industrial Area

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Abstract: Studies of elemental pollution in the soil of the Klang industrial area were conducted to determine the concentration and level of pollution in that area using neutron activation analysis (NAA) techniques. The average concentration of major elements (Fe, Mg, Ti), heavy metals (As, Sb, Cr, Zn), and actinide (U and Th) in the soil of the Klang industrial area exceeded the average concentration in granitic igneous rocks. In comparison, the average concentration of rare earth elements (REEs) in soil samples in the study area is lower than in granitic igneous rocks (reference value). As, Zn and Cr elements showed a higher concentration in the SL 11 area, where business activities, vehicle workshops and residential were located. The REEs show a higher concentration in the SL 14 area compared to other sites. The Igeo index of Mg and U can be categorised as unpolluted to moderately polluted. As and Sb can be categorised as unpolluted to moderately polluted, and as extremely polluted in the areas of SL 11 and SL 14. The element of Th can be categorised as unpolluted to moderately and strongly polluted. The Igeo index of REEs can be categorised as unpolluted in the soil of the Klang Industrial area.

1.0 Introduction

In Malaysia, rapid development and urbanisation have become issues related to the release of major elements, heavy metals into the environment. Actinide elements (U, Th) become an issue due to their radiation level, and rare earth elements (REEs) activities such as mining, processing, recycling, waste treatment, and disposal are also an issue [1]. In general, sources of major elements, heavy metals, actinide and REEs contamination in soil mainly originate from two sources, namely anthropogenic activities and geogenic processes. The major activities that contribute to anthropogenic pollution such as industrial waste, mining, logging, land clearing, road construction, processing and manufacturing, domestic waste, sewage, agriculture (crops, palm oil and rubber), livestock farming and shipping activities [2][3]. Meanwhile, the geogenic process occurs with weathering of soil and rocks, soil erosion, terrestrial runoff and atmosphere deposition [2][4]. This study aims to determine the concentration, distribution and contamination level of major elements, heavy metals, actinide and REEs in the soil samples of Klang Industrial area.

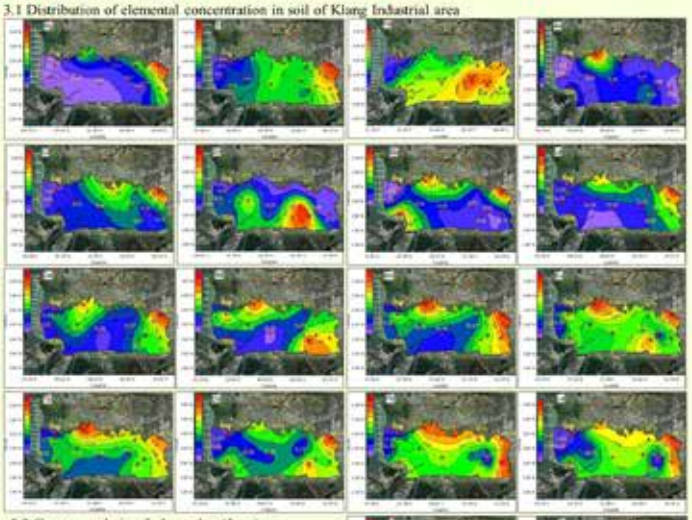
2.0 Methodology

2.1 Sampling Area

2.2 Analysis of elemental pollution by using Neutron Activation Analysis (NAA) at Reactor TRIGA PUSPATI, Malaysian Nuclear Agency and Gamma Spectrometer

3.0 Results and Discussion

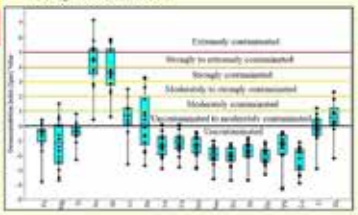
3.1 Distribution of elemental concentration in soil of Klang Industrial area



3.2 Geoaccumulation Index value (*Igeo*)

Geoaccumulation Index value (*Igeo*) [5]	Degree of contamination categories
Igeo < 0	Uncontaminated
0 < Igeo ≤ 1	Uncontaminated to moderately contaminated
1< Igeo ≤ 2	Moderately contaminated
2 < Igeo ≤ 3	Moderately to strongly contaminated
3 < Igeo ≤ 4	Strongly contaminated
4 < Igeo ≤ 5	Strongly to extremely contaminated
Igeo ≥ 5	Extremely contaminated

3.3 Degree of contamination of elements in soil of the Klang Industrial Area



4.0 Conclusion

The possible sources of major elements, heavy metals and actinide pollution could be originated from anthropogenic activities and natural land-based (landslides and terrestrial runoff). Average concentrations of all REEs showed lower than igneous granitic rock values of the respective elements. This clearly indicates no additional pollution of REEs in the soil samples of the Klang industrial area.

5.0 Acknowledgement

The authors would like to thank the Malaysian Nuclear Agency and the Regional Cooperative Agreement Regional Office (RCARO), Korea for financial support under the research grant (RCARP02/RC03).

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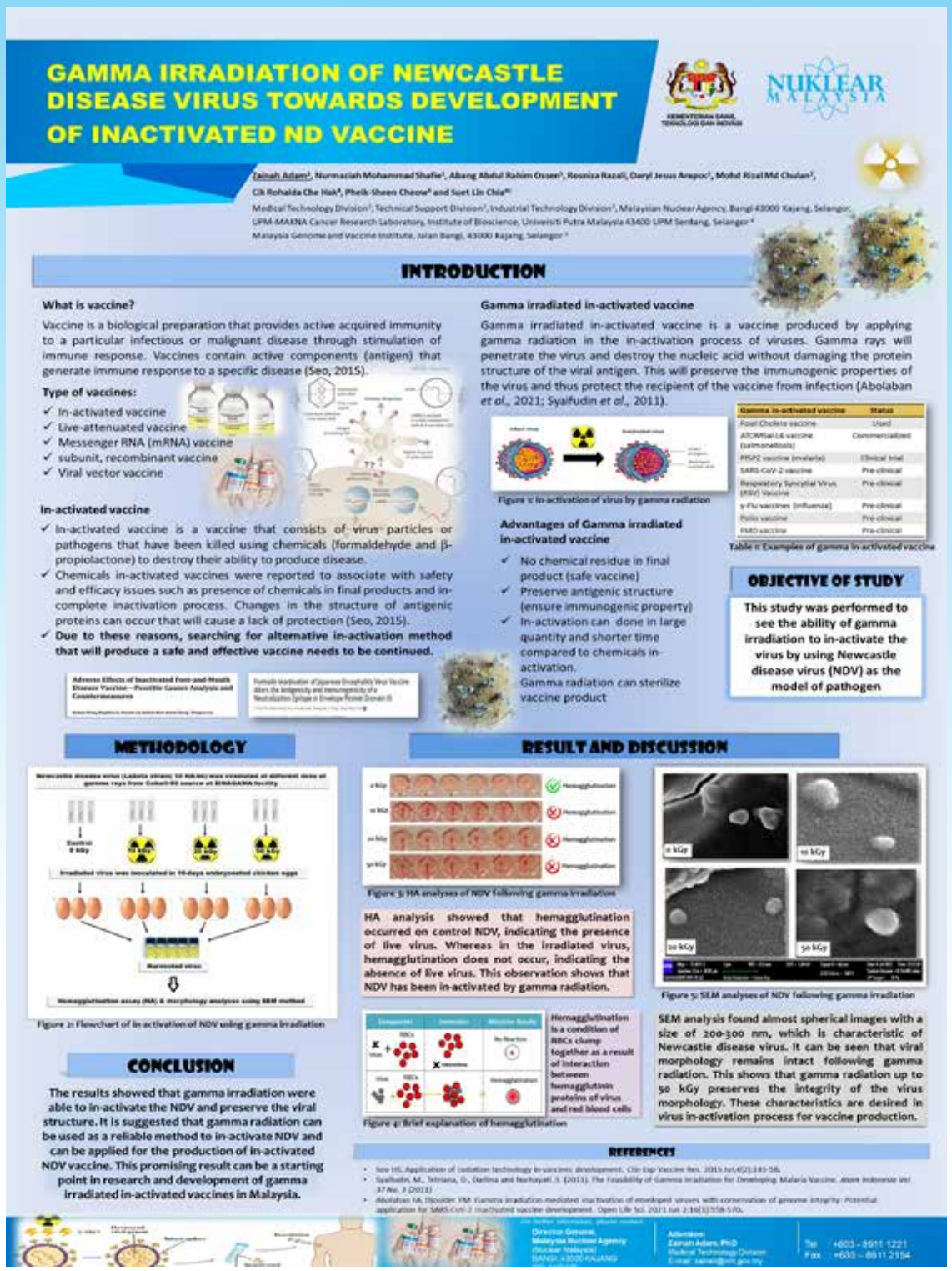
GAMMA IRRADIATION OF NEWCASTLE DISEASE VIRUS TOWARDS DEVELOPMENT OF INACTIVATED ND VACCINE
NUKLEAR MALAYSIA
Zainah Adam, Nurnaciah Mohammad Shafie, Abang Abdul Rahim Ossen, Rosniza Razali, Daryl Jesus Arapoc, Mohd Rizal Md Chulan, Cik Rohaida Che Hak, Pheik-Sheen Cheow and Suet Lin Chia
INTRODUCTION
What is vaccine?
Vaccine is a biological preparation that provides active acquired immunity to a particular infectious or malignant disease through stimulation of immune response. Vaccines contain active components (antigen) that generate immune response to a specific disease (Seo, 2015).
Type of vaccines:
✓ In-activated vaccine
✓ Live-attenuated vaccine
✓ Messenger RNA (mRNA) vaccine
✓ subunit, recombinant vaccine
✓ Viral vector vaccine
In-activated vaccine
✓ In-activated vaccine is a vaccine that consists of virus particles or pathogens that have been killed using chemicals (formaldehyde and β-propiolactone) to destroy their ability to produce disease.
✓ Chemicals in-activated vaccines were reported to associate with safety and efficacy issues such as presence of chemicals in final products and in-complete inactivation process. Changes in the structure of antigenic proteins can occur that will cause a lack of protection (Seo, 2015).
✓ Due to these reasons, searching for alternative in-activation method that will produce a safe and effective vaccine needs to be continued.
Gamma irradiated in-activated vaccine
Gamma irradiated in-activated vaccine is a vaccine produced by applying gamma radiation in the in-activation process of viruses. Gamma rays will penetrate the virus and destroy the nucleic acid without damaging the protein structure of the viral antigen. This will preserve the immunogenic properties of the virus and thus protect the recipient of the vaccine from infection (Abolaban et al., 2021; Syaifudin et al., 2011).
Figure 1: In-activation of virus by gamma radiation
Table 1: Examples of gamma in-activated vaccine
Advantages of Gamma irradiated in-activated vaccine
✓ No chemical residue in final product (safe vaccine)
✓ Preserve antigenic structure (ensure immunogenic property)
✓ In-activation can done in large quantity and shorter time compared to chemicals in-activation.
Gamma radiation can sterilize vaccine product
OBJECTIVE OF STUDY
This study was performed to see the ability of gamma irradiation to in-activate the virus by using Newcastle disease virus (NDV) as the model of pathogen
METHODOLOGY
Figure 2: Flowchart of in-activation of NDV using gamma irradiation
RESULT AND DISCUSSION
Figure 3: HA analyses of NDV following gamma irradiation
HA analysis showed that hemagglutination occurred on control NDV, indicating the presence of live virus. Whereas in the irradiated virus, hemagglutination does not occur, indicating the absence of live virus. This observation shows that NDV has been in-activated by gamma radiation.
Figure 4: Brief explanation of hemagglutination
Hemagglutination is a condition of RBCs clump together as a result of interaction between hemagglutinin proteins of virus and red blood cells
Figure 5: SEM analyses of NDV following gamma irradiation
SEM analysis found almost spherical images with a size of 200-300 nm, which is characteristic of Newcastle disease virus. It can be seen that viral morphology remains intact following gamma radiation. This shows that gamma radiation up to 50 kGy preserves the integrity of the virus morphology. These characteristics are desired in virus in-activation process for vaccine production.
CONCLUSION
The results showed that gamma irradiation were able to in-activate the NDV and preserve the viral structure. It is suggested that gamma radiation can be used as a reliable method to in-activate NDV and can be applied for the production of in-activated NDV vaccine. This promising result can be a starting point in research and development of gamma irradiated in-activated vaccines in Malaysia.
REFERENCES

Natural Weathering Effects on the Morphological and Physicochemical Properties of Radiation Curable Coatings in Tropical Climate

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1 Abstract

The purpose of this research was to study the natural weathering on palm oil-based and petrochemical-based coatings prepared using the radiation curing approach. The coatings were cured using bio-based resins with TiO_2 nanoparticle loading and POBUA. The petrochemical-based coatings were cured using commercial resins. The performance of natural and synthetic coatings was evaluated for natural weathering for up to 60 days at varied angles of 0°, 45°, and 90°. The effect of natural weathering conditions on the surface morphological, physiochemical, and also flexural characteristics of coatings, as well as the discoloration visual inspection and the growth of mould or fungus on the tested specimen, was studied. The results showed that natural weathering exposure induced severe discoloration and deterioration of the polymer network structure of the coatings due to photo-oxidation reaction and the presence of fungi. Overall, palm oil-based coatings deteriorate slower than petroleum-based coatings, especially at a 90° angle. This study indicated that bioresources-based palm oil has a significant potential for wood-based structural applications due to its superior qualities over synthetic-based coatings.

2 Introduction

Surface finishing materials derived from biomass resources, such as palm oil, have the potential to be one of the top choices among local industries since they have quality characteristics comparable to petrochemical-based coating products, and are even more environmentally friendly.

Along with the manufacturing of such cutting-edge materials, radiation curing technology is a green technology because it emits less or no volatile organic compounds (VOC) into the environment when compared to conventional techniques.

3 Objective

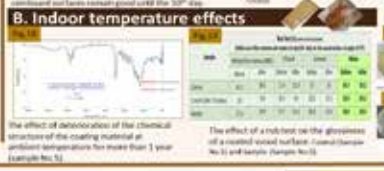
1. To compare the durability studies on a series of palm oil-based and petrochemical-based UV curable coatings under tropical climate.
2. To evaluate the surface morphological and physiochemical properties of the coatings for weathered and indoor environments.
3. To analyse the coatings fracture behaviour and mould/fungus growth.

4 Materials & Methods

5 Results

A. Natural weathering effects

B. Indoor temperature effects



C. Antimicrobial Assessment

6 Conclusion

1. The coatings were severely discolored as a result of the weathering effect resulting from film coating degradation after exposure to natural weathering.
2. The natural weathering exposure on the coatings decreased the surface morphological and physiochemical properties due to surface deterioration as revealed by FTIR and visual observation.
3. Significant reductions in surface morphological features of the uncoated wood substrate where mould formed were detected, showing that the effects of weathering conditions are more obvious in uncoated surfaces than in coated surfaces.
4. The hydrophobic nature of the coatings and TiO_2 reduced the water molecule penetration and water absorption into the coated specimens.
5. Significant reductions were observed in chemical functional group properties of coatings where the polymer structure deteriorated for the weathered specimen was reduced drastically at 0° and 45° for the bio-based coatings, indicating the effects of weathering conditions are more pronounced in 0 and 45 angles than 90 angle.

Palm oil-based coatings have the potential to be used in related applications such as wood-based material, due to their comparable properties to synthetic petrochemical-based coatings. An appropriate treatment or coating is advised to apply to the substrate, such as rubber wood and cemboard, to improve its durability performance for widespread application in many industries, particularly in the surface finishing for wood varnish.

7 Acknowledgment

The Authors would like to thank Radiation Processing Technology Division, Malaysia Nuclear Agency (Nuclear Malaysia), and Ministry of Science, Technology and Innovation Malaysia (MOSTI) for the research support. The authors would like to extend their gratitude to Nuclear Malaysia for the funding of this research through Researchers Project numbers (NM-R&D-20-52 and NM-R&D-22-96).

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KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

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ANALYSIS OF URANIUM AND THORIUM IN RADIOACTIVE WASTEWATER SAMPLES IN ACCORDANCE WITH AMERICAN PUBLIC HEALTH ASSOCIATION (APHA) 3125 METHOD

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ABSTRACT

The main issue with uranium and thorium in wastewater is their potential to contaminate the water bodies. The unregulated wastewater release can affect the ecosystem and potentially harm aquatic life. Therefore, there is a need to establish the analysis of uranium and thorium using standard method to obtain better sensitivity and good confidence in the final report. In this study, the determination of uranium and thorium was employed using the American Public Health Association (APHA) method 3125 standard method. The method performance and method detection level (MDL) samples were prepared in the deionized water and digested using hot block (APHA 3030E) and microwave digester (APHA 3030K). The quantification of uranium (^{235}U, ^{238}U,) and thorium (^{232}Th) in the method performance and MDL samples was performed using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS).

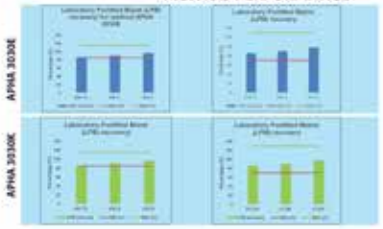
From the results, the method performance samples for both digestion methods were in accordance to the of APHA requirement. The MDL obtained from APHA 3030E for ^{232}Th , ^{238}U, and ^{235}U were 5, 7, and 8 µg L^{-1} respectively. Meanwhile, the MDL obtained from the microwave digester for ^{232}Th, ^{238}U, and ^{235}U, and were 2, 3, and 3 µg L^{-1} respectively. The microwave digester technique gives lower and better detection limit and compared to the hot block digestion technique. Based on APHA 3030K MDL, ^{232}Th was detected in wastewater sample while ^{238}U and ^{235}U were less than MDL. Meanwhile for APHA 3030E, all elements were below than MDL. This study will enhance the detection of uranium and thorium in the wastewater sample towards better environmental monitoring programs at the national and global levels.

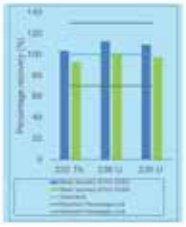
Keywords: Uranium, Thorium, ICP-MS, method detection limit, microwave digester, hot block digester

METHODOLOGY

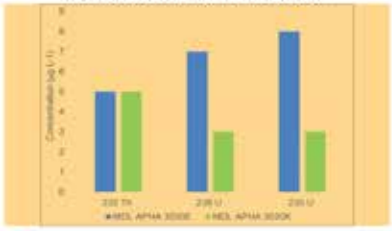
RESULT & DISCUSSION

METHOD PERFORMANCE

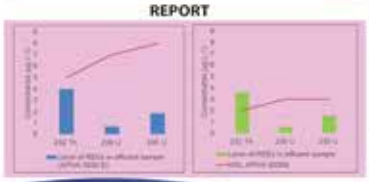




METHOD DETECTION LEVEL (MDL)



REPORT



CONCLUSIONS

1) Both method deliver good method performance (MB, LFB, LFM, LFMD)
2) MDL of ^{232}Th, ^{238}U and ^{235}U is higher in APHA 3030E than MDL of ^{232}Th, ^{238}U and ^{235}U.
3) ^{232}Th is detected using APHA 3030K method and <MDL in APHA 3030E in effluent sample
4) Standard APHA 3125 method able to determine ^{232}Th, ^{238}U and ^{235}U in precise and accurate

ACKNOWLEDGEMENTS

The authors would like thanks to the Analytical Chemistry Application (ACA) Group from Malaysian Nuclear Agency for the support in budgetary from Trust Account and technical works. The author also would like to thank to WASTEC of Malaysian Nuclear Agency group for their support during effluent sample collection.

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References:
1) American Public Health Association (APHA), 23rd edition, 2017

KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

NUKLEAR MALAYSIA

INTERNATIONAL NUSTEC 2023

INTERNATIONAL NUCLEAR SCIENCE,TECHNOLOGY AND ENGINEERING CONFERENCE 2023

DENSITY PROFILE COMPARISON OF DIFFERENT BUILD-UP USING GAMMA TRANSMISSION

Mohd Fitri Abd Rahman[1], Hanafi Ithnin[1], Nurul Huda Azahar[1], Lalisson @ Normanshah Duhing[1], Airwan Affandi Mahmood[1], Hearie Hasan[1] and Nurliyana Abdullah[2]

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ABSTRACT

Utilizing gamma radiation, a specialized pipe scanning apparatus was employed to detect anomalies within piping systems, showcasing its remarkable ability to effortlessly permeate metals and steel. Nevertheless, the task of identifying constituent materials within piping systems becomes intricate in the presence of multiple samples. This state-of-the-art pipe scanning technology serves the purpose of non-destructively examining pipes and finds extensive application in industries like oil and gas, manufacturing, and infrastructure. This study primarily focuses on a comparative analysis between empirical experimentation and computational modelling. The investigation underscores the pipe scanner's precision in recognizing and characterizing anomalies within simulated samples. The outcomes of this research bear significant relevance to industries reliant on pipe systems, signifying advancements in inspection methodologies.

Figure 1: Schematic Diagram Experimental on Different Samples using Pipe Scanner

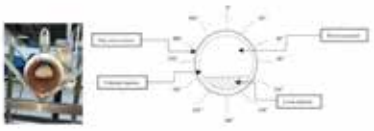

Figure 2: Sample position inside the pipeline (left) the scanning orientation and the measurement points (right)

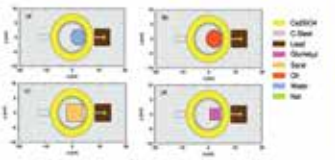

Figure 3: Pipe Scanning model in PHITS code with four different sample

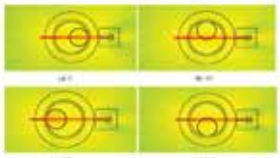

Figure 4: The example of gamma-ray tracking in the PHITS simulation at four different angles

INTRODUCTION

Gamma rays can be used for on-line investigations because they penetrate and pass through matter, such as steel pipe, and are attenuated to a degree directly proportional to the material density and thickness. The comparison of density profiles of different build-ups can be used to study the effects of the build-up factor on the accuracy of the density measurements. The comparison can also be used to develop more accurate build-up factors for different materials and gamma ray energies.

METHODOLOGY

- Four different sample densities were used in this study.
- Two different insulated pipe diameters were used.
- The study incorporated both experimental and simulation methods. The experimental setups are illustrated in *Figure 1 and Figure 2.*
- The simulation for the pipe scanning experiment was executed using the Particle and Heavy Ion Transport Code System (PHITS) as shown in *Figure 3 and Figure 4.*
- Both the experimental and simulation scanning were done using the same angle setup.

RESULTS

Figure 5 illustrates the PHITS simulation results, while *Figure 6* presents the experimental findings. Both sets of results concur with each other, demonstrating that the attenuation for the different materials depends on their density, with the detector response decreasing as the material density increases. The shape also influenced the detector response count, as the gamma-ray attenuation path inside the sample depends on that sample shape at different scanning angles. The graph in the simulation results clearly shows the distinction between the gamma ray profile with different densities and shapes. While some of the graphs in the experimental results overlap, they still reveal three groups of plots with different density. The overlap in graphs with small density differences can be due to the random effect of the radiation source decay.

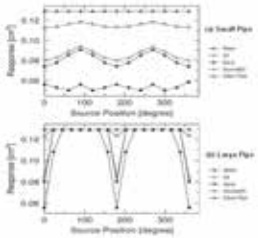

Figure 5: Graph of detector response at different scanning angel for (a) Small pipe and (b) Large pipe.

Figure 6: Graph of gamma-ray intensity profile for small pipe

CONCLUSION

The exploration of density profile disparities in different build-up materials through gamma transmission techniques has yielded significant findings and implications, underscoring the importance of this research in radiation-intensive applications and industries. Throughout our investigation, we have discerned that the choice of build-up materials plays a pivotal role in shaping the behaviours of gamma radiation across various scenarios. Our comprehensive examination of density profiles in materials such as sand, water, oil, and GlurnetDC has unveiled distinct attenuation and penetration characteristics. These insights are paramount for optimizing the precision and efficacy of radiation-based procedures. Nevertheless, conducting simulations prior to any experimental work remains a crucial prerequisite.

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KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

NUKLEAR MALAYSIA

INTERNATIONAL NUSTEC 2023

INTERNATIONAL NUCLEAR SCIENCE, TECHNOLOGY AND ENGINEERING CONFERENCE 2023

AN OVERVIEW OF X-RAY MICRO COMPUTED TOMOGRAPHY (MICRO-CT) APPLICATION AT THE MALAYSIAN NUCLEAR AGENCY

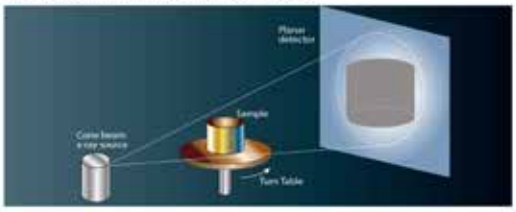
Roslan Yahya, Mohd Fitri Abdul Rahman, Lahasen @ Normanshah Dahing, Nazrul Hizam, Azhani Mohd Razali, Khairiah Yazid @ Khalid, Maziah Jamaludin and Hearie Hassan

INTRODUCTION

Tomography technology, initially employed in the 1970s, became crucial in medicine for creating internal images of the human body using X-rays. Concurrently, as computer technology advanced, X-ray Micro Computed Tomography (Micro-CT) was developed, offering high-resolution cross-sectional imaging of microscopic objects. This enables precise research into materials like biological tissues, morphology, and small component distribution within products.

Micro-CT PRINCIPLES

Micro-CT imaging operates on a principle similar to medical CT scans, utilizing cone beam X-rays directed at the object being examined. Some X-rays are absorbed by the object's internal structures based on their density, while the remaining X-rays reach a planar detector. The object is rotated on a turntable during scanning, capturing multiple X-ray projections from different angles. These projections are then processed by a computer to create a 2D cross-sectional as well as 3D image of the object.



BASIC SPECIFICATIONS OF MICRO-CT AT MALAYSIAN NUCLEAR AGENCY

- High-resolution imaging: down to 5µm.
- X-ray sources: Ranging from 20 to 100 kV.
- Radiation detector: CCD (charge-coupled device) resolution of 1.3Mp.
- Sample size: 20mm diameter and 20mm length (max).
- Scanning time: Ranging from 15 minutes to 1 hour.
- Image reconstruction: Nrecon software for data processing and image reconstruction.

Skyscan 1172 Micro-CT system at Malaysian Nuclear Agency

APPLICATION OF MICRO-CT AT NUCLEAR MALAYSIA

One specific application involves exploring dual-energy imaging's potential to improve image quality. A complex electronic microcontroller was used as a specimen and scanned with a Micro-CT at two energy levels (60kVp and 100kVp). Dual-energy image processing was applied, and results were compared with single-energy images, revealing the sample's internal structure effectively, including raised surfaces.

(a) Actual picture (b) Dual-energy weighted average method (c) Dual-energy subtraction method

Another research utilized Micro-CT and scanning electron microscopy to examine agarwood's resin micro-structure. Two sets of agarwood chips, high-quality and lower quality were compared. The study revealed that wood cells containing resin had higher attenuation levels. The combined use of scanning electron microscopy and Micro-CT produced high-resolution images, detailing the location and structure of agarwood resin. Scanning electron microscopy provided 2D morphological data, while Micro-CT allowed for a comprehensive 3D analysis of agarwood's internal structure. These advanced imaging methods hold promise for standardizing the grading of agarwood.

Different study explores the potential of Micro-CT in entomology, focusing on small insects. Micro-CT scans were used to create high-quality images, revealing both external and internal morphological features of the flower beetle. This technology advancement offers valuable insights into the intricate structures of tiny creatures and holds promise for entomology research and education. It may contribute to the development of interactive teaching methods, including virtual reality, in the field of entomology in the future.

(a) In actual photo (b) x-ray radiographic (c) 3D view

Micro-CT scanning has been applied to a variety of specimens beyond those discussed. This includes items such as bones, teeth, fly larvae, dried fruits, materials used in additive manufacturing, composites, and more. These samples are suitable for Micro-CT scanning due to their manageable size, absence of high-density materials, and solid composition, making them compatible with this imaging technique.

ADVANTAGES OF MICRO-CT

- Non-destructive
- High-resolution imaging: micrometer range
- Rapid imaging
- Quantitative data
- 3D imaging

LIMITATION OF MICRO-CT

- Sample size limitation
- Resolution constraints for large sample
- Contrast limitations
- Artifacts
- Temporal resolution limitations

CONCLUSION

Micro-CT is a non-destructive imaging technique that provides detailed 2D and 3D views of small objects. It finds applications in materials science, biology, and engineering, allowing examination of materials and biological specimens. Overall, Micro-CT is a powerful and essential tool in various research and development fields.

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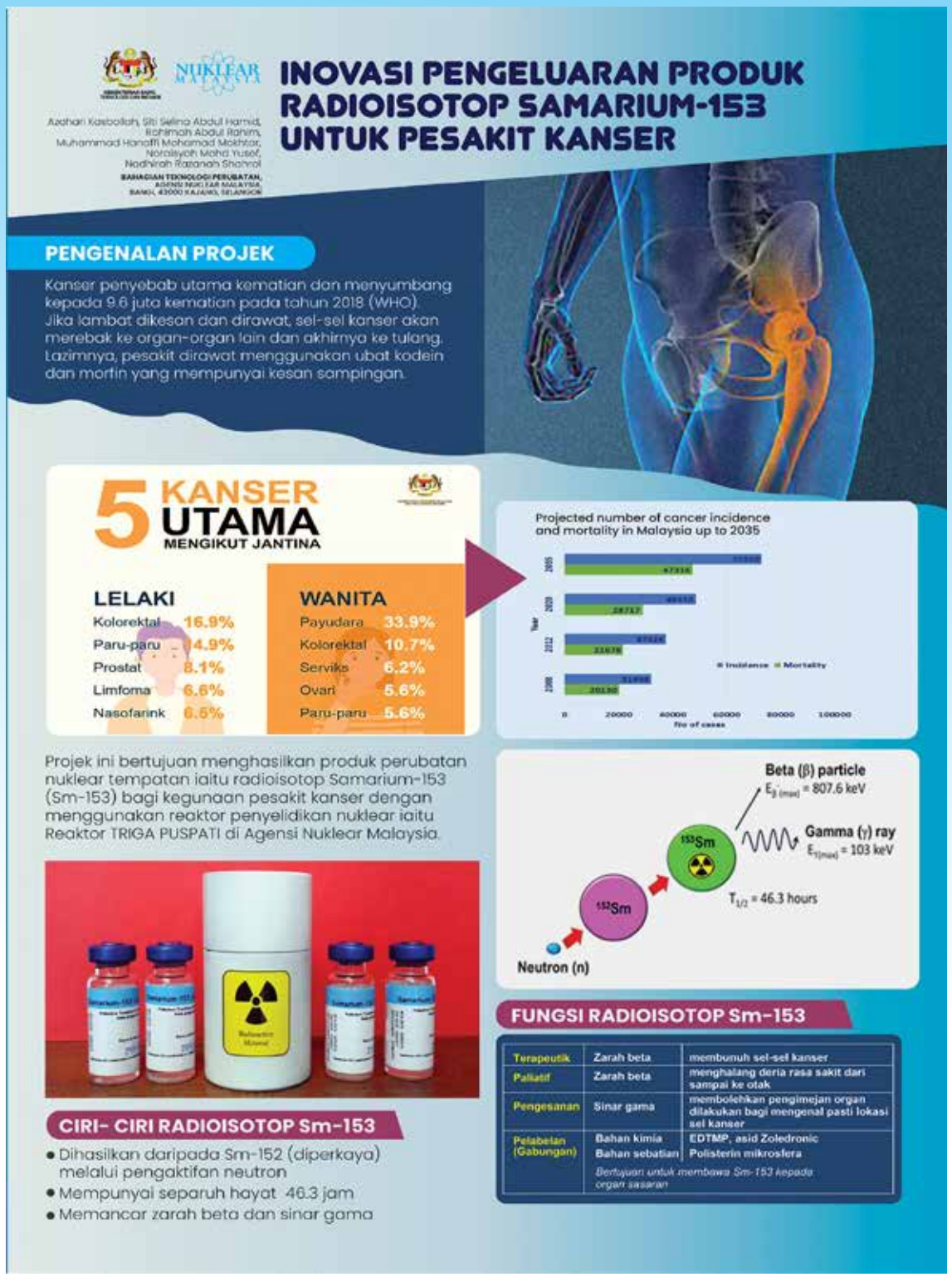
SELANGOR INTERNATIONAL EXPO (SRIE)

19-22 Okt 2023


NUKLEAR MALAYSIA
INOVASI PENGELUARAN PRODUK RADIOISOTOP SAMARIUM-153 UNTUK PESAKIT KANSER
Azahari Kasbollah, Siti Selina Abdul Hamid, Rohimah Abdul Rahim, Muhammad Hanaffi Mohamad Mokhtar, Norsilayoh Mohd Yusof, Nadhirah Razanah Shahrol
BAHAGIAN TEKNOLOGI PERUBATAN, AGENSI NUKLEAR MALAYSIA, BANGI, 43000 KAJANG, SELANGOR
PENGENALAN PROJEK
Kanser penyebab utama kematian dan menyumbang kepada 9.6 juta kematian pada tahun 2018 (WHO). Jika lambat dikesan dan dirawat, sel-sel kanser akan merebak ke organ-organ lain dan akhirnya ke tulang. Lazimnya, pesakit dirawat menggunakan ubat kodein dan morfin yang mempunyai kesan sampingan.
5 KANSER UTAMA MENGIKUT JANTINA
LELAKI
Kolorektal 16.9%
Paru-paru 14.9%
Prostat 8.1%
Limfoma 6.6%
Nasofarink 6.5%
WANITA
Payudara 33.9%
Kolorektal 10.7%
Serviks 6.2%
Ovari 5.6%
Paru-paru 5.6%
Projected number of cancer incidence and mortality in Malaysia up to 2035
Year
2035
2020
2012
2008
Incidence
Mortality
0
20000
40000
60000
80000
100000
No of cases
Projek ini bertujuan menghasilkan produk perubatan nuklear tempatan iaitu radioisotop Samarium-153 (Sm-153) bagi kegunaan pesakit kanser dengan menggunakan reaktor penyelidikan nuklear iaitu Reaktor TRIGA PUSPATI di Agensi Nuklear Malaysia.
Beta (β) particle
$E_{\beta(max)}$ = 807.6 keV
Gamma (γ) ray
$E_{\gamma(max)}$ = 103 keV
^{153}Sm
^{152}Sm
$T_{1/2}$ = 46.3 hours
Neutron (n)
CIRI- CIRI RADIOISOTOP Sm-153
• Dihasilkan daripada Sm-152 (diperkaya) melalui pengaktifan neutron
• Mempunyai separuh hayat 46.3 jam
• Memancar zarah beta dan sinar gama
FUNGSI RADIOISOTOP Sm-153
Terapeutik | Zarah beta | membunuh sel-sel kanser
Paliatif | Zarah beta | menghalang deria rasa sakit dari sampai ke otak
Pengesanan | Sinar gama | membolehkan pengimejan organ dilakukan bagi mengenal pasti lokasi sel kanser
Pelabelan (Gabungan) | Bahan kimia | EDTMP, asid Zoledronic
Bahan sebatian | Polisterin mikrosfera
Bertujuan untuk membawa Sm-153 kepada organ sasaran


NUKLEAR MALAYSIA
INOVASI PENGELUARAN PRODUK RADIOISOTOP SAMARIUM-153 UNTUK PESAKIT KANSER
Azahari Kasbollah, Siti Selina Abdul Hamid, Rahimah Abdul Rahim, Muhammad Hanafi Mohamad Mokhtar, Noraisyah Mohd Yusof, Nadhirah Razanah Shahrol
BAHAGIAN TEKNOLOGI PERUBATAN, AGENSI NUKLEAR MALAYSIA, BANGI, 43000 KAJANG, SELANGOR
PROSES INOVASI
Proses penghasilan Samarium-153 (Sm-153) menggunakan teknik yang dibangunkan untuk menghasilkan radioisotop beraktiviti tinggi untuk kegunaan perubatan melalui operasi kitaran menggunakan kemudahan Reaktor TRIGA PUSPATI (RTP)
Kaedah ini boleh mengelakkan racun neutron (kepekatan xenon dan samarium) yang dihasilkan daripada operasi kitaran reaktor yang dilanjutkan, sekali gus dapat meningkatkan hasil aktiviti spesifik (radioaktiviti) yang dikehendaki.
PEMPROSESAN Sm-153
KEPENTINGAN PROJEK DAN SUMBANGAN KEPADA MASYARAKAT DAN NEGARA
BERIMPAK TINGGI
Produk menepati spesifikasi piawaian antarabangsa (British Pharmacopeia dan United State Pharmacopeia)
Mudah dan cepat diperolehi berbanding produk import
Membantu meningkatkan kualiti hidup pesakit kanser
Membunuh sel-sel kanser pada organ sasaran
NILAI UNTUK WANG (VALUE FOR MONEY)
Keluaran tempatan : Lebih murah berbanding produk yang sama keluaran luar negara
Mengurangkan kos rawatan pesakit kanser
Mengurangkan kebergantungan ubatan dari luar negara
Mengurangkan pengaliran wang ke luar negara
KEMAMPANAN
Berpotensi tinggi di pasaran perubatan nuklear berikutan kadar kes kanser yang semakin meningkat
Berpotensi untuk dieksport ke negara jiran
Menggalakkan industri perlancongan perubatan ke Malaysia
PENDIGITALAN
Pendigitalan imej diagnostik dalam bentuk 3D
Memudahkan lokasi sel kanser dikenalpasti
Membantu penentuan jenis rawatan kepada pesakit
Pendigitalan laporan perubatan pesakit kanser
Mudah diakses
Spesifik kepada jenis kanser
REAKTOR TRIGA PUSPATI
Sm-153 keluaran tempatan vs Sm-153 yang di import
IMPAK | Produk radioisotop tempatan Sm-153 | Sm-153 import
KOS | 1/5 pengurangan dari kos import | Sangat mahal, RM20,000/ rawatan
KETERSEDIAAN | Boleh diperolehi pada bila-bila masa, mengikut permintaan | Perlu di import dari luar negara
MASA | Dalam 5 hari bekerja | Minimum tempoh menunggu 30 hari
Samarium
Radioactive Material

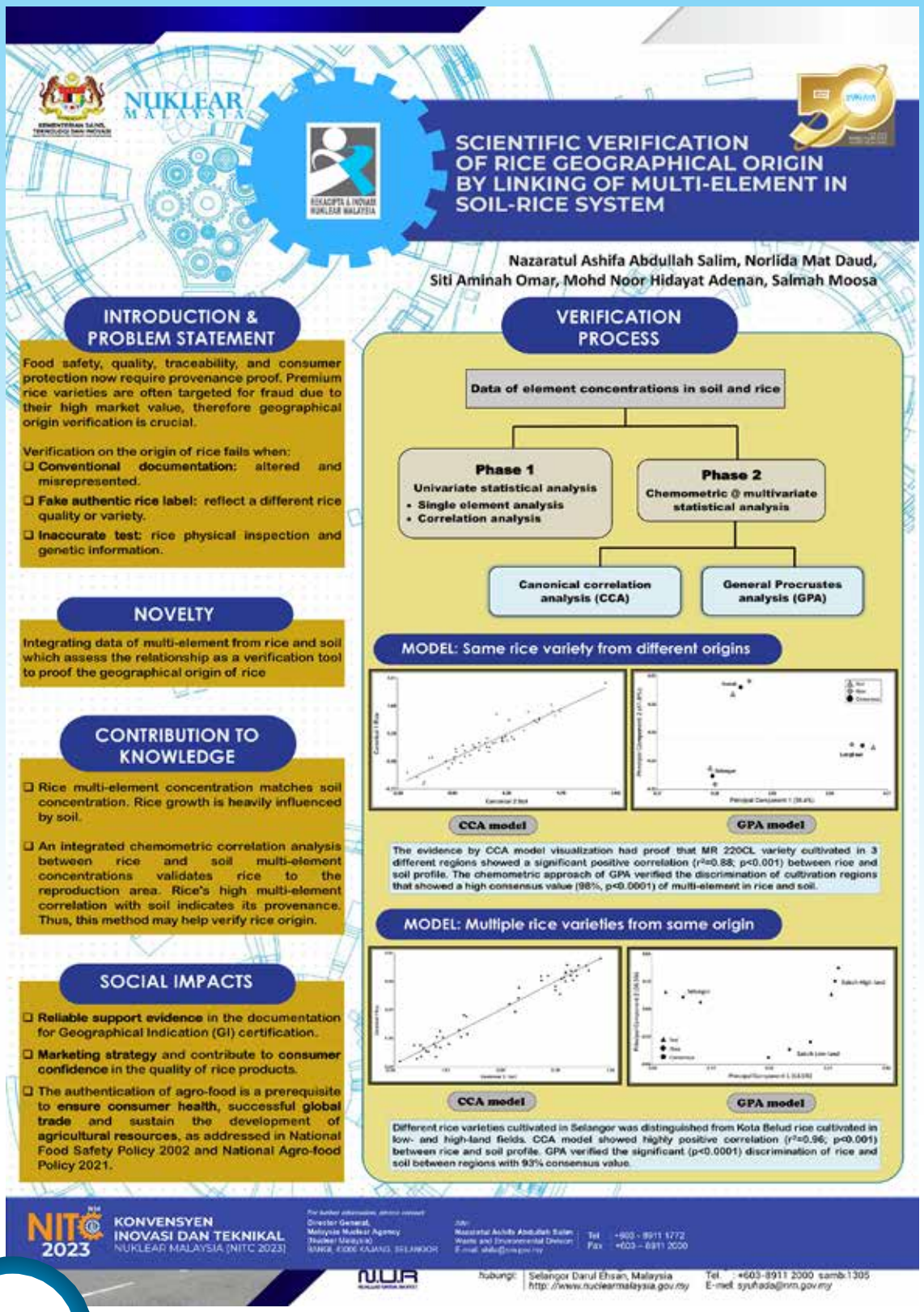
SELANGOR INTERNATIONAL EXPO (SRIE)

SELANGOR INTERNATIONAL EXPO (SRIE)

HARI INOVASI NUKLEAR MALAYSIA (HINM)

24-26 Okt 2023

SELANGOR INTERNATIONAL EXPO (SRIE)


NUKLEAR MALAYSIA
SCIENTIFIC VERIFICATION OF RICE GEOGRAPHICAL ORIGIN BY LINKING OF MULTI-ELEMENT IN SOIL-RICE SYSTEM
Nazaratul Ashifa Abdullah Salim, Norlida Mat Daud, Siti Aminah Omar, Mohd Noor Hidayat Adenan, Salmah Moosa
INTRODUCTION & PROBLEM STATEMENT
Food safety, quality, traceability, and consumer protection now require provenance proof. Premium rice varieties are often targeted for fraud due to their high market value, therefore geographical origin verification is crucial.
Verification on the origin of rice fails when:
Conventional documentation: altered and misrepresented.
Fake authentic rice label: reflect a different rice quality or variety.
Inaccurate test: rice physical inspection and genetic information.
NOVELTY
Integrating data of multi-element from rice and soil which assess the relationship as a verification tool to proof the geographical origin of rice
CONTRIBUTION TO KNOWLEDGE
Rice multi-element concentration matches soil concentration. Rice growth is heavily influenced by soil.
An integrated chemometric correlation analysis between rice and soil multi-element concentrations validates rice to the reproduction area. Rice's high multi-element correlation with soil indicates its provenance. Thus, this method may help verify rice origin.
SOCIAL IMPACTS
Reliable support evidence in the documentation for Geographical Indication (GI) certification.
Marketing strategy and contribute to consumer confidence in the quality of rice products.
The authentication of agro-food is a prerequisite to ensure consumer health, successful global trade and sustain the development of agricultural resources, as addressed in National Food Safety Policy 2002 and National Agro-food Policy 2021.
VERIFICATION PROCESS
Data of element concentrations in soil and rice
Phase 1
Univariate statistical analysis
Single element analysis
Correlation analysis
Phase 2
Chemometric @ multivariate statistical analysis
Canonical correlation analysis (CCA)
General Procrustes analysis (GPA)
MODEL: Same rice variety from different origins
CCA model
GPA model
The evidence by CCA model visualization had proof that MR 220CL variety cultivated in 3 different regions showed a significant positive correlation (r^2=0.88; p<0.001) between rice and soil profile. The chemometric approach of GPA verified the discrimination of cultivation regions that showed a high consensus value (98%, p<0.0001) of multi-element in rice and soil.
MODEL: Multiple rice varieties from same origin
CCA model
GPA model
Different rice varieties cultivated in Selangor was distinguished from Kota Belud rice cultivated in low- and high-land fields. CCA model showed highly positive correlation (r^2=0.96; p<0.001) between rice and soil profile. GPA verified the significant (p<0.0001) discrimination of rice and soil between regions with 93% consensus value.
NITC 2023
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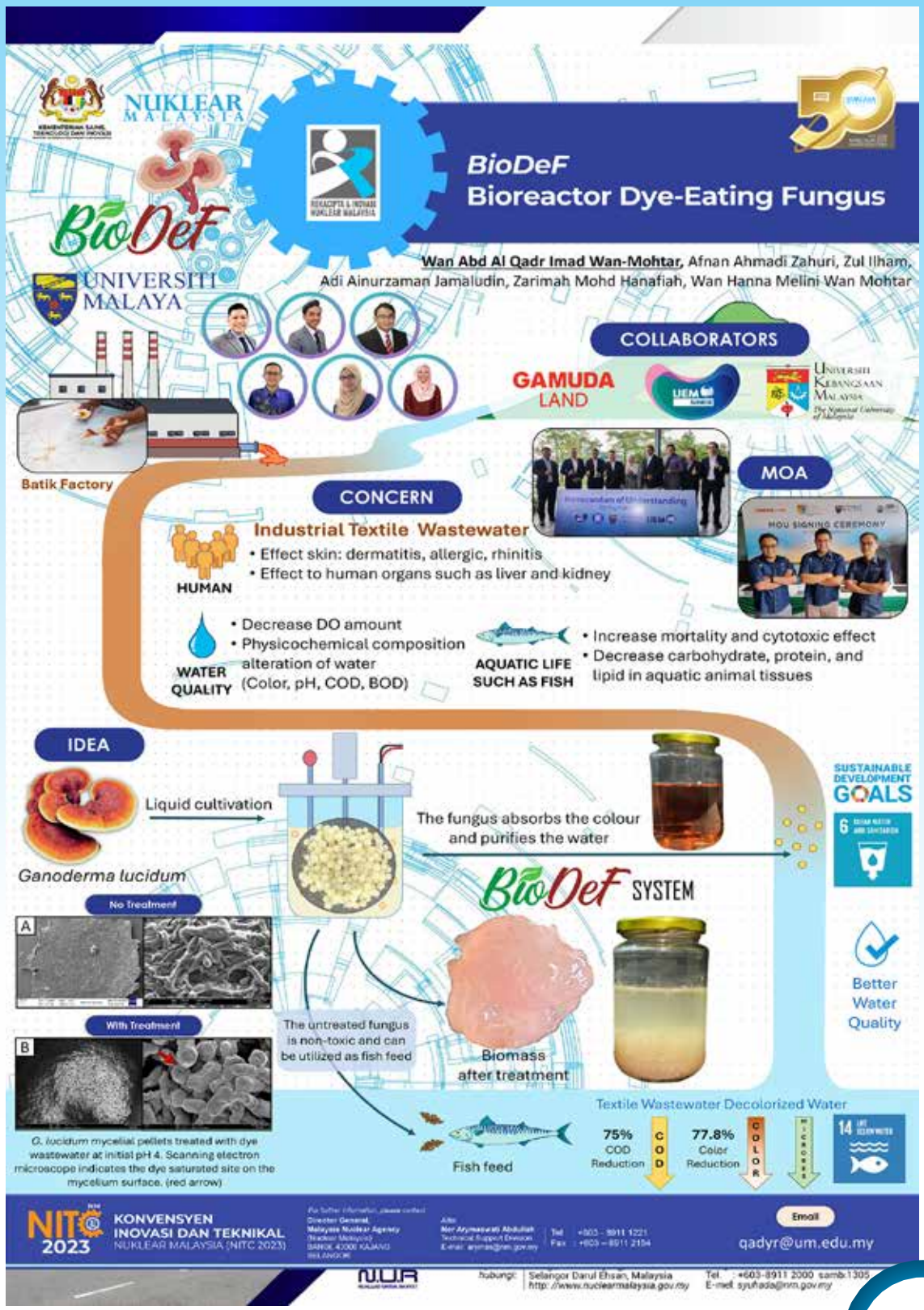
NUKLEAR MALAYSIA
BioDeF
UNIVERSITI MALAYA
BioDeF
Bioreactor Dye-Eating Fungus
Wan Abd Al Qadr Imad Wan-Mohtar, Afnan Ahmadi Zahuri, Zul Ilham, Adi Ainurzaman Jamaludin, Zarimah Mohd Hanafiah, Wan Hanna Melini Wan Mohtar
COLLABORATORS
GAMUDA LAND
UKM
UNIVERSITI KEBANGSAAN MALAYSIA
MOA
MOU SIGNING CEREMONY
Batik Factory
CONCERN
Industrial Textile Wastewater
HUMAN
• Effect skin: dermatitis, allergic, rhinitis
• Effect to human organs such as liver and kidney
WATER QUALITY
• Decrease DO amount
• Physicochemical composition alteration of water (Color, pH, COD, BOD)
AQUATIC LIFE SUCH AS FISH
• Increase mortality and cytotoxic effect
• Decrease carbohydrate, protein, and lipid in aquatic animal tissues
IDEA
Liquid cultivation
Ganoderma lucidum
The fungus absorbs the colour and purifies the water
BioDeF SYSTEM
SUSTAINABLE DEVELOPMENT GOALS
Better Water Quality
No Treatment
With Treatment
A
B
G. lucidum mycelial pellets treated with dye wastewater at initial pH 4. Scanning electron microscope indicates the dye saturated site on the mycelium surface. (red arrow)
The untreated fungus is non-toxic and can be utilized as fish feed
Biomass after treatment
Fish feed
Textile Wastewater Decolorized Water
75% COD Reduction
77.8% Color Reduction
COLOR
MICROBES
NITC 2023
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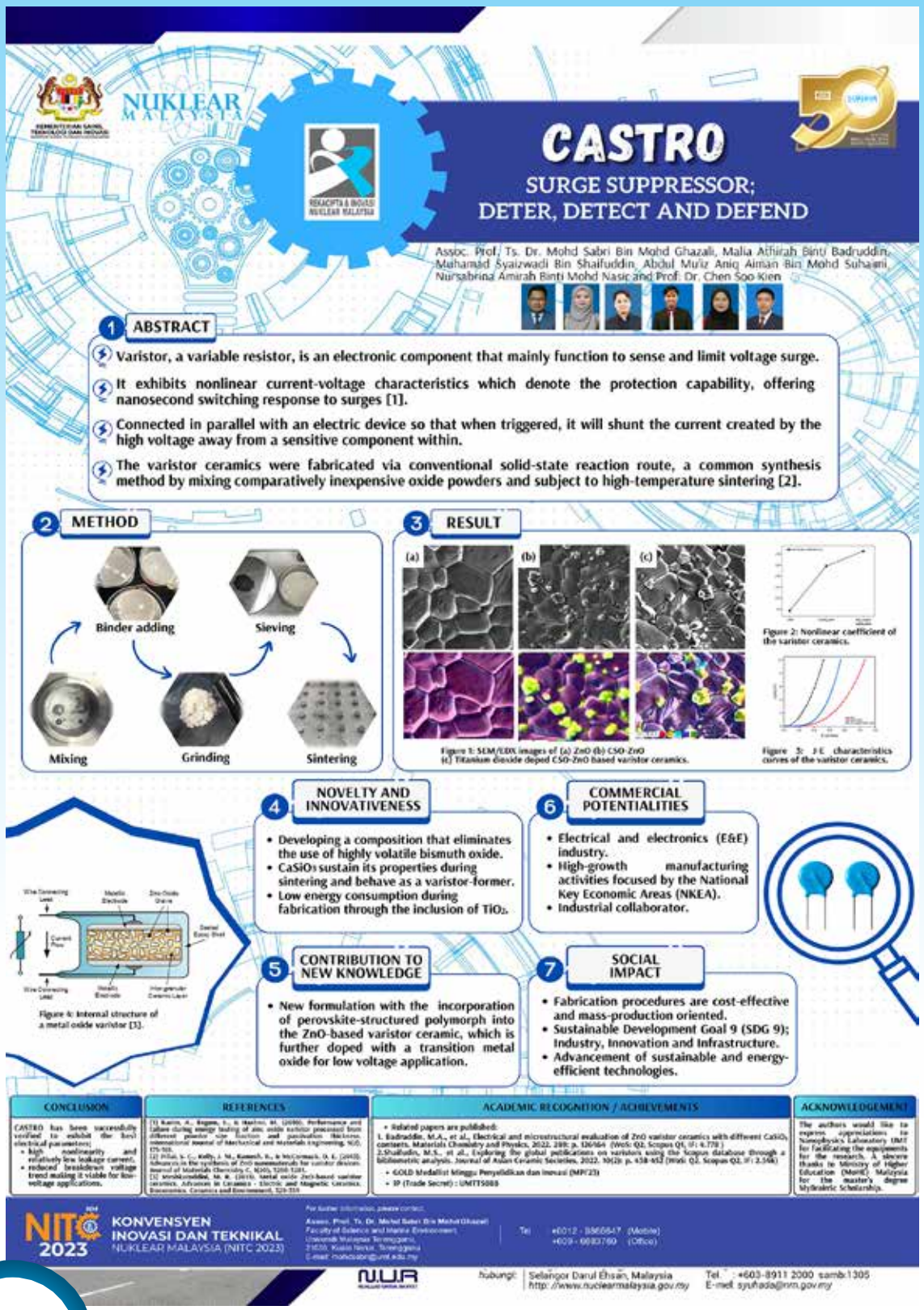
NUKLEAR MALAYSIA
CASTRO
SURGE SUPPRESSOR;
DETER, DETECT AND DEFEND
Assoc. Prof. Ts. Dr. Mohd Sabri Bin Mohd Ghazali, Malia Athirah Binti Badruddin, Muhamad Syaizwadi Bin Shaifuddin, Abdul Mu'iz Aniq Aiman Bin Mohd Suhaimi, Nursabrina Amirah Binti Mohd Nasir and Prof. Dr. Chen Soo Kien
1 ABSTRACT
Varistor, a variable resistor, is an electronic component that mainly function to sense and limit voltage surge.
It exhibits nonlinear current-voltage characteristics which denote the protection capability, offering nanosecond switching response to surges [1].
Connected in parallel with an electric device so that when triggered, it will shunt the current created by the high voltage away from a sensitive component within.
The varistor ceramics were fabricated via conventional solid-state reaction route, a common synthesis method by mixing comparatively inexpensive oxide powders and subject to high-temperature sintering [2].
2 METHOD
Binder adding
Sieving
Mixing
Grinding
Sintering
3 RESULT
(a)
(b)
(c)
Figure 1: SEM/EDX images of (a) ZnO (b) CSO-ZnO (c) Titanium dioxide doped CSO-ZnO based varistor ceramics.
Figure 2: Nonlinear coefficient of the varistor ceramics.
Figure 3: J-E characteristics curves of the varistor ceramics.
Figure 4: Internal structure of a metal oxide varistor [3].
4 NOVELTY AND INNOVATIVENESS
Developing a composition that eliminates the use of highly volatile bismuth oxide.
CaSiO3 sustain its properties during sintering and behave as a varistor-former.
Low energy consumption during fabrication through the inclusion of TiO2.
6 COMMERCIAL POTENTIALITIES
Electrical and electronics (E&E) industry.
High-growth manufacturing activities focused by the National Key Economic Areas (NKEA).
Industrial collaborator.
5 CONTRIBUTION TO NEW KNOWLEDGE
New formulation with the incorporation of perovskite-structured polymorph into the ZnO-based varistor ceramic, which is further doped with a transition metal oxide for low voltage application.
7 SOCIAL IMPACT
Fabrication procedures are cost-effective and mass-production oriented.
Sustainable Development Goal 9 (SDG 9); Industry, Innovation and Infrastructure.
Advancement of sustainable and energy-efficient technologies.
CONCLUSION
REFERENCES
ACADEMIC RECOGNITION / ACHIEVEMENTS
ACKNOWLEDGEMENT
NITC 2023
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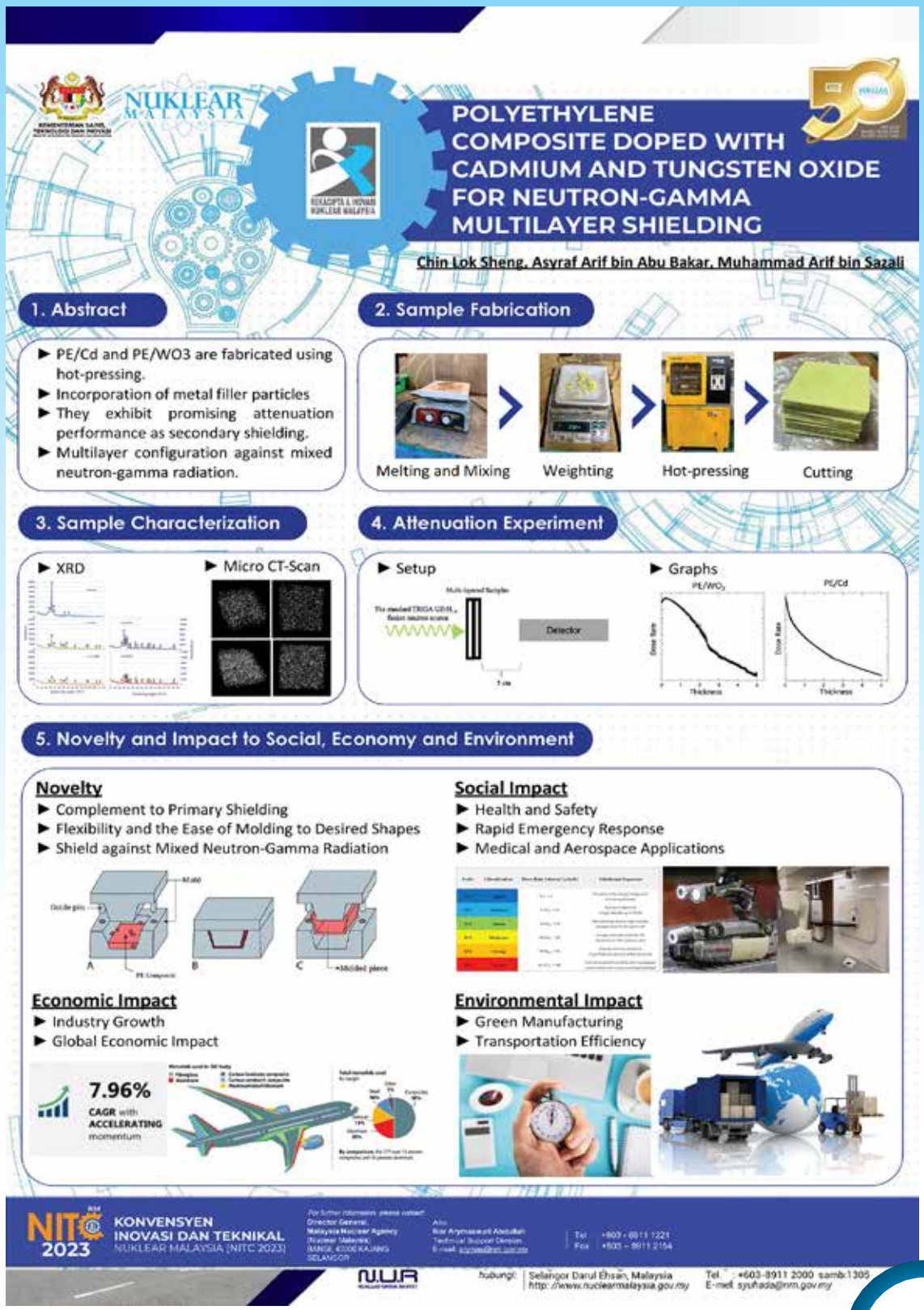
NUKLEAR MALAYSIA
POLYETHYLENE COMPOSITE DOPED WITH CADMIUM AND TUNGSTEN OXIDE FOR NEUTRON-GAMMA MULTILAYER SHIELDING
Chin Lok Sheng, Asyraf Arif bin Abu Bakar, Muhammad Arif bin Sazali
1. Abstract
► PE/Cd and PE/WO3 are fabricated using hot-pressing.
► Incorporation of metal filler particles
► They exhibit promising attenuation performance as secondary shielding.
► Multilayer configuration against mixed neutron-gamma radiation.
2. Sample Fabrication
Melting and Mixing
Weighting
Hot-pressing
Cutting
3. Sample Characterization
► XRD
► Micro CT-Scan
4. Attenuation Experiment
► Setup
► Graphs
Detector
5. Novelty and Impact to Social, Economy and Environment
Novelty
► Complement to Primary Shielding
► Flexibility and the Ease of Molding to Desired Shapes
► Shield against Mixed Neutron-Gamma Radiation
Social Impact
► Health and Safety
► Rapid Emergency Response
► Medical and Aerospace Applications
Economic Impact
► Industry Growth
► Global Economic Impact
7.96%
CAGR with ACCELERATING momentum
Environmental Impact
► Green Manufacturing
► Transportation Efficiency
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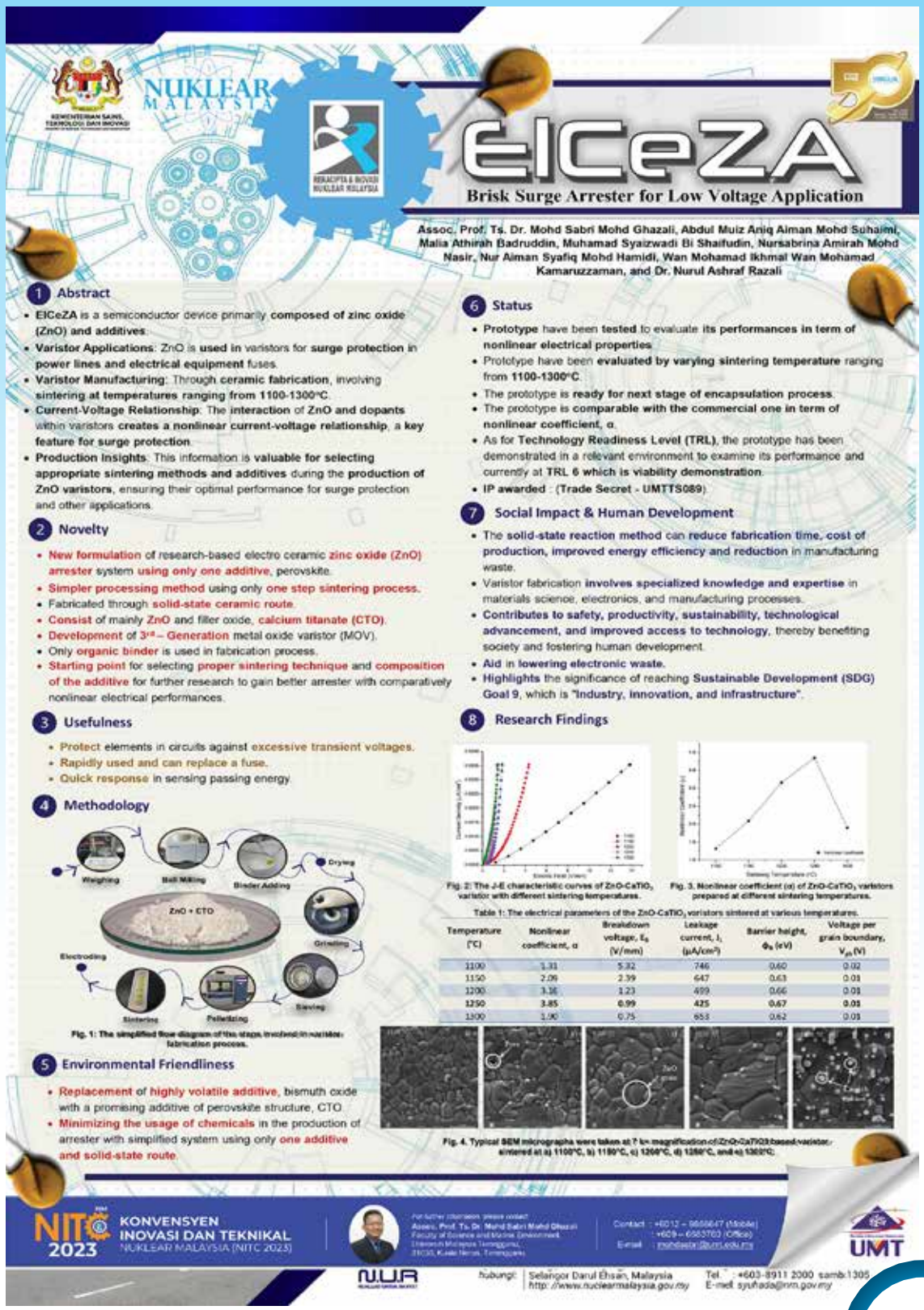
HARI INOVASI NUKLEAR MALAYSIA (HINM)


NUKLEAR MALAYSIA
ElCeZA
Brisk Surge Arrester for Low Voltage Application
Assoc. Prof. Ts. Dr. Mohd Sabri Mohd Ghazali, Abdul Muiz Aniq Aiman Mohd Suhaimi, Malia Athirah Badruddin, Muhamad Syaizwadi Bi Shaifudin, Nursabrina Amirah Mohd Nasir, Nur Aiman Syafiq Mohd Hamidi, Wan Mohamad Ikhmal Wan Mohamad Kamaruzzaman, and Dr. Nurul Ashraf Razali
1 Abstract
• ElCeZA is a semiconductor device primarily composed of zinc oxide (ZnO) and additives.
• Varistor Applications: ZnO is used in varistors for surge protection in power lines and electrical equipment fuses.
• Varistor Manufacturing: Through ceramic fabrication, involving sintering at temperatures ranging from 1100-1300°C.
• Current-Voltage Relationship: The interaction of ZnO and dopants within varistors creates a nonlinear current-voltage relationship, a key feature for surge protection.
• Production Insights: This information is valuable for selecting appropriate sintering methods and additives during the production of ZnO varistors, ensuring their optimal performance for surge protection and other applications.
2 Novelty
• New formulation of research-based electro ceramic zinc oxide (ZnO) arrester system using only one additive, perovskite.
• Simpler processing method using only one step sintering process.
• Fabricated through solid-state ceramic route.
• Consist of mainly ZnO and filler oxide, calcium titanate (CTO).
• Development of 3rd – Generation metal oxide varistor (MOV).
• Only organic binder is used in fabrication process.
• Starting point for selecting proper sintering technique and composition of the additive for further research to gain better arrester with comparatively nonlinear electrical performances.
3 Usefulness
• Protect elements in circuits against excessive transient voltages.
• Rapidly used and can replace a fuse.
• Quick response in sensing passing energy.
4 Methodology
Weighing
Ball Milling
Binder Adding
Drying
ZnO + CTO
Grinding
Electroding
Sintering
Pelletizing
Sieving
Fig. 1: The simplified flow diagram of the steps involved in varistor fabrication process.
5 Environmental Friendliness
• Replacement of highly volatile additive, bismuth oxide with a promising additive of perovskite structure, CTO.
• Minimizing the usage of chemicals in the production of arrester with simplified system using only one additive and solid-state route.
6 Status
• Prototype have been tested to evaluate its performances in term of nonlinear electrical properties.
• Prototype have been evaluated by varying sintering temperature ranging from 1100-1300°C.
• The prototype is ready for next stage of encapsulation process.
• The prototype is comparable with the commercial one in term of nonlinear coefficient, α.
• As for Technology Readiness Level (TRL), the prototype has been demonstrated in a relevant environment to examine its performance and currently at TRL 6 which is viability demonstration.
• IP awarded : (Trade Secret - UMTTS089)
7 Social Impact & Human Development
• The solid-state reaction method can reduce fabrication time, cost of production, improved energy efficiency and reduction in manufacturing waste.
• Varistor fabrication involves specialized knowledge and expertise in materials science, electronics, and manufacturing processes.
• Contributes to safety, productivity, sustainability, technological advancement, and improved access to technology, thereby benefiting society and fostering human development.
• Aid in lowering electronic waste.
• Highlights the significance of reaching Sustainable Development (SDG) Goal 9, which is "Industry, innovation, and infrastructure".
8 Research Findings
Fig. 2: The J-E characteristic curves of ZnO-CaTiO3 varistor with different sintering temperatures.
Fig. 3. Nonlinear coefficient (α) of ZnO-CaTiO3 varistors prepared at different sintering temperatures.
Table 1: The electrical parameters of the ZnO-CaTiO3 varistors sintered at various temperatures.
Temperature (°C) | Nonlinear coefficient, α | Breakdown voltage, E0 (V/mm) | Leakage current, IL (μA/cm²) | Barrier height, Φb (eV) | Voltage per grain boundary, Vgb (V)
1100 | 1.31 | 5.32 | 746 | 0.60 | 0.02
1150 | 2.09 | 2.39 | 647 | 0.63 | 0.03
1200 | 3.16 | 1.23 | 499 | 0.66 | 0.01
1250 | 3.85 | 0.99 | 425 | 0.67 | 0.01
1300 | 1.90 | 0.75 | 653 | 0.62 | 0.03
Fig. 4. Typical SEM micrographs were taken at 7 k× magnification of ZnO-CaTiO3 based varistor sintered at a) 1100°C, b) 1150°C, c) 1200°C, d) 1250°C, and e) 1300°C.
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NUKLEAR MALAYSIA
IRITS: Innovative Pico Hydro Turbine for Remote Area and Innovative Learning
Assoc Prof. Ir. Dr. Shamsul bin Sarip
shamsuls.kl@utm.my
Technology Readiness Level: 9
COLLABORATORS
HAYATECH SDN BHD
UPNM
NAHRIM
Shamsul Sarip, Nor Amyra Hana Mohd Yusoff, Nur Syahirah Faiha Shawalludin, Hazilah Mad Kaidi, Mohamed Azlan Suhot, Idris Md Yamin, Nor Fazilah Mohd Hashim, Noraimi Shafie and Mohd Yusof Md. Daud
https://people.utm.my/shamsul/pico-hydro-turbine-steam/
NEED
This innovation was developed collaboratively to selected areas confronted with the issue of obtaining electricity for daily use such as the indigenous communities of Sungai Kejar, Sungai Tiang, Pos Lemoi and Pos Tenom which are located in Perak's Royal Belum State Park, Cameron Highlands Pahang and Slim River Perak respectively.
IRITS is the Innovative Pico Hydro Turbine for Remote Area and Innovative Learning. It works efficiently by using the water in the pipeline to turn the compact and small hydro turbine blades via the jet nozzle, which generates kinetic energized electricity via an electromagnetic generator.
APPROACH
As Pico hydropower is the only device that can generate renewable energy electricity that can provide a continuous supply of energy without batteries as long as there is running water, 15-50 Watts of electrical power was produced with IRITS, making it ideal for Orang Asli residential homes.
BENEFITS
As a results, 100% transmission loss assumption and a 40% increased in electricity demand results, significantly increasing the community's daily electricity needs while conserving biodiversity and promoting water as kinetic energy.
Mountain water is a lifesaver
Target Market
Individual 10%
School 30%
Orang Asli 60%
Pico hydro turbines provide a source of clean and renewable energy, particularly in remote and off-grid areas where access to electricity is limited
The development and deployment of pico hydro technologies promote innovation in renewable energy and infrastructure development, particularly in remote areas
Pico hydro can help electrify rural and remote communities, contributing to the development of sustainable and resilient communities
Promoting collaboration and partnerships among different groups to share knowledge, ultimately working together to make the world a better place
IP: PATENT
Reference No. : IP/PT/02270
Title : IRITS WHEEL TURBINE
Contact us: +607-5591504 icc@utm.my icc.utm.my
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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)
UTM OTEC


NUKLEAR MALAYSIA
M-SENSYS: SOLUTION FOR MONITORING IN HARSH ENVIRONMENT
UNIVERSITI MALAYSIA PAHANG AL-SULTAN ABDULLAH
Mohd Hafizi Bin Zohari, Mohd Padzly Radzi
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facebook
THE 'M-SENSYS'
Multiparameter sensor network system (M-SENSYS)
PI2018701581, Under substantive examination
PI2020006650, Awaiting substantive examination
M-SENSYS has successfully addressed certain limitations encountered by traditional electrical based sensors, such as challenges related to sensor installation, susceptibility to electromagnetic interference, and the need for extensive cabling to facilitate long-range monitoring. One of the most significant features of the system is its multiplexing capabilities.
State of the Art – Multi parameter sensing!
Vibration sensor
Strain sensor
Pressure sensor
Temperature sensor
Product has high demand for commercialization
All highway's management
Building management
Hydropower dam
All chemical plants, Oil and gas pipelines
Optical based system @ nonelectrical
Massive cabling with conventional monitoring
Conventional copper cable
Fiber optic cable
FBG sensor network on structures
Product: FBG System
Interactive Graphical User Interface
"The all-in-one and compact FBG measurement system."
The use of this optical-based monitoring system has the potential to enhance the effectiveness of structural health monitoring, both in operational and construction phases. Given the increasing occurrences of catastrophic disasters impacting structures both during construction and operation, there is an urgent need for the establishment of an effective monitoring system. This device facilitates the monitoring of the structural health of engineering structures in harsh conditions.
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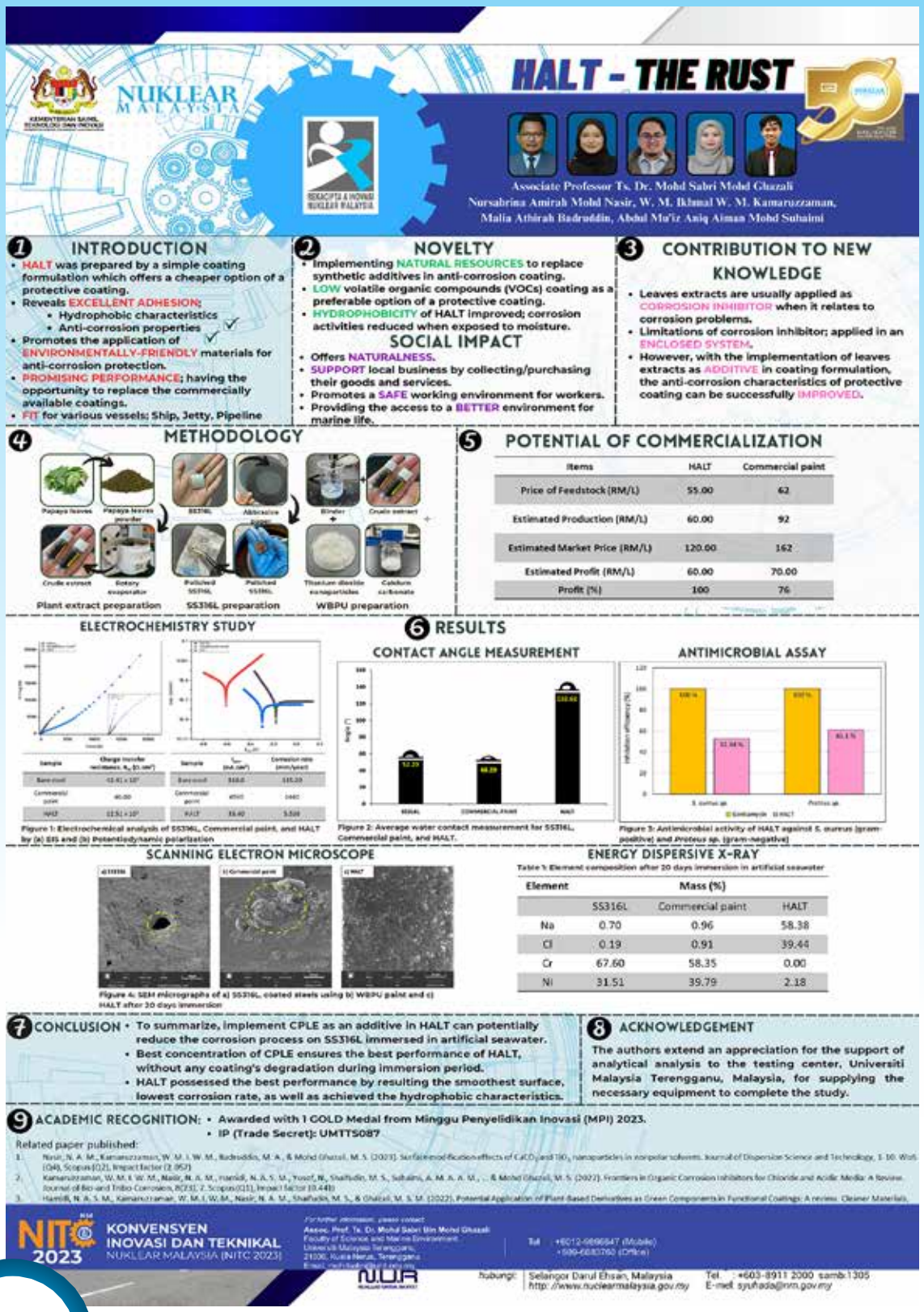
NUKLEAR MALAYSIA
HALT - THE RUST
Associate Professor Ts. Dr. Mohd Sabri Mohd Ghazali
Nursabrina Amirah Mohd Nasir, W. M. Ikhmal W. M. Kamaruzzaman,
Malia Athirah Badruddin, Abdul Mu'iz Aniq Aiman Mohd Suhaimi
1 INTRODUCTION
HALT was prepared by a simple coating formulation which offers a cheaper option of a protective coating.
Reveals EXCELLENT ADHESION;
Hydrophobic characteristics
Anti-corrosion properties
Promotes the application of ENVIRONMENTALLY-FRIENDLY materials for anti-corrosion protection.
PROMISING PERFORMANCE; having the opportunity to replace the commercially available coatings.
FIT for various vessels; Ship, Jetty, Pipeline
2 NOVELTY
Implementing NATURAL RESOURCES to replace synthetic additives in anti-corrosion coating.
LOW volatile organic compounds (VOCs) coating as a preferable option of a protective coating.
HYDROPHOBICITY of HALT improved; corrosion activities reduced when exposed to moisture.
SOCIAL IMPACT
Offers NATURALNESS.
SUPPORT local business by collecting/purchasing their goods and services.
Promotes a SAFE working environment for workers.
Providing the access to a BETTER environment for marine life.
3 CONTRIBUTION TO NEW KNOWLEDGE
Leaves extracts are usually applied as CORROSION INHIBITOR when it relates to corrosion problems.
Limitations of corrosion inhibitor; applied in an ENCLOSED SYSTEM.
However, with the implementation of leaves extracts as ADDITIVE in coating formulation, the anti-corrosion characteristics of protective coating can be successfully IMPROVED.
4 METHODOLOGY
Plant extract preparation
SS316L preparation
WBPU preparation
5 POTENTIAL OF COMMERCIALIZATION
Items | HALT | Commercial paint
Price of Feedstock (RM/L) | 55.00 | 62
Estimated Production (RM/L) | 60.00 | 92
Estimated Market Price (RM/L) | 120.00 | 162
Estimated Profit (RM/L) | 60.00 | 70.00
Profit (%) | 100 | 76
6 RESULTS
ELECTROCHEMISTRY STUDY
CONTACT ANGLE MEASUREMENT
ANTIMICROBIAL ASSAY
SCANNING ELECTRON MICROSCOPE
ENERGY DISPERSIVE X-RAY
Element | Mass (%)
SS316L | Commercial paint | HALT
Na | 0.70 | 0.96 | 58.38
Cl | 0.19 | 0.91 | 39.44
Cr | 67.60 | 58.35 | 0.00
Ni | 31.51 | 39.79 | 2.18
7 CONCLUSION
To summarize, implement CPLE as an additive in HALT can potentially reduce the corrosion process on SS316L immersed in artificial seawater.
Best concentration of CPLE ensures the best performance of HALT, without any coating's degradation during immersion period.
HALT possessed the best performance by resulting the smoothest surface, lowest corrosion rate, as well as achieved the hydrophobic characteristics.
8 ACKNOWLEDGEMENT
The authors extend an appreciation for the support of analytical analysis to the testing center, Universiti Malaysia Terengganu, Malaysia, for supplying the necessary equipment to complete the study.
9 ACADEMIC RECOGNITION:
Awarded with 1 GOLD Medal from Minggu Penyelidikan Inovasi (MPI) 2023.
IP (Trade Secret): UMTTS087
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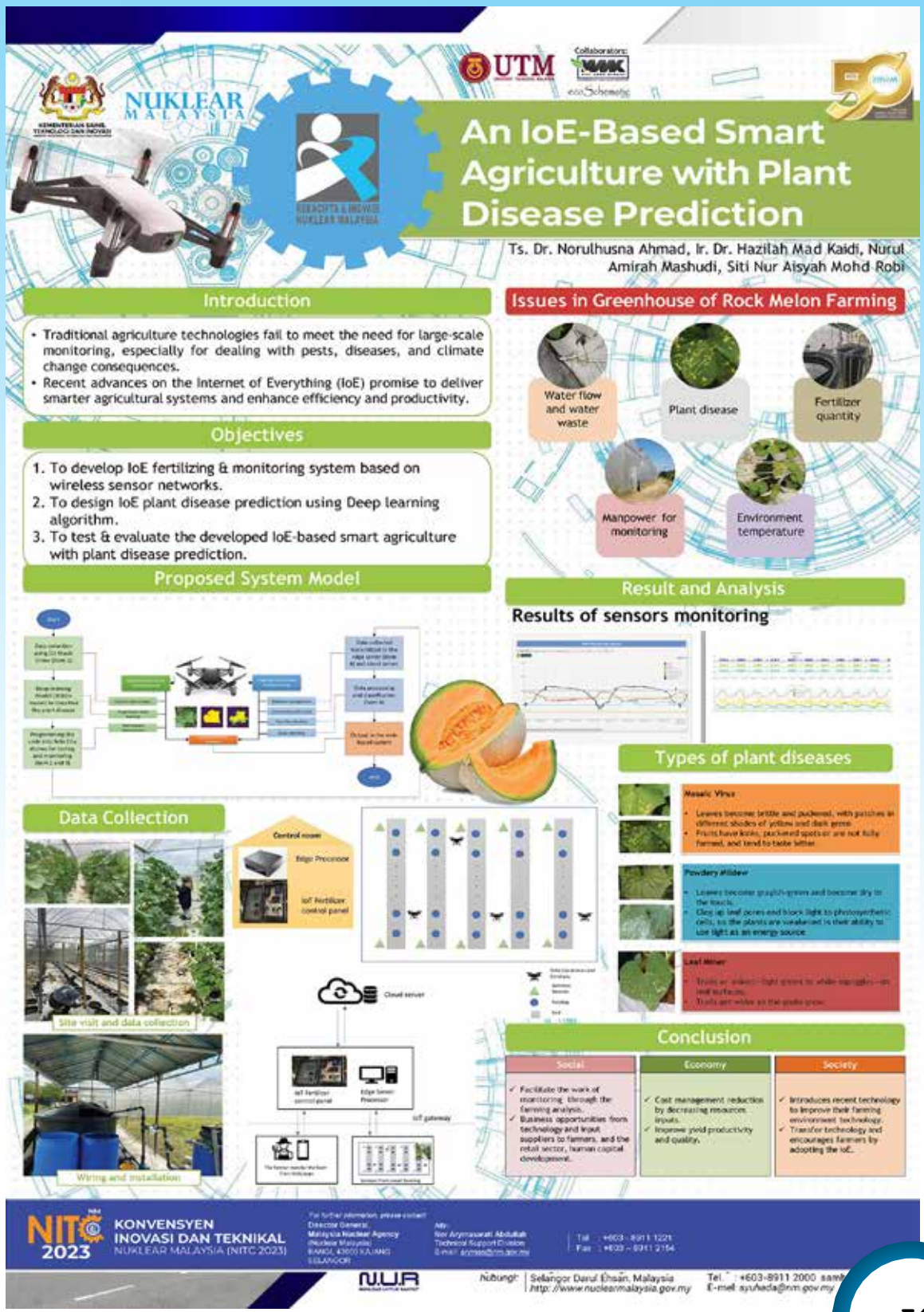
UTM
Collaborators:
NUKLEAR MALAYSIA
An IoE-Based Smart Agriculture with Plant Disease Prediction
Ts. Dr. Norulhusna Ahmad, Ir. Dr. Hazilah Mad Kaidi, Nurul Amirah Mashudi, Siti Nur Aisyah Mohd Robi
Introduction
• Traditional agriculture technologies fail to meet the need for large-scale monitoring, especially for dealing with pests, diseases, and climate change consequences.
• Recent advances on the Internet of Everything (IoE) promise to deliver smarter agricultural systems and enhance efficiency and productivity.
Objectives
1. To develop IoE fertilizing & monitoring system based on wireless sensor networks.
2. To design IoE plant disease prediction using Deep learning algorithm.
3. To test & evaluate the developed IoE-based smart agriculture with plant disease prediction.
Proposed System Model
Issues in Greenhouse of Rock Melon Farming
Water flow and water waste
Plant disease
Fertilizer quantity
Manpower for monitoring
Environment temperature
Result and Analysis
Results of sensors monitoring
Types of plant diseases
Mosaic Virus
Powdery Mildew
Leaf Miner
Data Collection
Control room
Edge Processor
IoT Fertilizer control panel
Site visit and data collection
Cloud server
IoT gateway
Wiring and installation
Conclusion
Social
Economy
Society
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N.U.R

NUKLEAR MALAYSIA

MyFlexiTomoScanner for Edu, Demo and PreTest

Khairiah Yazid@ Khalid, Azraf Azman, Hasif Mohammad, Lo Cheng Sheng ,Julie Andrianny Murshidi, Rafhayudi Jamro

PROBLEM

- Tomography is an advance NDT imaging technique to investigate internal structure sample
- Required complex tomography system with radiation source
- Limited access to X-ray lab & neutron facility
- Risk of radiation exposure at control area
- Expensive X-ray scanner (USD 30K-38K)

SOLUTION & ADVANTAGES

- Develop an economical, portable tomography scanner for education and training tool, requiring minimal investment (<MYR 3000)
- The light source eliminates the need for access to a reactor or X-ray facility and does not require any additional safety measures.
- Easily used for testing and verify scanning procedures and reconstruction algorithms, prior to carrying out a real X-ray or neutron tomography experiments
- Easy to set up; plug and play components seamlessly mimic a real tomography system.
- Can be integrated to real X-ray or neutron tomography. Interchangeable options include USB web camera-digital detector, Raspberry Pi-computer, Light source – imaging radiation source
- Combined with commercial image reconstruction to produce CT result and image rendering to produce 3D image
- Potential for remote control X-ray or neutron Tomography system

WORKFLOW

IMAGE ACQUISITION

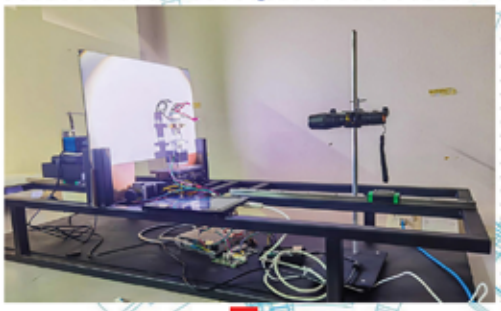


IMAGE RECONSTRUCTION

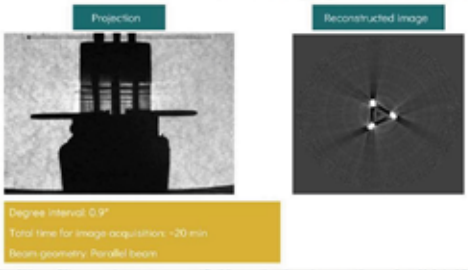
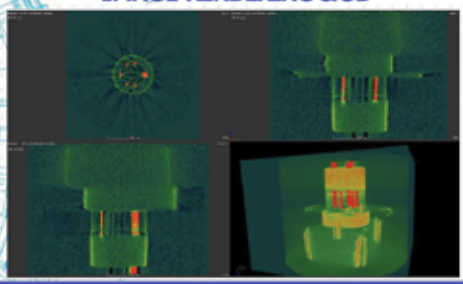


IMAGE RENDERING & 3D



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NUKLEAR MALAYSIA
MDFA: Mobile Apps Development Tools using Multiple Dynamic Flip Algorithm
Collaboration of UniSZA, UMT and AADK
DR. WAN AEZWANI WAN ABU BAKAR (UNISZA), ASSOC. PROF. TS. DR. MUSTAFA BIN MAN (UMT), DR. MOHD. KAMIR BIN YUSOF (UNISZA), TENGKU HANIZAR BT TENGKU AWANG (AADK), CIK NUR LAILA BINTI JOSDI (UNISZA)
PROBLEM STATEMENT
6 BIGGEST CHALLENGES IN MOBILE APPS DEVELOPMENT
REASONS WHY YOU SHOULD TAKE APP MAINTENANCE SERIOUSLY
MOBILE APP DEVELOPMENT PROCESS
ABSTRACT
MDFA is a new algorithm in developing mobile-based applications. The aims is to provide a framework for dynamic database administration for mobile-based application development. Recently, the process of updating information needs to be generated back in mobile-based programming and needs to be back uploaded in the Google Play Store or Apple Store and users must download the application software back. By using this MDFA algorithm, the problem is no longer needed and can be solved quickly. The mobile apps developer just needs to follow 2-simple steps; First, the content (data) needs to be stored in the database. Then, system admin can only change the data according to the categories of data that have been systematically arranged in the MDFA framework.
MDFA APPROACH (BACK-END/FRONT-END)
Normal/Current Process
Proposed MDFA
MDFA ARCHITECTURE
STRATEGIC PARTNERS
UPAYA VISTA SDN BHD (1006482-V)
AADK
BREAD-ON-MOBILE APPS
PAMERAN DADAH MAYA
AWARDS & RECOGNITION
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• UPAYA VISTA SDN. BHD.
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• Malaysia-Jordan Grant RM 60,000.00
PUBLICATION
Man, Mustafa, Wan Aezwani Wan Abu Bakar, Mohd Kamir B. Yusof, Tengku Hanizar Tengku Awang, and Terry Yeow. "MDFA: A New Multiple Dynamic Flip Algorithm for Mobile-based Apps Development." In 2022 IEEE 18th International Colloqium on Signal Processing & Applications (CSPA), pp. 371-376. IEEE, 2022.
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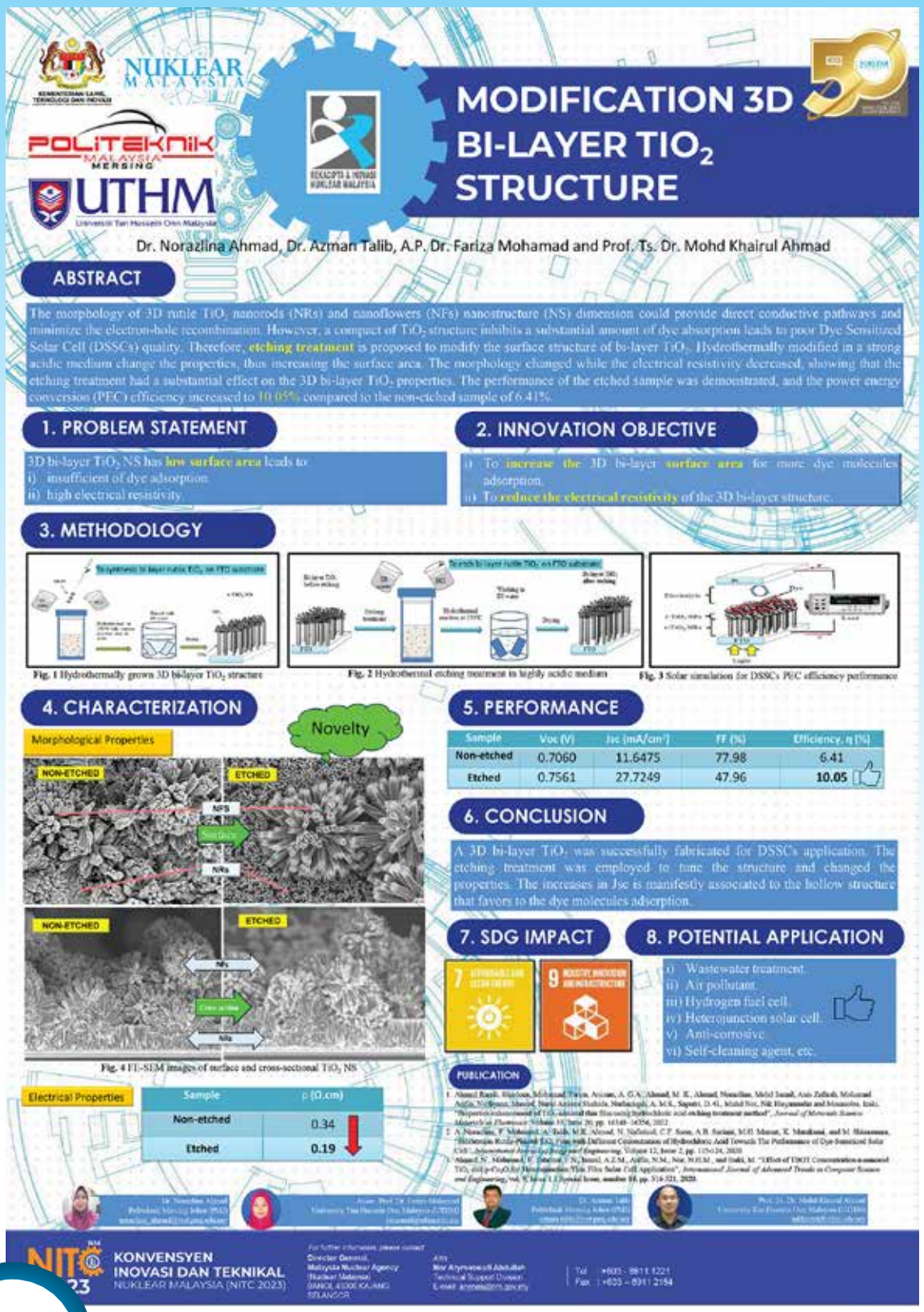
NUKLEAR MALAYSIA
POLITEKNIK MALAYSIA MERSING
UTHM
MODIFICATION 3D BI-LAYER TIO2 STRUCTURE
Dr. Norazlina Ahmad, Dr. Azman Talib, A.P. Dr. Fariza Mohamad and Prof. Ts. Dr. Mohd Khairul Ahmad
ABSTRACT
The morphology of 3D rutile TiO2 nanorods (NRs) and nanoflowers (NFs) nanostructure (NS) dimension could provide direct conductive pathways and minimize the electron-hole recombination. However, a compact of TiO2 structure inhibits a substantial amount of dye absorption leads to poor Dye Sensitized Solar Cell (DSSCs) quality. Therefore, etching treatment is proposed to modify the surface structure of bi-layer TiO2. Hydrothermally modified in a strong acidic medium change the properties, thus increasing the surface area. The morphology changed while the electrical resistivity decreased, showing that the etching treatment had a substantial effect on the 3D bi-layer TiO2 properties. The performance of the etched sample was demonstrated, and the power energy conversion (PEC) efficiency increased to 10.05% compared to the non-etched sample of 6.41%.
1. PROBLEM STATEMENT
3D bi-layer TiO2 NS has low surface area leads to
i) insufficient of dye adsorption
ii) high electrical resistivity
2. INNOVATION OBJECTIVE
i) To increase the 3D bi-layer surface area for more dye molecules adsorption.
ii) To reduce the electrical resistivity of the 3D bi-layer structure.
3. METHODOLOGY
Fig. 1 Hydrothermally grown 3D bi-layer TiO2 structure
Fig. 2 Hydrothermal etching treatment in highly acidic medium
Fig. 3 Solar simulation for DSSCs PEC efficiency performance
4. CHARACTERIZATION
Novelty
Morphological Properties
NON-ETCHED
ETCHED
NFS
NRs
Fig. 4 FE-SEM images of surface and cross-sectional TiO2 NS
Electrical Properties
Sample
ρ (Ω.cm)
Non-etched
0.34
Etched
0.19
5. PERFORMANCE
Sample | Voc (V) | Jsc (mA/cm2) | FF (%) | Efficiency, η (%)
Non-etched | 0.7060 | 11.6475 | 77.98 | 6.41
Etched | 0.7561 | 27.7249 | 47.96 | 10.05
6. CONCLUSION
A 3D bi-layer TiO2 was successfully fabricated for DSSC's application. The etching treatment was employed to tune the structure and changed the properties. The increases in Jsc is manifestly associated to the hollow structure that favors to the dye molecules adsorption.
7. SDG IMPACT
8. POTENTIAL APPLICATION
i) Wastewater treatment.
ii) Air pollutant.
iii) Hydrogen fuel cell.
iv) Heterojunction solar cell.
v) Anti-corrosive
vi) Self-cleaning agent, etc.
PUBLICATION
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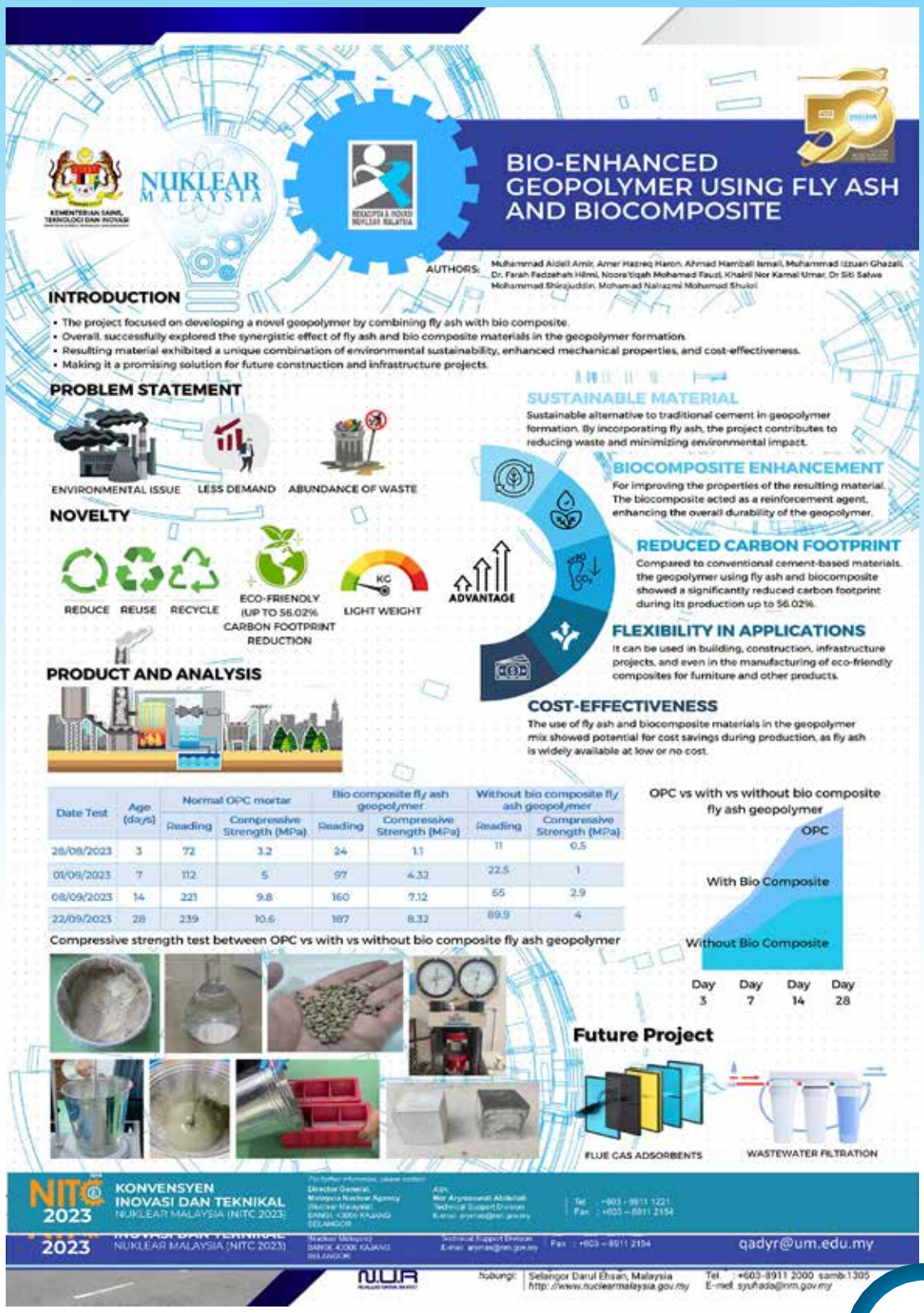

Date Test	Age (days)	Normal OPC mortar		Bio composite fly ash geopolymer		Without bio composite fly ash geopolymer	
		Reading	Compressive Strength (MPa)	Reading	Compressive Strength (MPa)	Reading	Compressive Strength (MPa)
28/08/2023	3	72	3.2	24	1.1	11	0.5
01/09/2023	7	112	5	97	4.32	22.5	1
08/09/2023	14	221	9.8	160	7.12	65	2.9
22/09/2023	28	239	10.6	187	8.32	89.9	4


NUKLEAR MALAYSIA
IRRADIATION CAPSULE
Muhammad Hannan Bahrin, Anwar Abdul Rahman, Mohd Zaid Hassan, Mohd Rizal Mamat, Azraf Azman, Harfidzul Faidzal Haris, Mohammad Hafiz Bakri, Wan Ismail Wan Yusof, Muhamad Nor Atan, Mohamed Zaffar Ali Mohamed Amiroudine
INTRODUCTION
Radioisotopes are produced by exposing target materials to the neutron flux in a nuclear reactor. Isotopes in the form of solid, powder or liquid shall be contained in the special capsule. The capsule shall have the special characteristic to ensure the irradiation operation is safe, low neutron absorbent, good thermal conductivity, water-tight and cost-effective.
PROBLEM STATEMENT
Cold Weld / Press
✗ Old capsule – single use capsule
✗ Complex operation and equipment needed
✗ Water tightness not consistent
Damage capsule - radiation-induced gas pressure
IRRADIATION CAPSULE
To tie the capsule
Lead (as weight)
Cap
Thread
Washer
Thread
To hold the capsule during tighten
Irradiated sample position
Irradiation Capsule design
Fabricated Irradiation Capsule
IDEA OF INNOVATION
Water tight design
Reusable capsule
Thread method
Why watertight is important?
To reduce risk of contamination to/from the irradiated sample
TESTING
Tested at 5.5 meter water depth and 70°C for more than 24hr
ADVANTAGES OF INNOVATION
✓ The capsule is made from Aluminium and it has low neutron absorption cross section
✓ This capsule is waterproof and tested resistant to TRIGA water depth pressure and temperature condition
✓ Reusable
✓ The capsule is easy to fabricate
✓ The Aluminium is easily replaced
BENEFITS OF INNOVATION
✓ This capsule can be used to contain radioactive material in the liquid or solid phase
✓ This capsule can be reusable – cost effective
✓ The capsule is waterproof design
✓ Capsule can be use in any experimental facilities in TRIGA PUSPATI reactor. Either in Dry Irradiation Tube, Central Thimble and Rotary Rack
✓ Potentially use as carrier in any work that involves immersion into water
✓ Using special thread design and washer to tighten the capsule
✓ Total weight : 213 gram
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Selangor Darul Ehsan, Malaysia
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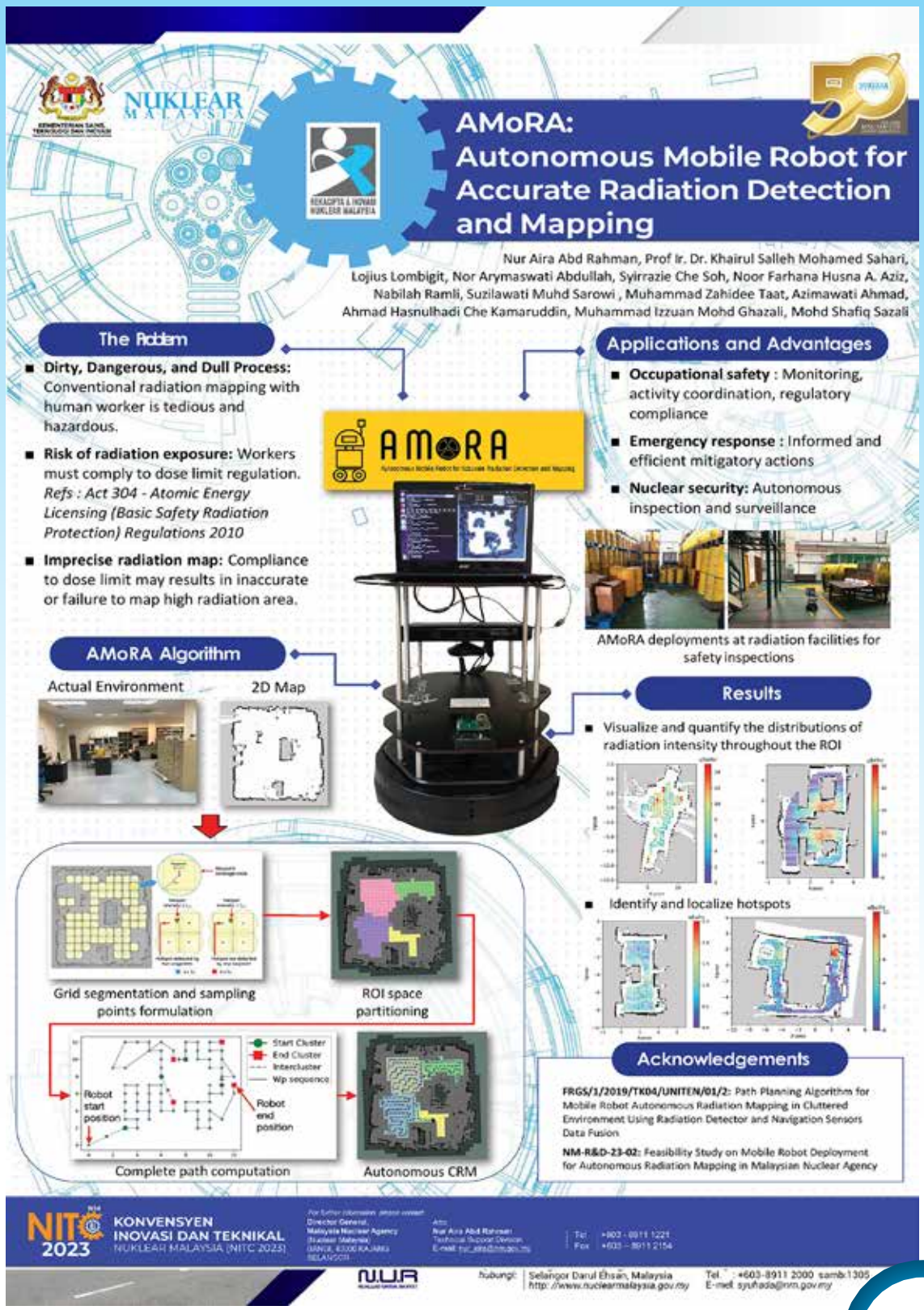
NUKLEAR MALAYSIA
AMoRA:
Autonomous Mobile Robot for Accurate Radiation Detection and Mapping
Nur Aira Abd Rahman, Prof Ir. Dr. Khairul Salleh Mohamed Sahari, Lojius Lombigit, Nor Arymaswati Abdullah, Syirrazie Che Soh, Noor Farhana Husna A. Aziz, Nabilah Ramli, Suzilawati Muhd Sarowi , Muhammad Zahidee Taat, Azimawati Ahmad, Ahmad Hasnulhadi Che Kamaruddin, Muhammad Izzuan Mohd Ghazali, Mohd Shafiq Sazali
The Problem
Dirty, Dangerous, and Dull Process: Conventional radiation mapping with human worker is tedious and hazardous.
Risk of radiation exposure: Workers must comply to dose limit regulation. Refs : Act 304 - Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010
Imprecise radiation map: Compliance to dose limit may results in inaccurate or failure to map high radiation area.
AMoRA
Applications and Advantages
Occupational safety : Monitoring, activity coordination, regulatory compliance
Emergency response : Informed and efficient mitigatory actions
Nuclear security: Autonomous inspection and surveillance
AMoRA deployments at radiation facilities for safety inspections
AMoRA Algorithm
Actual Environment
2D Map
Grid segmentation and sampling points formulation
ROI space partitioning
Start Cluster
End Cluster
Intercluster
Wp sequence
Robot start position
Robot end position
Complete path computation
Autonomous CRM
Results
Visualize and quantify the distributions of radiation intensity throughout the ROI
Identify and localize hotspots
Acknowledgements
FRGS/1/2019/TK04/UNITEN/01/2: Path Planning Algorithm for Mobile Robot Autonomous Radiation Mapping in Cluttered Environment Using Radiation Detector and Navigation Sensors Data Fusion
NM-R&D-23-02: Feasibility Study on Mobile Robot Deployment for Autonomous Radiation Mapping in Malaysian Nuclear Agency
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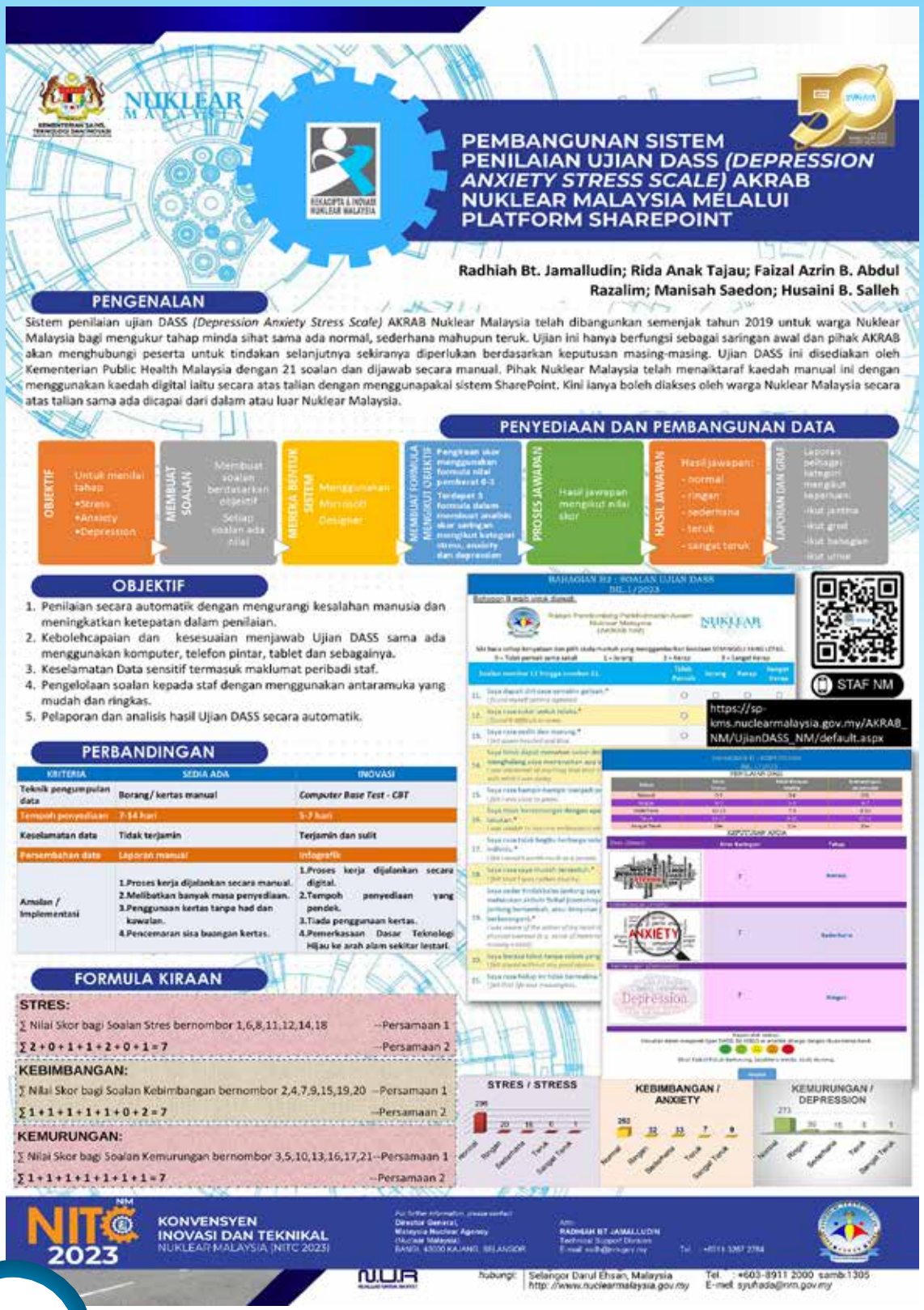
NUKLEAR MALAYSIA
PEMBANGUNAN SISTEM PENILAIAN UJIAN DASS (DEPRESSION ANXIETY STRESS SCALE) AKRAB NUKLEAR MALAYSIA MELALUI PLATFORM SHAREPOINT
Radhiah Bt. Jamalludin; Rida Anak Tajau; Faizal Azrin B. Abdul Razalim; Manisah Saedon; Husaini B. Salleh
PENGENALAN
Sistem penilaian ujian DASS (Depression Anxiety Stress Scale) AKRAB Nuklear Malaysia telah dibangunkan semenjak tahun 2019 untuk warga Nuklear Malaysia bagi mengukur tahap minda sihat sama ada normal, sederhana mahupun teruk. Ujian ini hanya berfungsi sebagai saringan awal dan pihak AKRAB akan menghubungi peserta untuk tindakan selanjutnya sekiranya diperlukan berdasarkan keputusan masing-masing. Ujian DASS ini disediakan oleh Kementerian Public Health Malaysia dengan 21 soalan dan dijawab secara manual. Pihak Nuklear Malaysia telah menaiktaraf kaedah manual ini dengan menggunakan kaedah digital iaitu secara atas talian dengan menggunapakai sistem SharePoint. Kini ianya boleh diakses oleh warga Nuklear Malaysia secara atas talian sama ada dicapai dari dalam atau luar Nuklear Malaysia.
PENYEDIAAN DAN PEMBANGUNAN DATA
OBJEKTIF
Untuk menilai tahap: •Stress •Anxiety •Depression
MEMBUAT SOALAN
Membuat soalan berstatarkan objektif. Setiap soalan ada nilai
MEREKA BENTUK SISTEM
Menggunakan Microsoft Designer
MEMBUAT FORMULA MENGIKUT OBJEKTIF
Pengiraan skor menggunakan formula nilai pemberat 0-3. Terdapat 3 formula dalam membuat analisis skor setiap satu mengikut kategori stress, anxiety dan depression
PROSES JAWAPAN
Hasil jawapan mengikut nilai skor
HASIL JAWAPAN
Hasil jawapan: - normal - ringan - sederhana - teruk - sangat teruk
LAPORAN DAN GRAF
Laporan peringkat kategori mengikut seperkara: -ikut jantina -ikut gred -ikut bahagian -ikut umur
OBJEKTIF
1. Penilaian secara automatik dengan mengurangi kesalahan manusia dan meningkatkan ketepatan dalam penilaian.
2. Kebolehcapaian dan kesesuaian menjawab Ujian DASS sama ada menggunakan komputer, telefon pintar, tablet dan sebagainya.
3. Keselamatan Data sensitif termasuk maklumat peribadi staf.
4. Pengelolaan soalan kepada staf dengan menggunakan antaramuka yang mudah dan ringkas.
5. Pelaporan dan analisis hasil Ujian DASS secara automatik.
STAF NM
https://sp-kms.nuclearmalaysia.gov.my/AKRAB_NM/UjianDASS_NM/default.aspx
PERBANDINGAN
KRITERIA | SEDIA ADA | INOVASI
Teknik pengumpulan data | Borang/ kertas manual | Computer Base Test - CBT
Tempoh penyediaan | 7-14 hari | 1-2 hari
Keselamatan data | Tidak terjamin | Terjamin dan sulit
Persembahan data | Laporan manual | Infografik
Amalan / Implementasi | 1.Proses kerja dijalankan secara manual. 2.Melibatkan banyak masa penyediaan. 3.Penggunaan kertas tanpa had dan kawalan. 4.Pencemaran sisa buangan kertas. | 1.Proses kerja dijalankan secara digital. 2.Tempoh penyediaan yang pendek. 3.Tiada penggunaan kertas. 4.Pemerkasaan Dasar Teknologi Hijau ke arah alam sekitar lestari.
FORMULA KIRAAN
STRES:
∑ Nilai Skor bagi Soalan Stres bernombor 1,6,8,11,12,14,18 --Persamaan 1
∑ 2+0+1+1+2+0+1=7 --Persamaan 2
KEBIMBANGAN:
∑ Nilai Skor bagi Soalan Kebimbangan bernombor 2,4,7,9,15,19,20 --Persamaan 1
∑ 1+1+1+1+1+0+2=7 --Persamaan 2
KEMURUNGAN:
∑ Nilai Skor bagi Soalan Kemurungan bernombor 3,5,10,13,16,17,21--Persamaan 1
∑ 1+1+1+1+1+1+1=7 --Persamaan 2
STRES / STRESS
KEBIMBANGAN / ANXIETY
KEMURUNGAN / DEPRESSION
NITC 2023
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RADHIAH BT JAMALLUDIN
hubungi: Selangor Darul Ehsan, Malaysia http://www.nuclearmalaysia.gov.my Tel. : +603-8911 2000 samb:1305 E-mel: syuhada@nrm.gov.my

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IMPROVING OPERATION EFFICIENCY OF 30 YEARS OLD MVAC SYSTEM AT BANGUNAN PERSEKUTUAN KEMAMAN (BPK) THROUGH APPLICATION OF INDUSTRY 4.0 TECHNOLOGY






Dr. Ramhuzaini bin Abd. Rahman
Dr. Ashok Vajravelu
Ts. Azli bin Yusop
Ts. Maizul bin Ishak
Ts. Mohamad bin Md Som
Mr. Bala Kumaran Arumugham

PROBLEM STATEMENTS

Issues with operation of MVAC system @BPK

1. **Unreliable and unoptimized operation** — the system needs to be manually turned ON and OFF at a specific time by technician for its daily operation.
2. **Energy wasting due to over-use** — temperature of the room is not automatically regulated by manually depend on the number of compressor used.
3. **Poor energy management** — total energy usage is unknown as the system is not equipped with data logger.
4. **Poor maintenance management** — status of important parameters of the system such as supply/return water temperature, line pressure and flowrate are not easily available.

PROJECT OBJECTIVES

1. To develop IoT-based Automation and Energy Monitoring system (IoT-AEMS) for MVAC at BKP
2. To evaluate effectiveness of the developed IoT-AEMS in operation management of MVAC at BKP
3. To assess reduction in energy consumption due to the application of the developed IoT-AEMS

PRODUCT DESCRIPTIONS

The IoT-based Automation and Energy Monitoring System for MVAC is developed to achieve excellence in energy management, improved system maintenance and efficiency in operation of MVAC system. This is realized through **real-time energy monitoring** and **automation** of MVAC. The system is equipped with IR4.0 technology, that is, **Web-based SCADA** enhanced with **Internet of Things (IoT)** functionality. Also, the system provides **automatic generated daily and monthly energy reports** in order to help customers achieving Energy Management Gold Standard (EMGS) certification.

NOVELTY AND INVENTIVENESS

1. **Innovative and customized product** — developed in-house according to the need of customers .
2. **Flexible system** — can be expanded to other process control system such as remote location IoT, water system monitoring, flood monitoring and building automation.

PROJECT CONTRIBUTIONS

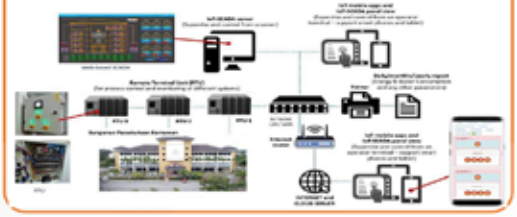
1. **Supporting UN-SDG7** in doubling the improvement in energy efficiency. (target 7.3)
2. **Assisting local SMEs** in adopting IR4.0 technology for higher productivity due to efficient system operation.
3. **Improving UTHM reputation** through product branding and hence contributes towards increased graduate employability.
4. **Income generation to UTHM** from consultation project fees.

MAIN FINDINGS

1. **Energy saving** due to efficient operation of MVAC.
2. **Minimized manpower** due to reduced number of technician needed to operate and monitor the MVAC system.
3. **Reduced complaints** from the occupants as technicians can quickly response to the real-time alert system failure.
4. **Continuous improvement in energy management strategy** due to systematic data-collection and energy report.

PRODUCT PICTURE AND ARCHITECTURE

Video of product development and installation



COMMERCIALIZATION POTENTIAL

INDUSTRY PARTNER & AWARDS

building LINDUNGAN SDN BHD

1. **Gold medal** @RISE 2022
2. **Silver medal** @MTE 2023
3. **Gold medal** @INVIDE2023
4. **Gold medal** @i-RITEC2023

ACKNOWLEDGEMENT

This project was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through UTHM's contract grant (vot Q278)

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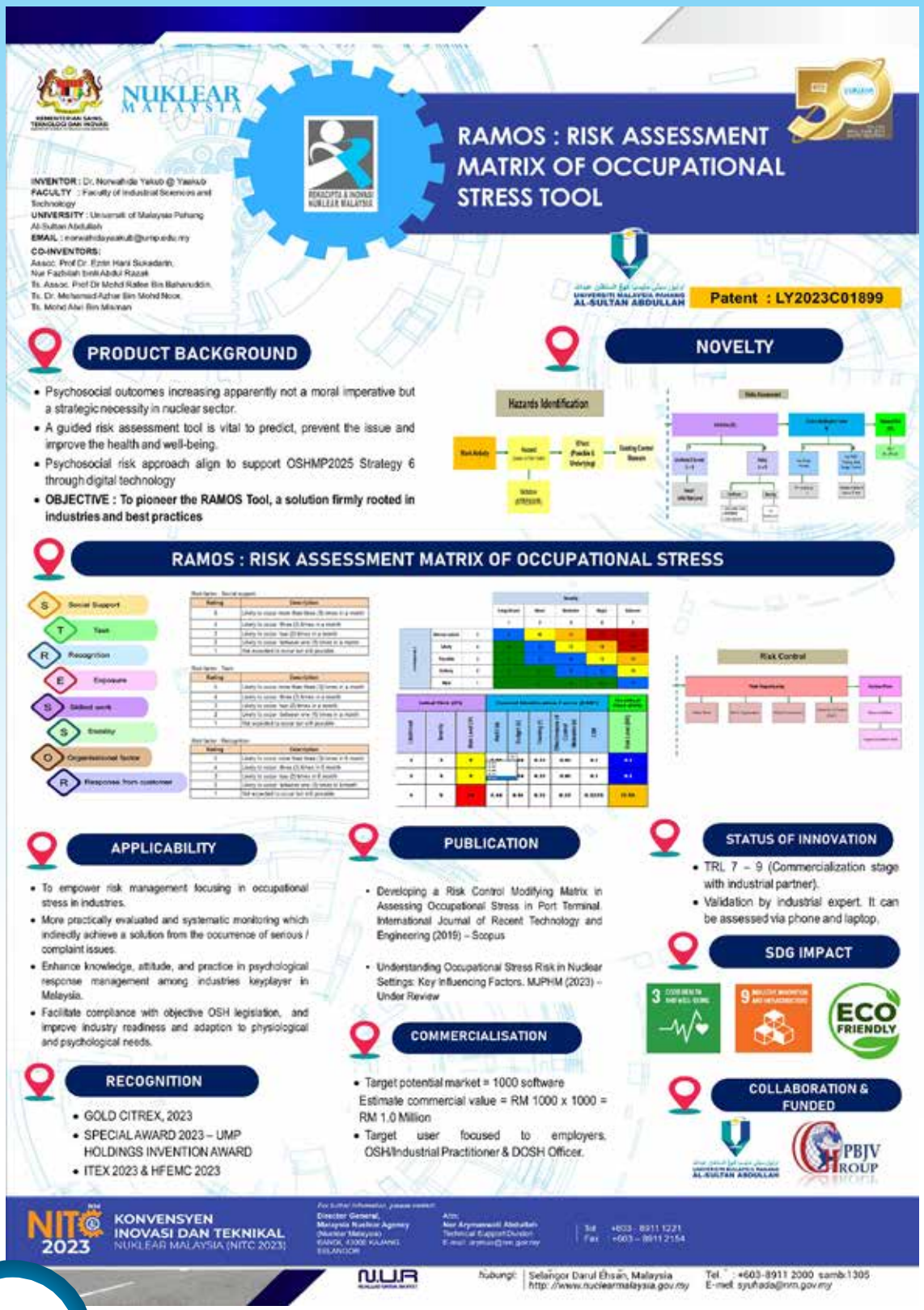
NUKLEAR MALAYSIA
RAMOS : RISK ASSESSMENT MATRIX OF OCCUPATIONAL STRESS TOOL
INVENTOR : Dr. Norwahida Yakub @ Yaakub
FACULTY : Faculty of Industrial Sciences and Technology
UNIVERSITY : Universiti Malaysia Pahang Al-Sultan Abdullah
EMAIL : norwahida@ump.edu.my
CO-INVENTORS:
Assoc. Prof Dr. Ezlin Hani Sukadarin,
Nur Fadhilah binti Abdul Razak
Ts. Assoc. Prof Dr Mohd Rafee Bin Baharuddin,
Ts. Dr. Mohamad Azhar Bin Mohd Noor,
Ts. Mohd Alwi Bin Mixman
Patent : LY2023C01899
PRODUCT BACKGROUND
Psychosocial outcomes increasing apparently not a moral imperative but a strategic necessity in nuclear sector.
A guided risk assessment tool is vital to predict, prevent the issue and improve the health and well-being.
Psychosocial risk approach align to support OSHMP2025 Strategy 6 through digital technology
OBJECTIVE : To pioneer the RAMOS Tool, a solution firmly rooted in industries and best practices
NOVELTY
Hazards Identification
RAMOS : RISK ASSESSMENT MATRIX OF OCCUPATIONAL STRESS
S Social Support
T Task
R Recognition
E Exposure
S Skilled work
S Stability
O Organisational factor
R Response from customer
Risk Control
APPLICABILITY
To empower risk management focusing in occupational stress in industries.
More practically evaluated and systematic monitoring which indirectly achieve a solution from the occurrence of serious / complaint issues.
Enhance knowledge, attitude, and practice in psychological response management among industries keyplayer in Malaysia.
Facilitate compliance with objective OSH legislation, and improve industry readiness and adaption to physiological and psychological needs.
PUBLICATION
Developing a Risk Control Modifying Matrix in Assessing Occupational Stress in Port Terminal. International Journal of Recent Technology and Engineering (2019) – Scopus
Understanding Occupational Stress Risk in Nuclear Settings: Key Influencing Factors. MJPHM (2023) – Under Review
STATUS OF INNOVATION
TRL 7 – 9 (Commercialization stage with industrial partner).
Validation by industrial expert. It can be assessed via phone and laptop.
SDG IMPACT
3
9
ECO FRIENDLY
RECOGNITION
GOLD CITREX, 2023
SPECIAL AWARD 2023 – UMP HOLDINGS INVENTION AWARD
ITEX 2023 & HFEMC 2023
COMMERCIALISATION
Target potential market = 1000 software
Estimate commercial value = RM 1000 x 1000 = RM 1.0 Million
Target user focused to employers, OSH/Industrial Practitioner & DOSH Officer.
COLLABORATION & FUNDED
PBJV GROUP
NITC 2023
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Director General,
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NUKLEAR MALAYSIA
USM
APEX
PEKACIPTA & INOVASI NUKLEAR MALAYSIA
HyBGC: Bio-composite Film Patch for Soft Tissue Regeneration
Ruzalina Baharin, Siti Noor Fazliah Mohd Noor, Norzita Yaacob and Siti Fatimah Samsurrijal
INTRODUCTION
HyBGC ulcer patch is a novel resorbable bio-composite film patch produced from natural and synthetic sources approved by the FDA.
It contains bioactive elements that can induce and enhance tissue generation during the ulcer healing process.
PROBLEM STATEMENT
Non-resorbable patch is attached tightly to skin, soaked or wet when it absorbed water.
Difficult to find product that can regenerate tissues while in use
Treatment of patient with ulceration problem
Physical treatments to cover the ulcer/wound
Conventional
Innovation
Plaster dressing, paste, gel, patch
Film patch
Traumatic, stress & clinical waste
Resorbable, enhance tissue regeneration, non-toxic
SOLUTION
HyBGC – Hydrogel Bioactive Glass Composite Film
USEFULLNESS & APPLICATIONS
Safe to use
Saves money and cost for non-resorbable plaster
Can be applied for potential use in ulcerative lesion, wound, traumatise skin, cuts, abrasion, diabetic foot ulceration
NOVELTY AND UNIQUENESS
Dual effect radiation technology – crosslink and sterilization
Biocompatible & Resorbable
Bioactive elements for wound healing
NOVEL COMPOSITIONS
Bioactive glass
Bond formation with hard and soft tissue
Facilitate healing mechanism, and bioactivity
Hydrogel
Cooling effect
Tackiness – increase skin attachment
Chitosan
Antimicrobial
Structural support
Poly-Ɛ-Caprolactone
FDA approved non-toxic plasticizer
Biocompatible
MTE Expo 2023 International Innovation Awards
4th International Invention & Innovation in Dentistry, IIIDentEx2022
NITC 2023
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NUKLEAR MALAYSIA

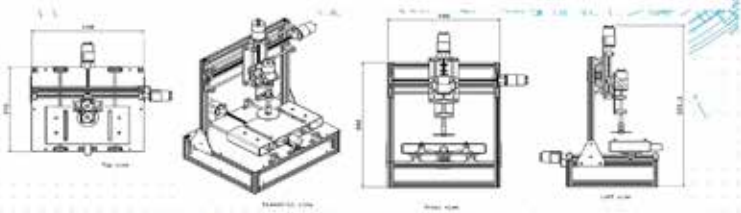
STRIDE

INOVASI *SHOE CUTTING PLATFORM* (SHU-CUTT)

Noorhasifah Ab Aziz, Nik Nur Ilyani Mohamed Nazri, Nor Hafizah Mohd Jais, Mohd Redhuan Mat Isa, Dr. Noreen Farzuhana Mohd Zulkifli, Nur Atiqah Abdullah, Nurul Hidayah Abdul Aziz, Mustafa Unap, Zukri Ahmad, Low Jun Hin, Muhammad Shahsyimir Shahadan, Noor Hafifi Zuriani Abdul Rahim, M Nuzulhakimi Che Hassan

PENGENALAN

Bahagian Teknologi Perlindungan dan Biofizikal (BTPB) terletak di bawah organisasi Institut Penyelidikan Sains dan Teknologi Pertahanan (STRIDE), Kementerian Pertahanan Malaysia yang bertanggungjawab dalam merancang dan melaksanakan penyelidikan serta ujian kawalan kualiti bagi proses perolehan, pembekalan, penggunaan dan penyimpanan peralatan serta kelengkapan Angkatan Tentera Malaysia (ATM). Antara ujian makmal yang dijalankan ialah pengujian sampel kasut kulit. Penyediaan sampel melibatkan proses pemotongan kasut kepada beberapa bahagian untuk membolehkan ujian kimia dan fizikal ke atas sampel dilaksanakan.



JUSTIFIKASI PROJEK

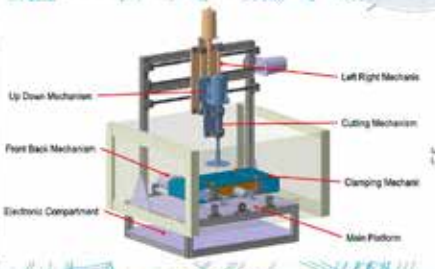
SHU-CUTT dibangunkan bertujuan untuk mencipta satu sistem pemotongan kasut yang lebih selamat dan dapat mengurangkan risiko kecederaan pada pengendali semasa melaksanakan kerja-kerja penyediaan sampel kasut. SHU-CUTT dicipta dengan ciri-ciri *light* dan *compact*, berkonsepkan kasut akan bergerak dan dikawal dengan motor, manakala *spindle* dengan pisau akan digerakkan untuk memisahkan bahagian atas kasut dengan tapak kasut. Inovasi ini menggunakan alat kawalan jauh dan dilengkapi dengan pelindung (*shield*) untuk melindungi pengendali daripada risiko kecederaan.

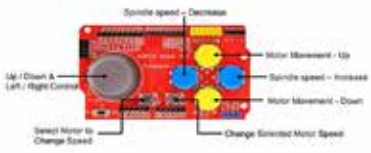
KELEBIHAN SHU-CUTT

MENGURANGKAN RISIKO KECEDERAAN

PEMOTONGAN KASUT SEMI AUTOMATIK

MENGOPTIMUMKAN PENGGUNAAN MASA DAN SUMBER MANUSIA





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Fax +603 – 87335942

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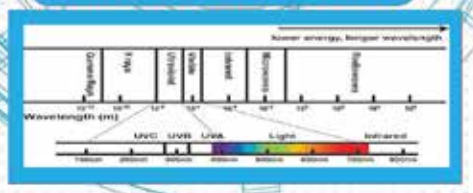
NUKLEAR MALAYSIA

PORTABLE UV IRRADIATOR

Sofian Ibrahim, Chai Chee Keong, Muhammad Hannan Bahrin, Hasan Sham, Anwar Abdul Rahman, Mohd Noorwadi Mat Lazim, Mohd Yusof Bin Hamzah, Naurah Mat Isa, Ahmad Bazlie Abdul Kadir, Noor Mohd Rizwan Brahim, Siti Hajar Said, Wan Ismail Wan Yusof, Muhamad Nor Atan, Khairul Hisyam Mohamed Yusop, Hafizuddin Maseri & Noor Hasni M Ali

BACKGROUND OF INNOVATION



Ultraviolet light (UV) is a form of electromagnetic radiation that falls within the invisible portion of the electromagnetic spectrum, beyond violet light. It has shorter wavelengths and higher energy than visible light; UV light is categorized into three types based on its wavelength (UVA, UVB & UVC).

Currently, fundamental experiments involving the use of UV light in the laboratory are carried out without proper instruments; where the researchers only build a simple UV irradiator without safety features and accurate irradiation parameters (time, distance and intensity of UV light). For these reasons, portable UV irradiator was built to help researchers to carry out their research in the laboratory more safely and systematically.

UV LIGHT APPLICATIONS

i. Photochemistry: Often used to initiate photochemical reactions; organic synthesis, environmental analysis, and materials science.

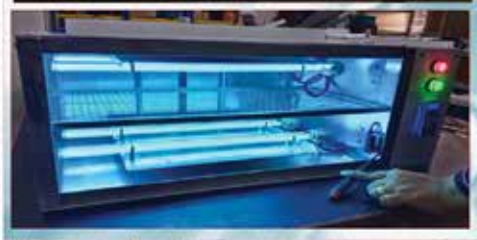
ii. Photolithography: In semiconductor manufacturing, it is used to expose and pattern photoresist layers on silicon wafers, facilitating the creation of intricate microelectronic circuitry.

iii. UV Sterilization: UV light possesses germicidal properties (sterilization purposes).

iv. Polymerization: several advantages over traditional polymerization methods; faster curing times & the ability to polymerize in the absence of heat or solvents.

TARGET BENEFICIARIES/ TARGET MARKET

- ✓ The portable UV irradiator will help to accelerate research (fundamental) on the application of UV irradiation to polymers, electronic components, pharmaceuticals and etc.
- ✓ Target market- Researchers or players from polymer, pharmaceutical and electronic industries



UV IRRADIATOR SPECIFICATIONS

- ✓ Size -750 x 400 x 313 mm
- ✓ Weight – 20 kg
- ✓ 4 X 55 Watt UV lamps
- ✓ 4 x Electronic Ballast
- ✓ Timer Cooling fan
- ✓ 24 Volt power supply cooling fan
- ✓ Input Voltage 220 to 240 V

Novelty
Safe and Systematic Portable UV irradiator for fundamental/ small experimental purpose

ADVANTAGES OF PORTABLE UV IRRADIATOR

i. Easy to operate
ii. Low cost (less than RM 1000)
iii. Small, compact and robust equipment for the time or dose control irradiation of sample
iv. Long operating hour; UV lamp lifespan 9000 hours
v. The UV light intensity accurately measured; dose measurement purpose (Dose = intensity x time)
vi. Safe to handle
vii. Changing the UV lamp from UVA to UVC is easier and faster
viii. Distance between the lamps and the sample can be adjust/manipulate
ix. Easy to maintains

RADIATION PROCESS CONDUCTED BY THE PORTABLE UV IRRADIATOR

- ✓ Vulcanization of natural rubber latex
- ✓ Vulcanization of wire & cable
- ✓ Sterilization of medical devices (gloves, mask etc.)
- ✓ Polymerization of (PEDOT:PSS) thin film and solution

PUBLICATIONS

i. Effect of Various Ultraviolet Irradiation Dose on Mechanical Properties of Hybrid Ultraviolet-Peroxide Prevulcanized Natural Rubber Latex, NTC 2023

ii. Hybrid Ultraviolet - Peroxide Vulcanizations: A Potential Sulphur-free Prevulcanized Natural Rubber Latex Preparation Method, eJSNM, 2023

NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

Director General,
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SELANGOR

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E-mel: sofian_ib@nm.gov.my
Tel : +6012 - 3

NUKLEAR MALAYSIA

SMART CONTROL SYSTEM FOR MUSHROOM HOUSE

Mohamad Suhaimi Yahaya[1], Azhar Mohamad[1], Mohamad Safuan Sulaiman[1], Mohd Dzul Aiman Aslan[1], Nordin Salleh[1], Mohamad Fazreen Abdul Mutalib[1], Mohd Hafiz Abd Nasir[1], Juhari Yasiran[2], Sani Mohamad[2] and Tan Pong Seng[2]
[1]Agensi Nuklear Malaysia
[2]Sky Aire Resources

ABSTRACT

Smart Mushroom House located near to Block 46, Dengkil Complex Nuklear Malaysia

- Agrotechnology & Biosciences Division (BAB) has received development expenditure (DE) allocation to build Smart Mushroom House in 2022.
- This Smart Mushroom House is important to study the potential of mushrooms (Volvariella, Pleurotus, Auricularia) to be commercialized and as a reference center among the mushroom entrepreneurs.
- One of the features in Smart Mushroom House that has been developed was the use of smart control system with total cost about RM15,000.00.
- Smart automation will be activated when parameters of humidity and temperature has been achieved.

FEATURES

- 2 parameters have been successfully controlled: humidity level (65-80%RH), temperature (25 – 30°C), by installation of misting system, circulation and ventilation fan.
- The data can be viewed online using a smartphone or computer and will be stored for a more detailed mushroom research study.

- Smart control system uses local server (raspberry pi) , temperature&humidity sensor, modem

ADVANTAGES

- Research on mushroom can be carried out effectively and systematically
- Remote monitoring can save researchers time
- Savings on electricity and water utility bills
- Cost effective as less wiring works required

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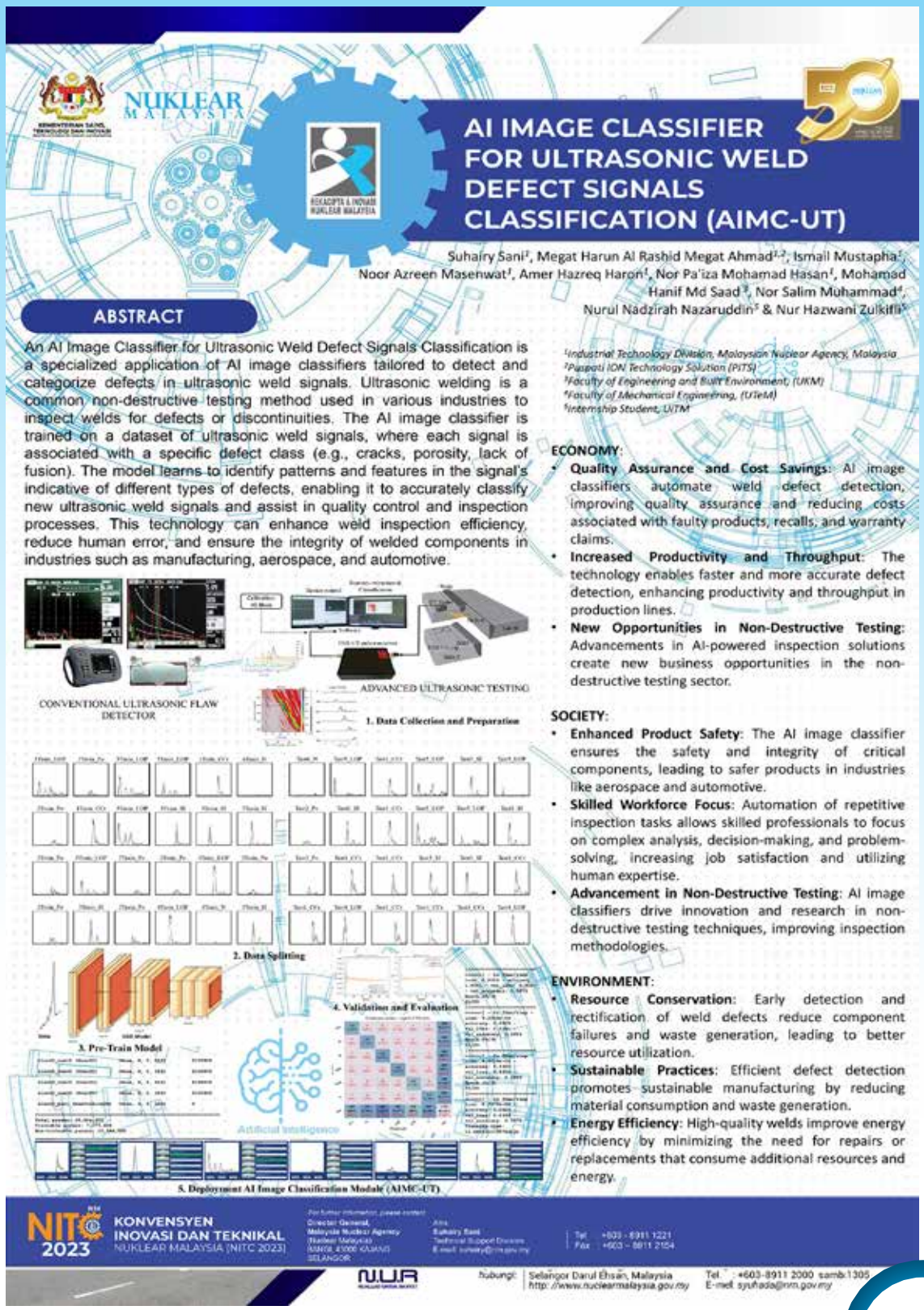

NUKLEAR MALAYSIA

AI IMAGE CLASSIFIER FOR ULTRASONIC WELD DEFECT SIGNALS CLASSIFICATION (AIMC-UT)

Suhairy Sani[2], Megat Harun Al Rashid Megat Ahmad[1,2], Ismail Mustapha[3], Noor Azreen Masenwat[1], Amer Hazreq Haron[1], Nor Pa'iza Mohamad Hasan[1], Mohamad Hanif Md Saad [3], Nor Salim Muhammad[4], Nurul Nadzirah Nazaruddin[5] & Nur Hazwani Zulkifli[5]

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ABSTRACT

An AI Image Classifier for Ultrasonic Weld Defect Signals Classification is a specialized application of AI image classifiers tailored to detect and categorize defects in ultrasonic weld signals. Ultrasonic welding is a common non-destructive testing method used in various industries to inspect welds for defects or discontinuities. The AI image classifier is trained on a dataset of ultrasonic weld signals, where each signal is associated with a specific defect class (e.g., cracks, porosity, lack of fusion). The model learns to identify patterns and features in the signal's indicative of different types of defects, enabling it to accurately classify new ultrasonic weld signals and assist in quality control and inspection processes. This technology can enhance weld inspection efficiency, reduce human error, and ensure the integrity of welded components in industries such as manufacturing, aerospace, and automotive.

CONVENTIONAL ULTRASONIC FLAW DETECTOR

ADVANCED ULTRASONIC TESTING

1. Data Collection and Preparation

2. Data Splitting

3. Pre-Train Model

4. Validation and Evaluation

Artificial Intelligence

5. Deployment AI Image Classification Module (AIMC-UT)

ECONOMY:

- **Quality Assurance and Cost Savings:** AI image classifiers automate weld defect detection, improving quality assurance and reducing costs associated with faulty products, recalls, and warranty claims.
- **Increased Productivity and Throughput:** The technology enables faster and more accurate defect detection, enhancing productivity and throughput in production lines.
- **New Opportunities in Non-Destructive Testing:** Advancements in AI-powered inspection solutions create new business opportunities in the non-destructive testing sector.

SOCIETY:

- **Enhanced Product Safety:** The AI image classifier ensures the safety and integrity of critical components, leading to safer products in industries like aerospace and automotive.
- **Skilled Workforce Focus:** Automation of repetitive inspection tasks allows skilled professionals to focus on complex analysis, decision-making, and problem-solving, increasing job satisfaction and utilizing human expertise.
- **Advancement in Non-Destructive Testing:** AI image classifiers drive innovation and research in non-destructive testing techniques, improving inspection methodologies.

ENVIRONMENT:

- **Resource Conservation:** Early detection and rectification of weld defects reduce component failures and waste generation, leading to better resource utilization.
- **Sustainable Practices:** Efficient defect detection promotes sustainable manufacturing by reducing material consumption and waste generation.
- **Energy Efficiency:** High-quality welds improve energy efficiency by minimizing the need for repairs or replacements that consume additional resources and energy.

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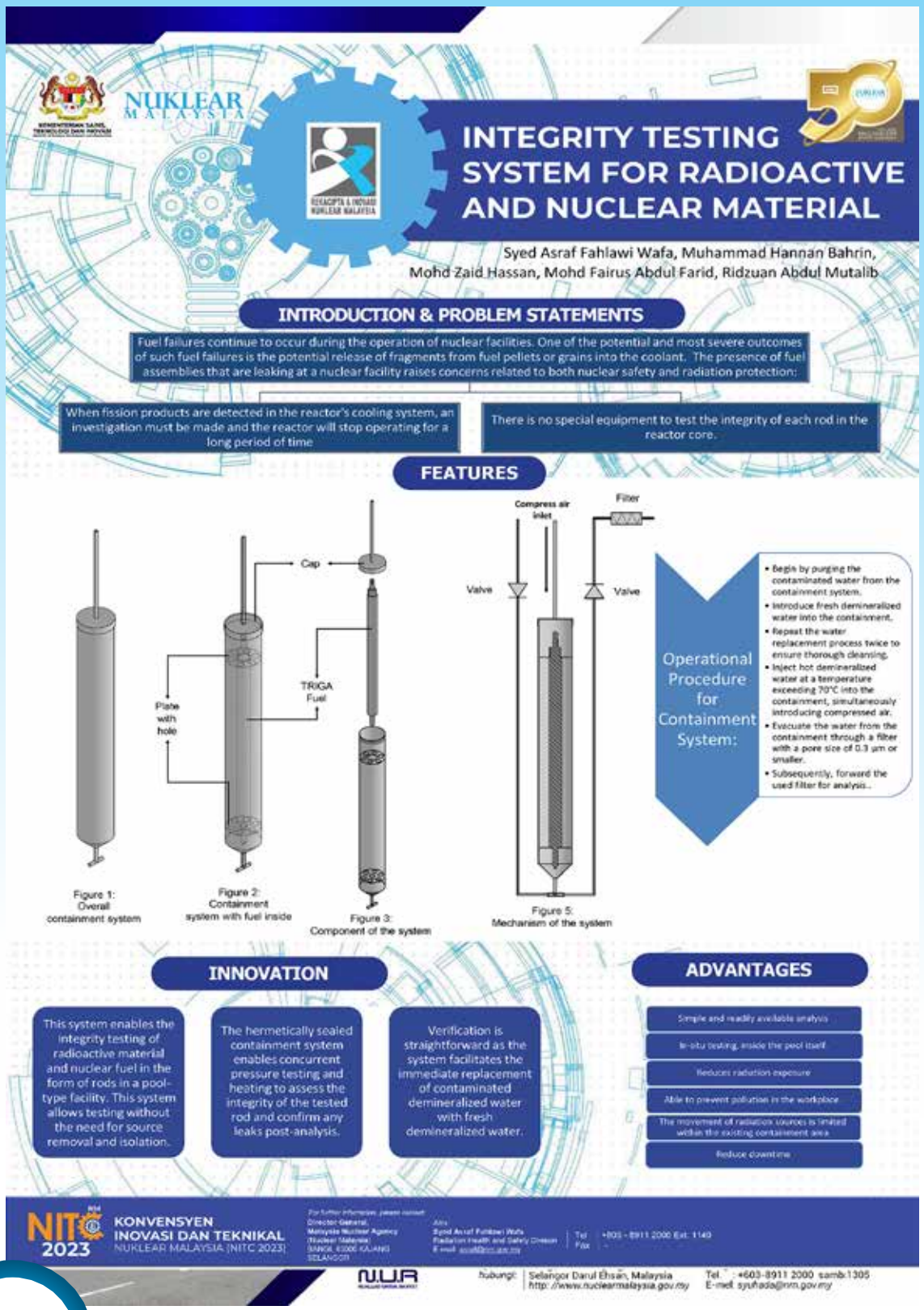
NUKLEAR MALAYSIA
INTEGRITY TESTING SYSTEM FOR RADIOACTIVE AND NUCLEAR MATERIAL
Syed Asraf Fahlawi Wafa, Muhammad Hannan Bahrin,
Mohd Zaid Hassan, Mohd Fairus Abdul Farid, Ridzuan Abdul Mutalib
INTRODUCTION & PROBLEM STATEMENTS
Fuel failures continue to occur during the operation of nuclear facilities. One of the potential and most severe outcomes of such fuel failures is the potential release of fragments from fuel pellets or grains into the coolant. The presence of fuel assemblies that are leaking at a nuclear facility raises concerns related to both nuclear safety and radiation protection:
When fission products are detected in the reactor's cooling system, an investigation must be made and the reactor will stop operating for a long period of time
There is no special equipment to test the integrity of each rod in the reactor core.
FEATURES
Cap
TRIGA Fuel
Plate with hole
Figure 1: Overall containment system
Figure 2: Containment system with fuel inside
Figure 3: Component of the system
Compress air inlet
Filter
Valve
Valve
Figure 5: Mechanism of the system
Operational Procedure for Containment System:
• Begin by purging the contaminated water from the containment system.
• Introduce fresh demineralized water into the containment.
• Repeat the water replacement process twice to ensure thorough cleansing.
• Inject hot demineralized water at a temperature exceeding 70°C into the containment, simultaneously introducing compressed air.
• Evacuate the water from the containment through a filter with a pore size of 0.3 µm or smaller.
• Subsequently, forward the used filter for analysis..
INNOVATION
This system enables the integrity testing of radioactive material and nuclear fuel in the form of rods in a pool-type facility. This system allows testing without the need for source removal and isolation.
The hermetically sealed containment system enables concurrent pressure testing and heating to assess the integrity of the tested rod and confirm any leaks post-analysis.
Verification is straightforward as the system facilitates the immediate replacement of contaminated demineralized water with fresh demineralized water.
ADVANTAGES
Simple and readily available analysis
In-situ testing, inside the pool itself
Reduces radiation exposure
Able to prevent pollution in the workplace
The movement of radiation sources is limited within the existing containment area
Reduce downtime
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NUKLEAR MALAYSIA

GREENHOUSE GASES SAMPLING SWITCHING SYSTEM AND CONTROL PANEL

Ahmad Nazrul Abd Wahid, Maizatul Akmam Mhd Nasir, Abdul Razak Ruslan, Hazlina Abdullah, Azania Shazlin Mohamad Razali & Mohamad Taufik Abdullah

PROBLEM STATEMENTS

Greenhouse gases (GHGs) derived from agriculture and land use changes such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), play a major role in regulating earth's temperature. Basically, the study of GHGs emissions in Nuclear Malaysia is to evaluate the emissions and find mitigation plan to reduce GHGs emissions in the agricultural ecosystem. Previously, GHGs sampling in the field is used a conventional method where, a syringe was used to pull out a GHGs sample from the chambers. However, the method is less effective because the sample had to be stored for a long time before being analyzed. It causing the data obtained to be less accurate. This method also causes the staff was exposed to sun heat for a long time during sampling in the field. The conventional method also involves the use of more staff.

Conventional GHGs Sampling Technique in the field

INNOVATION

Through the procurement of CH_4, CO_2 and N_2O analyzers, an innovation has been done by developed of **Greenhouse Gases Sampling System and Control Panel**. This innovation tools aims to make it easier for the analyzers to measure GHGs emission directly and suitable to apply on any agricultural field conditions. The **Sampling Switching System** acts to control GHGs flow in the chambers in the rice field enter to the analyzers. The staff no longer need to go into the field to pull out the GHGs in chambers using the syringe. The staff only needs to control the switches on **Sampling Switching System** panel to allow GHGs from the chambers enter to the analyzers via tube. The **Control Panel** acts as a tool for directing GHGs into which analyzers that want to use.

Attachment of Innovation Tools to the Analyzers

Connected Chambers to Switching System via Tube

BENEFITS & IMPACTS

- ❑ Cost effective compare to using of the market Multiplexer.
- ❑ Save cost from the use a lot of vials and syringes.
- ❑ GHGs data can be obtained immediately.
- ❑ Reduce a lot of staff for GHGs sampling.
- ❑ Reduce long heat exposure during GHGs sampling.
- ❑ Reduce impact on agricultural soil during GHGs sampling.
- ❑ Data reliable and precise.
- ❑ Easy handling, installation and mobile.

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NUCLEAR TECHNICAL CONVENTION (NTC)

24-26 Okt 2023

STATISTICAL ANALYSIS FOR DISUSED SEALED RADIOACTIVE SOURCES (DSRS) IN WASTE TECHNOLOGY DEVELOPMENT CENTRE (WasTeC)

Ahmad Hasnulhadi Che Kamaruddin and Noor Hidirah Kamarulzaman

INTRODUCTION

DSRS inventory data is crucial for safety assessments and borehole design, not only during acquisition but also for disposal. It includes source details, and precise location knowledge is essential for safe dismantling. Inaccurate data may lead to assessment errors. This study focuses on DSRS collected by WasTeC from 2019 to 2022, analyzed descriptively.

METHODOLOGY

1 Collection of the DSRS data

DSRS data is obtained by waste operators through WasTeC's filing system using unique waste IDs. While these IDs typically grant access to radioactive waste information, not all DSRS have them due to various factors. In such cases, inventory records are reviewed to match device details (model, serial number, activity, radionuclides), and new waste IDs are created when necessary.

2 Sorting information of the DSRS

The DSRS are classified based on different radionuclides types, purpose & applications, sectors, radioactivity, and its category. Different radionuclide means the activity of the sources will decay depends on its half-life.

$$A_t = A_0 e^{-\lambda t}$$

Category of radioactive sources	Activity ratio (A/D)
1	A/D ≥ 1000
2	1000 > A/D ≥ 10
3	10 > A/D ≥ 1
4	1 > A/D ≥ 0.01
5	0.01 > A/D

RESULT AND DISCUSSION

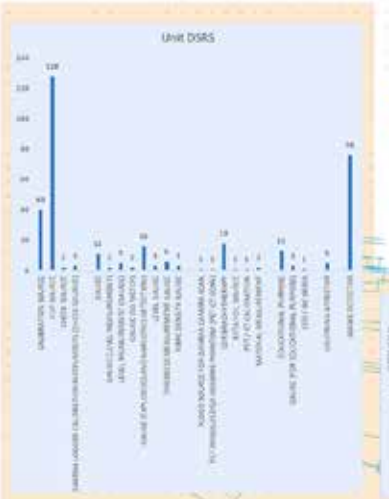

Figure 7 : The quantity of DSRS at different purpose and applications in 2022

Figure 8: The quantity of DSRS was sorted as main purpose and applications in 2022

In 2022, 50 services were provided and 343 DSRS were collected throughout the year which arose from different main sectors as shown in Figure 8. Twenty-five (25) services provided come from educational sectors such as schools and universities and 173 units of the DSRS are cup sources which distribute the highest number of sources. The quantity of DSRS for different purpose and applications in 2022 are shown in Figure 7 and Figure 8. Meanwhile, the total current activity is 194 GBq (5.24 Curie)

CONCLUSION

Sorting and organizing the radioactive waste inventory is an initial step before upgrading the structured data into an inventory database system. Dealing with many records will need consistency in checking, reviewing, tracking and fixing the missing records, managing uncertainties with the best practise and optimizing the current records to make sure data or records that we have is convincing and reliable. By considering current activity of the DSRS, some of the sources were not significant in term of their risk because they will be fully decayed for some period of time. The waste also can be exempted or cleared from the regulatory control if the activity limit is below the exemption value as gazetted by federal government under Atomic Energy Licensing for Low Activity Radioactive Material (Exemption) Order 2020. Output from the structured inventory data can be used to choose a disposal option for Malaysia such as borehole disposal facility (BDF) and Low-Level Radioactive Waste Repository.

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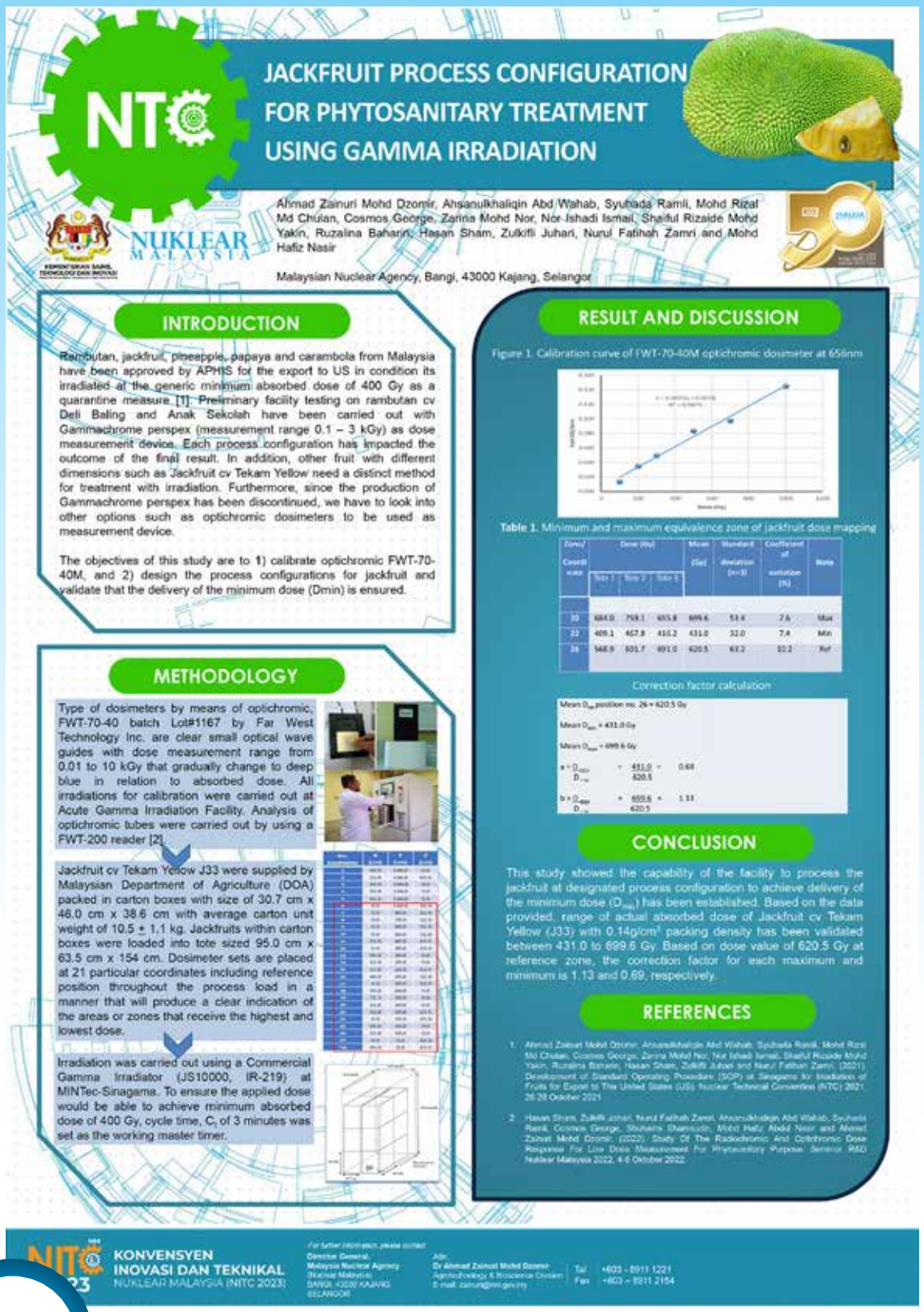

JACKFRUIT PROCESS CONFIGURATION FOR PHYTOSANITARY TREATMENT USING GAMMA IRRADIATION

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Malaysian Nuclear Agency, Bangi, 43000 Kajang, Selangor

INTRODUCTION

Rambutan, jackfruit, pineapple, papaya and carambola from Malaysia have been approved by APHIS for the export to US in condition its irradiated at the generic minimum absorbed dose of 400 Gy as a quarantine measure [1]. Preliminary facility testing on rambutan cv Deli Baling and Anak Sekolah have been carried out with Gammachrome perspex (measurement range 0.1 – 3 kGy) as dose measurement device. Each process configuration has impacted the outcome of the final result. In addition, other fruit with different dimensions such as Jackfruit cv Tekam Yellow need a distinct method for treatment with irradiation. Furthermore, since the production of Gammachrome perspex has been discontinued, we have to look into other options such as optichromic dosimeters to be used as measurement device.

The objectives of this study are to 1) calibrate optichromic FWT-70-40M, and 2) design the process configurations for jackfruit and validate that the delivery of the minimum dose (Dmin) is ensured.

METHODOLOGY

Type of dosimeters by means of optichromic, FWT-70-40 batch Lot#1167 by Far West Technology Inc. are clear small optical wave guides with dose measurement range from 0.01 to 10 kGy that gradually change to deep blue in relation to absorbed dose. All irradiations for calibration were carried out at Acute Gamma Irradiation Facility. Analysis of optichromic tubes were carried out by using a FWT-200 reader [2].

Jackfruit cv Tekam Yellow J33 were supplied by Malaysian Department of Agriculture (DOA) packed in carton boxes with size of 30.7 cm x 46.0 cm x 38.6 cm with average carton unit weight of 10.5 ± 1.1 kg. Jackfruits within carton boxes were loaded into tote sized 95.0 cm x 63.5 cm x 154 cm. Dosimeter sets are placed at 21 particular coordinates including reference position throughout the process load in a manner that will produce a clear indication of the areas or zones that receive the highest and lowest dose.

Irradiation was carried out using a Commercial Gamma Irradiator (JS10000, IR-219) at MINTec-Sinagama. To ensure the applied dose would be able to achieve minimum absorbed dose of 400 Gy, cycle time, C_t of 3 minutes was set as the working master timer.

RESULT AND DISCUSSION

Figure 1. Calibration curve of FWT-70-40M optichromic dosimeter at 656nm

Table 1. Minimum and maximum equivalence zone of jackfruit dose mapping

Zone/ Coordinate	Dose (Gy) Tube 1	Tube 2	Tube 3	Mean (Da)	Standard deviation (n=3)	Coefficient of variation (%)	Note
20	684.0	759.1	655.8	699.6	53.6	7.6	Max
22	409.1	467.8	416.2	431.0	32.0	7.4	Min
26	568.9	631.7	491.0	620.5	63.2	10.2	Ref

Correction factor calculation

Mean D_{ref} position no. 26 = 620.5 Gy

Mean D_{min} = 431.0 Gy

Mean D_{max} = 699.6 Gy

$a = \frac{D_{min}}{D_{ref}} = \frac{431.0}{620.5} = 0.69$

$b = \frac{D_{max}}{D_{ref}} = \frac{699.6}{620.5} = 1.13$

CONCLUSION

This study showed the capability of the facility to process the jackfruit at designated process configuration to achieve delivery of the minimum dose (D_{min}) has been established. Based on the data provided, range of actual absorbed dose of Jackfruit cv Tekam Yellow (J33) with 0.14g/cm³ packing density has been validated between 431.0 to 699.6 Gy. Based on dose value of 620.5 Gy at reference zone, the correction factor for each maximum and minimum is 1.13 and 0.69, respectively.

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THE USE OF ACUTE GAMMA IRRADIATION FOR EDIBLE MUSHROOM IMPROVEMENT

Azhar Mohamad, Seri Chempaka Mohd Yusof, Nur Diyana Osman, Mohd Hafiz Abd Nasir, Irwan Syafri Rusli

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INTRODUCTION

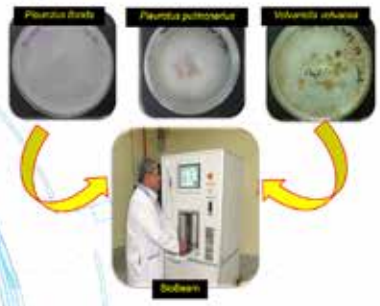
Mutation breeding is important in creating viable variation strains for mushroom industry. The variation in mushroom species through changes to external properties (phenotype) and internal properties (genotype) give choices for growers in selecting mushroom strains depending on their locality and full fill its demand in mushroom industry. At Nuclear Malaysia, acute gamma irradiation is one of the physical mutation methods used in the mutation induction process. Irradiation gives a significant dose responding onto different types of mushroom species. The findings in this study are important in applying mutation induction activities via acute gamma radiation towards sustainable of new improved strain for mushroom industries.

METHODOLOGY

The acute gamma irradiations were carried out in Gamma cell located at Nuclear Malaysia. Three species were used known as *Pleurotus florida*, *Plourotus pulmonarius* and *Volvarela volvacea*. The irradiation process involves two stages, laboratory stage and the farm stage. Dose respond is the first step in the laboratory. At the laboratory stage, identification of strains from superior species, irradiation, screening and selection were done intensively by *in vitro* propagation. While *in vivo* cultivation was done in multiple locations at mushroom farm for its locality trial.

RESULT AND DISCUSSION

The study shows that these species have certain specificities for temperature and humidity for their growth. The humidity required during mycelium development is 70% whereas for fruiting is 80% for these species. In field, the same parameters found varies according their location. The growth and development of mycelium by *in vitro* propagation for *Pleurotus sp.* and *Volvariella sp.* were between 25-28°C. *In vivo* growth requires temperatures between 22-28°C and 28-35°C for both Pleurotus and Volvariella respectively. Besides, good aeration was important for both species to enable production of their fruiting bodies and mycelium.



CONCLUSION

This study allows the development of smart mushroom houses for mushroom commercial production. Currently, the agricultural sector needs new strains in making mushrooms as one of the high value commodities for the country.

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Iso FLOW System for Efficient Analysis of Stable Isotope in Liquid Samples

Mohd Noor Hidayat Adenan, Azilah Abdul Malek, Shyful Azizi Abdul Rahman, Salmah Moosa, Rafiah Mohamed Roshidi

INTRODUCTION

- ✓ Iso FLOW is a fully automated and continuous flow sample preparation system for the isotopic analysis of liquid and gas samples.
- ✓ Applications: Geoscience, climate change, food adulteration, hydrology, and clinical investigations.
- ✓ The most typical sources of samples for Iso FLOW analysis: Human breath, carbonate, river, sea water, and potable water.
- ✓ For δ^2H dan $\delta^{18}O$ isotope measurement, the system's equilibration process eliminates the negative effects of organic chemicals in water, whether dissolved or in minute particles, better than direct injection into an elemental analyzer.
- ✓ The advantages of using the Iso FLOW are high sensitivity of detection, quality and reliability of data.
- ✓ A total of 180 samples can be processed simultaneously during the analysis.

METHODOLOGY

The Iso Flow system is connected to:

i. Purified helium (95%) mixed with 5% CO_2 gas ($\delta^{18}O$ isotope measurement).
ii. Purified helium (90%) mixed with 10% hydrogen gas (δ^2H isotope measurement).
iii. Isotope Ratio Mass Spectrometer (IRMS) detector for mass ratio measurement.

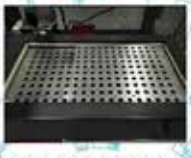
1

Hokko coil for δ^2H analysis

Without Hokko coil for $\delta^{18}O$ analysis

200 µl of sample in Iso FLOW vial (5.9 ml). Hokko coil is required in the vial for δ^2H measurement only. This coil is important for hydrogen gas equilibration process.

2



Sample vials must be inserted into the sample tray. The tray temperature is 40°C.

3

Analysis will be started with mix gas conditioning either 95% helium + 5% CO_2 or 90% helium + 10% hydrogen. Appropriate IAEA certified reference materials need to be selected. Sample vial analysis will be performed once conditioning done.

RESULT AND DISCUSSION

PROFICIENCY TEST AGROISOLAB (IUE/0323/1) (Water Sample)

^{18}O isotope measurement					^{2}H isotope measurement				
Mean	-7.1‰				Mean	-48.9‰			
SD	0.7				SD	1.3			
Lab number	Technique/ Analyzer	Mean (‰)	Z-Score	Rank	Lab number	Technique/ Analyzer	Mean (‰)	Z-Score	Rank
S (Nuclear Malaysia)	Iso FLOW	-7.1	0.00	1	S (Nuclear Malaysia)	Iso FLOW	-48.24	0.51	4
3	Pyrolysis	-7.8	-1.00	4	3	Pyrolysis	-48.3	0.46	3
6	Pyrolysis	-6.7	0.57	3	6	Pyrolysis	-47.7	0.92	7
13	Equilibration	-7.2	-0.14	2	13	Equilibration	-49	-0.08	1
14	Equilibration	-7.0	0.14	2	14	Equilibration	-46	2.23	10
15	Pyrolysis	-8.3	-1.71	5	15	Pyrolysis	-50.6	-1.31	9
18	Equilibration	-7.1	0.00	1	18	Equilibration	-49.9	-0.77	6
19	Equilibration	-7.1	0.00	1	19	Equilibration	-48.6	0.23	2
22	Equilibration	-7.5	-0.57	3	22	Equilibration	-50.3	-1.08	8
25	Laser	-5.3	2.57	6	25	Laser	-49.8	-0.69	5

- Involvement in International Proficiency Test Scheme by Agroisolab United Kingdom.
- Water sample (IUE/0323/1):
  i. Mean average of $\delta^{18}O$ and δ^2H from **all the laboratories**: **-7.1‰** and **-48.9‰** respectively.
  ii. Mean average of $\delta^{18}O$ and δ^2H from **Iso FLOW**: **-7.1‰** and **-48.24‰** respectively.
  iii. Z-score results for $\delta^{18}O$ and δ^2H are **0** and **0.51**, respectively. Z-score results show low distance value from the mean value of total samples.
  iv. Among laboratories, 1st rank for the lowest $\delta^{18}O$ Z-score value and 4th rank for the lowest ^2H Z-score value.

CONCLUSION

- Iso FLOW is a fast, sensitive, high accuracy and efficient system for $\delta^{18}O$ and δ^2H isotopes analysis in water sample.
- It provides insight to expand research scopes and ensure quality as well as reliable results.

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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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PROCEDURE FOR ISOLATION OF NITRATE-REDUCING BACTERIA FROM PALM OIL MILL EFFLUENT

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INTRODUCTION

Malaysia is the second major producer of oil palm in the world and produced 23% of total global palm oil in 2019 (Food and Agricultural Organization of the United Nations 2020). Palm oil is an important commodity in the country; the industry contributed about 37% of Malaysia's agricultural sector GDP (Department of Statistics, Malaysia 2021). A persisting environmental issue in the palm oil industry is to ensure effective treatment of Palm Oil Mill Effluent (POME) to avoid polluting water sources after discharge. Nitrate-reducing bacteria play a major role in the biological treatment of nitrate in POME. The objective of this study was to determine a procedure to isolate bacteria from POME, after which the nitrate reducing ability and the concentration of nitrite were determined.

METHODOLOGY

Isolation

- Bacteria were isolated from Palm Oil Mill Effluent (POME) and Aerobic Pond (AEP) collected from a Palm Oil Mill in Dengkil.

Growth in Broth

- Isolates from POME or AEP were grown in nitrate broth and incubated at 30°C for 24 hours. Isolates were observed for gas production.

Nitrate reduction test

- Nitrate reduction was detected by pipetting 50 µL of each Nitrate Reagent A (1-Naphthylamine Solution) (Sigma-Aldrich, St. Louis, MO, USA) and Nitrate Reagent B (Sulfanilic acid Solution) (Sigma-Aldrich) into the sample and left for 3 minutes. The sample was observed for colour changes to red (positive).

RESULTS AND DISCUSSION

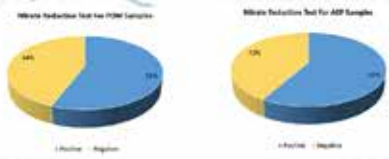

Figure 1. Percentage of POM (Total isolates = 34) and AEP (Total isolates = 24) isolates with positive and negative results for nitrate reduction.

Figure 2. Nitrite produced from reduction of nitrate.

A high number of bacteria isolated from POM and AEP have nitrate-reducing ability. Nitrate reduction test conducted on samples from POME and AEP revealed 56% and 58% of the isolates were able to reduce nitrate (Figure 1).

CONCLUSION

Isolates AEP H24, POM H7, POM H11 and POM H14 (Figure 2) were determined to have high nitrate reducing to nitrite efficiency compared to other isolates. These isolates will be further characterised and improved in radiation mutagenesis experiments.

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NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NTC 2023)

MOLASSES TO SUPPORT BACTERIAL GROWTH

Liew Pauline Woan Ying, Jong Bor Chyan,
Elly Ellyna Rashid and Hing Jan Nie

INTRODUCTION

- Molasses is a viscous, dark syrupy by-product of the sugar cane industry
- Contains sugars, vitamins, minerals, antioxidants and protein, commonly used as energy source and as a binding agent in compound feeds (3)
- Enhance denitrification (7), silage composting (5)
- Substrate to produce bio-ethanol (2), biopolymer (4) and bioelectricity (1)
- Inhibits growth of microbes at high concentration (6)

Figure 1. Molasses (feed grade).

Some facts of Molasses, feed grade

- Feed – improve palatability, increase sugars in livestock, improve digestion, increase milk production, reduce dust in feeds
- Fertilizer – quick source of energy, contain calcium, magnesium, iron and potassium, micronutrients etc
- Microorganisms – source of energy, encourage growth
- Cheaper than refined sugars
- Can kill insects, drive out Fire Ants
- Contain 30-40% sucrose, and other sugars
- Contain low fat, low protein
- A by-product of sugar cane processing

AIM

Studying molasses to support indigenous bacterial growth

METHODOLOGY

The molasses (*gula merah*) used contains at least 76 degrees Brix total dissolved solid, 45% total sugar, 30-32% sucrose, and pH 5.4-5.7. Minimal medium (MM) and Nutrient Agar (NA) (Merck, Germany) were prepared which contained different concentrations of molasses. Locally-isolated bacteria were obtained from rhizosphere soils and agriculture waste waters. Individual bacterial isolate was streaked on both media, and their ability to grow "+ or –" were recorded. Later, selected bacterial isolates were grown in Nutrient Broth (NB) (Merck, Germany) containing molasses as the carbon source by shaking at 200 rpm, 30±2 ºC. Their growth "CFU mL^{-1}" were recorded up to 2 days.

RESULT AND DISCUSSION

A total of 54 local bacterial isolates were screened by streaking on MM and NA containing 0-20% (vol/vol) molasses. Among these, 19 were obtained from rhizosphere soils and 35 were obtained from agriculture waste waters. The results are summarized in Table 1. Based on the results, high concentration of molasses inhibits bacterial growth.

To verify the ability of the bacteria to utilize molasses, 18 selected bacteria were tested in nutrient broth supplied with designated concentrations of molasses. The bacterial counts were shown in Table 2.

The different tolerance of these local bacterial isolates to molasses require further analysis. The bacterial isolates which achieved 10^7 to 10^9 CFU mL^{-1} of growth in NB confirmed their ability to utilize molasses. Meanwhile, those showing growth with lower CFU mL^{-1} might be partially inhibited by the molasses concentrations used, thus require further optimization. Overall, molasses can be utilized to culture the bacteria. However, suitable concentrations of molasses need to be determined for individual bacterial of interest.

Figure 2. Solid agar plates of NA and MM containing different concentrations of molasses.

Table 1. Growth of locally-isolated bacteria on solid media MM and NA containing molasses as carbon source.

Molasses (% vol/vol)	0	5	10	15	20
MM	54	46	24	0	0
NA	54	50	31	0	0

Table 2. Growth of locally-isolated bacteria in NB containing molasses as carbon source.

% molasses (vol/vol)	CFU mL^{-1}	No. isolates
5	2.8×10^9, 4.4×10^8, 6.8×10^8, 2.8×10^8, 1.7×10^8, 2.7×10^8, 2.9×10^7	7
10	8.5×10^8, 1.1×10^7, 3.1×10^7, 2.4×10^7, 1.3×10^8, 7.0×10^5, 2.9×10^7, 6.5×10^8, 3.0×10^8, 1.4×10^7, $<10^5$	11

CONCLUSION

In conclusion, the local bacterial isolates showed different adaptability to the molasses substrate. Molasses can be used to cultivate some bacteria, but not all. The results are important reference towards utilizing molasses as the carbon and energy source to cultivate these local bacteria and facilitate their bio-productions.

ACKNOWLEDGMENT

The activity was carried out at Blok 42 of Malaysian Nuclear Agency.

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IONIZING RADIATION DETECTION ALGORITHM FOR CMOS SENSOR FROM CONSUMER CAMERA DEVICE

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INTRODUCTION

Inexpensive and readily available consumer camera device with CMOS sensor has been shown able to detect ionizing radiation[1] event that can be observed as clustering of bright pixels on the detector image frame.

Figure 1: The webcam used for capturing ionizing events in a movie frame.

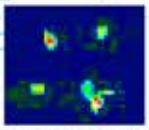


Figure 2: Cluster of bright pixels captured on a movie frame (enlarged area).

These bright cluster of pixels are quite similar in appearance to bright celestial objects in astronomical image observation. Similar method for detecting these astronomical objects therefore can be applied to detect ionizing events on CMOS image frame. The Laplacian of Gaussian (*LoG*) algorithm is one of the technique quite commonly used for astronomical objects identification by edge detection.

In this work, we applied the *LoG* to identify the central pixel position for each ionizing events on the CMOS image frame. The information on ionizing event position not only allows us to quantify it but also provide a reference area coordinate for further data processing, in particular with regards to computation of charge collection values that may be useful to discriminate energy spectrum.

Source (Nuclide)	Energies, keV (photons/100 disintegration)
^{241}Am	59.54 (35.92), 26.34 (2.31), 33.20 (0.12), *11.89-22.2 (37.66)

MATERIAL AND METHODS

The description of CMOS sensor used and experimental procedure were the same in previous report[1] with modifications *i.e.* the CMOS sensor instead functioned as a camera in which a movie of ionizing events was first taken for each radiation exposure before data processing and this resulted in more data frame per exposure time. The movie recording cycle was about 3.3 seconds (total of 99 frames or 30 frames/second). Three measurements were carried out for each source to detector distance of 0 to 5 cm. Noise removal from all image data frames were done by subtracting each pixel values with the frame median value. The source of radiation used was ^{241}Am (100 μCi). The movie was later processed frame by frame using the *LoG* function in *scikit-image* python library to detect bright cluster of pixels or blobs and their respective coordinates. Further computations were carry out to obtain charge collection value by summing all pixel values for each blobs that were then discriminated into bins or channels. The software tool for experimental control and details of data processing can be found in Ref[2].

RESULTS AND DISCUSSION

The thin layer of the CMOS indicates that the probability of any ionizing event is very low as most gamma photons, especially the high energy ones, may just pass through the active semiconductor depletion region. The ^{241}Am source used with its relatively low energy gamma photons allowed higher ionizing event to be captured for better statistics.

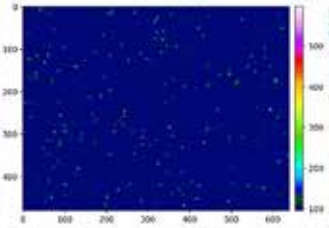


Figure 3: Summation of all ionizing events of all frames for a measurement at 5 cm source to detector distance.

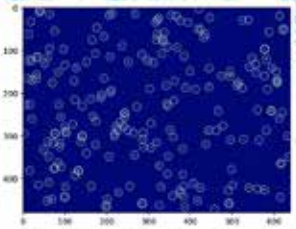
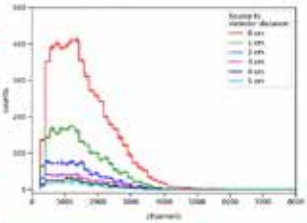


Figure 4: *LoG* identification of these ionizing events coordinates (shown as enlarge rings).

The output of *LoG* algorithm in *scikit-image python* library provides a list of image coordinates (center of rings as shown in Figure 4). In reference to these coordinates taken as center to an area, charge collection value was then calculated by summing all pixel intensities in the pixel area of 441 (21 x 21). Summation value for all the bright pixels inside the cluster area which was then regarded as charge collection value were then discriminated into channels to obtain a ^{241}Am spectrum for evaluation.



Two visible peaks can be discerned in Figure 5 spectra for 0 and 1 cm source to detector distances. These peaks are at around 700 and 1300 of charge collection values. At much larger source to detector distances, no discernible peaks can be seen because of insufficient ionization events and thus poor statistics. These two peaks perhaps represent gamma energy at 59.5 and 11-22 keV.

Figure 5: Spectra of ^{241}Am

CONCLUSION

Identification and quantification of ionizing gamma events on CMOS sensor in a consumer webcam can be attained using the *LoG* algorithm. Thereon, charge collection values can be computed and gamma spectrum be built for the gamma source. CMOS from webcam however may not be able to discriminate the gamma spectrum efficaciously. This is because of the low probability deposition of ionizing event on the thin CMOS sensitive region.

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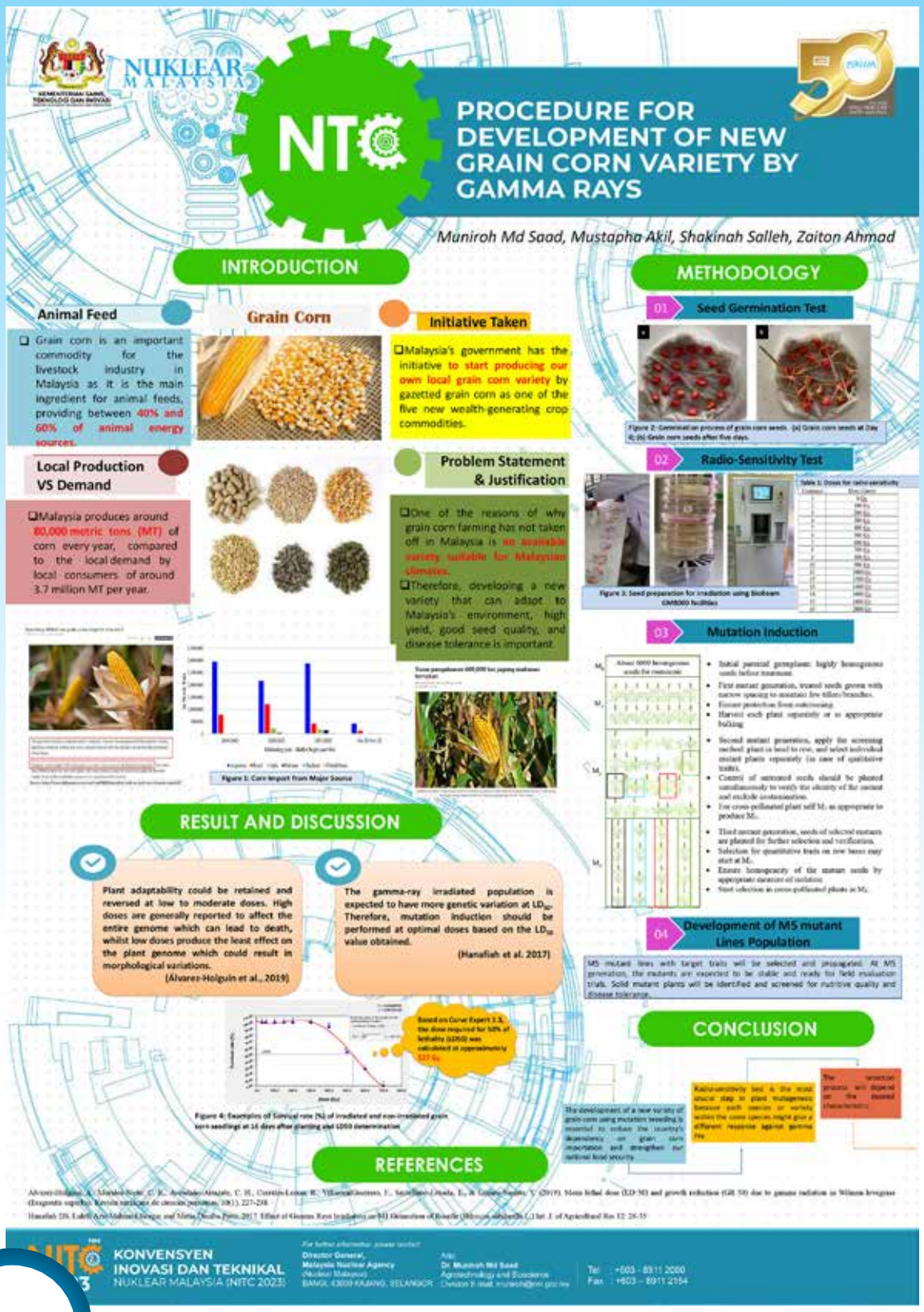
NUKLEAR MALAYSIA
NTC
PROCEDURE FOR DEVELOPMENT OF NEW GRAIN CORN VARIETY BY GAMMA RAYS
Muniroh Md Saad, Mustapha Akil, Shakinah Salleh, Zaiton Ahmad
INTRODUCTION
Animal Feed
Grain corn is an important commodity for the livestock industry in Malaysia as it is the main ingredient for animal feeds, providing between 40% and 60% of animal energy sources.
Grain Corn
Initiative Taken
Malaysia's government has the initiative to start producing our own local grain corn variety by gazetted grain corn as one of the five new wealth-generating crop commodities.
Local Production VS Demand
Malaysia produces around 80,000 metric tons (MT) of corn every year, compared to the local demand by local consumers of around 3.7 million MT per year.
Problem Statement & Justification
One of the reasons of why grain corn farming has not taken off in Malaysia is no available variety suitable for Malaysian climates.
Therefore, developing a new variety that can adapt to Malaysia's environment, high yield, good seed quality, and disease tolerance is important.
Figure 1: Corn import from Major Source
METHODOLOGY
01 Seed Germination Test
Figure 2: Germination process of grain corn seeds. (a) Grain corn seeds at Day 0; (b) Grain corn seeds after five days.
02 Radio-Sensitivity Test
Figure 3: Seed preparation for irradiation using Biobeam GM8000 facilities
03 Mutation Induction
Initial parental germplasm: highly homogenous seeds before treatment.
First mutant generation, treated seeds grown with narrow spacing to maximize low tillers/branches.
Ensure protection from outcrossing.
Harvest each plant separately or as appropriate bulking.
Second mutant generation, apply for screening method: plant to head to row, and select individual mutant plants separately (in case of qualitative traits).
Control of untreated seeds should be planted simultaneously to verify the identity of the mutant and exclude contamination.
For cross-pollinated plant self M_2 as appropriate to produce M_3.
Third mutant generation, seeds of selected mutants are planted for further selection and verification.
Selection for quantitative traits on row bases may start at M_3.
Ensure homogeneity of the mutant seeds by appropriate measure of isolation.
Start selection in cross-pollinated plants in M_3.
04 Development of M5 mutant Lines Population
M5 mutant lines with target traits will be selected and propagated. At M5 generation, the mutants are expected to be stable and ready for field evaluation trials. Solid mutant plants will be identified and screened for nutritive quality and disease tolerance.
RESULT AND DISCUSSION
Plant adaptability could be retained and reversed at low to moderate doses. High doses are generally reported to affect the entire genome which can lead to death, whilst low doses produce the least effect on the plant genome which could result in morphological variations.
(Alvarez-Holguin et al., 2019)
The gamma-ray irradiated population is expected to have more genetic variation at LD_{50}. Therefore, mutation induction should be performed at optimal doses based on the LD_{50} value obtained.
(Hanafiah et al. 2017)
Figure 4: Examples of survival rate (%) of irradiated and non-irradiated grain corn seedlings at 16 days after planting and LD50 determination
CONCLUSION
REFERENCES
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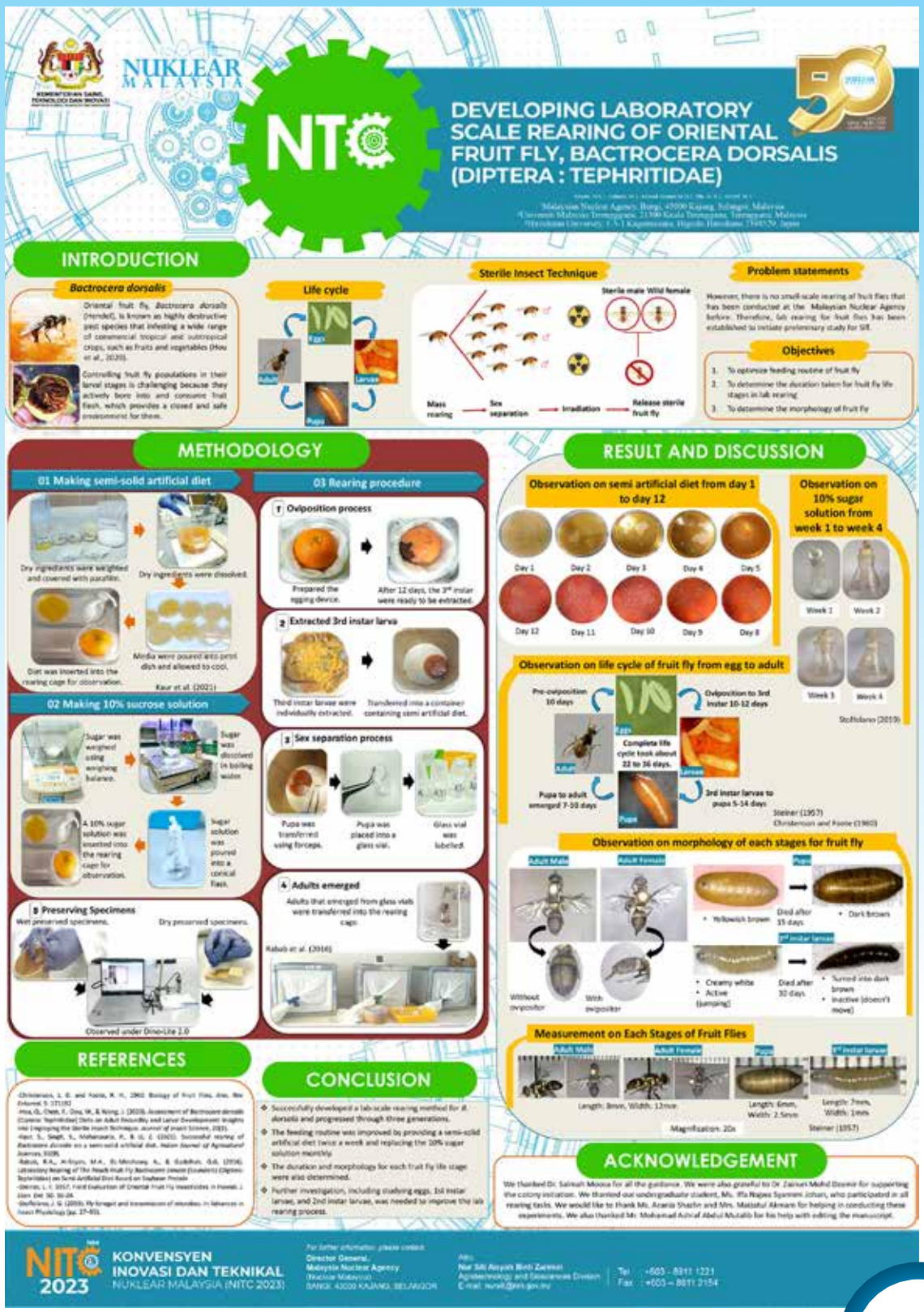
NUKLEAR MALAYSIA
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DEVELOPING LABORATORY SCALE REARING OF ORIENTAL FRUIT FLY, BACTROCERA DORSALIS (DIPTERA : TEPHRITIDAE)
INTRODUCTION
Bactrocera dorsalis
Life cycle
Egg
Larvae
Pupa
Adult
Sterile Insect Technique
Sterile male
Wild female
Mass rearing
Sex separation
Irradiation
Release sterile fruit fly
Problem statements
Objectives
1. To optimize feeding routine of fruit fly
2. To determine the duration taken for fruit fly life stages in lab rearing
3. To determine the morphology of fruit fly
METHODOLOGY
01 Making semi-solid artificial diet
Dry ingredients were weighted and covered with parafilm.
Dry ingredients were dissolved.
Media were poured into petri dish and allowed to cool.
Diet was inserted into the rearing cage for observation.
Kaur et al. (2021)
02 Making 10% sucrose solution
Sugar was weighed using weighing balance.
Sugar was dissolved in boiling water
A 10% sugar solution was inserted into the rearing cage for observation.
Sugar solution was poured into a conical flask.
03 Rearing procedure
1 Oviposition process
Prepared the egging device.
After 12 days, the 3rd instar were ready to be extracted.
2 Extracted 3rd instar larva
Third instar larvae were individually extracted.
Transferred into a container containing semi artificial diet.
3 Sex separation process
Pupa was transferred using forceps.
Pupa was placed into a glass vial.
Glass vial was labelled.
4 Adults emerged
Adults that emerged from glass vials were transferred into the rearing cage.
Rabub et al. (2016)
5 Preserving Specimens
Wet preserved specimens.
Dry preserved specimens.
Observed under Dino-Lite 2.0
RESULT AND DISCUSSION
Observation on semi artificial diet from day 1 to day 12
Day 1
Day 2
Day 3
Day 4
Day 5
Day 12
Day 11
Day 10
Day 9
Day 8
Observation on 10% sugar solution from week 1 to week 4
Week 1
Week 2
Week 3
Week 4
Stoffolano (2019)
Observation on life cycle of fruit fly from egg to adult
Pre-oviposition 10 days
Oviposition to 3rd instar 10-12 days
Complete life cycle took about 22 to 26 days.
Pupa to adult emerged 7-10 days
3rd instar larvae to pupa 5-14 days
Steiner (1957)
Christenson and Foote (1960)
Observation on morphology of each stages for fruit fly
Adult Male
Adult Female
Pupa
Yellowish brown
Died after 15 days
Dark Brown
Creamy white
Active (jumping)
Died after 10 days
Turned into dark brown
Inactive (doesn't move)
Without ovipositor
With ovipositor
Measurement on Each Stages of Fruit Flies
Length: 8mm, Width: 12mm
Length: 6mm, Width: 2.5mm
Length: 7mm, Width: 1mm
Magnification: 20x
Steiner (1957)
REFERENCES
CONCLUSION
Successfully developed a lab-scale rearing method for B. dorsalis and progressed through three generations.
The feeding routine was improved by providing a semi-solid artificial diet twice a week and replacing the 10% sugar solution monthly.
The duration and morphology for each fruit fly life stage were also determined.
Further investigation, including studying eggs, 1st instar larvae, and 2nd instar larvae, was needed to improve the lab rearing process.
ACKNOWLEDGEMENT
We thanked Dr. Salmah Moosa for all the guidance. We were also grateful to Dr. Zainon Mohd Dzomir for supporting the colony initiation. We thanked our undergraduate student, Ms. Ifa Najwa Syamimi Johari, who participated in all rearing tasks. We would like to thank Ms. Arania Shazlin and Mrs. Maisatul Akmam for helping in conducting these experiments. We also thanked Mr. Mohamad Ashraf Abdul Mutalib for his help with editing the manuscript.
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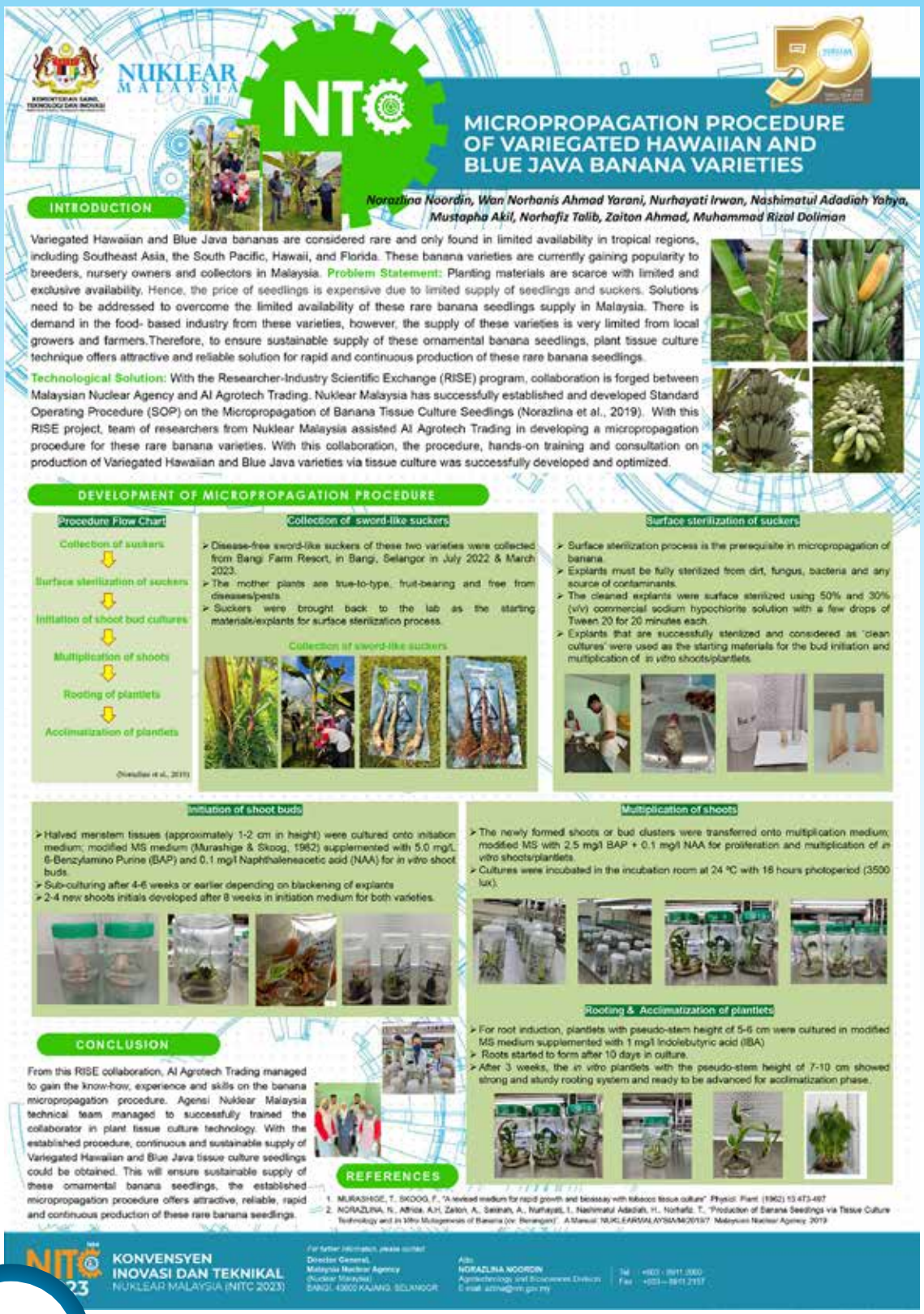
NUKLEAR MALAYSIA
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MICROPROPAGATION PROCEDURE OF VARIEGATED HAWAIIAN AND BLUE JAVA BANANA VARIETIES
Norazlina Noordin, Wan Norhanis Ahmad Yarani, Nurhayati Irwan, Nashimatul Adadiah Yahya, Mustapha Akil, Norhafiz Talib, Zaiton Ahmad, Muhammad Rizal Doliman
INTRODUCTION
Variegated Hawaiian and Blue Java bananas are considered rare and only found in limited availability in tropical regions, including Southeast Asia, the South Pacific, Hawaii, and Florida. These banana varieties are currently gaining popularity to breeders, nursery owners and collectors in Malaysia. Problem Statement: Planting materials are scarce with limited and exclusive availability. Hence, the price of seedlings is expensive due to limited supply of seedlings and suckers. Solutions need to be addressed to overcome the limited availability of these rare banana seedlings supply in Malaysia. There is demand in the food- based industry from these varieties, however, the supply of these varieties is very limited from local growers and farmers.Therefore, to ensure sustainable supply of these ornamental banana seedlings, plant tissue culture technique offers attractive and reliable solution for rapid and continuous production of these rare banana seedlings.
Technological Solution: With the Researcher-Industry Scientific Exchange (RISE) program, collaboration is forged between Malaysian Nuclear Agency and Al Agrotech Trading. Nuklear Malaysia has successfully established and developed Standard Operating Procedure (SOP) on the Micropropagation of Banana Tissue Culture Seedlings (Norazlina et al., 2019). With this RISE project, team of researchers from Nuklear Malaysia assisted Al Agrotech Trading in developing a micropropagation procedure for these rare banana varieties. With this collaboration, the procedure, hands-on training and consultation on production of Variegated Hawaiian and Blue Java varieties via tissue culture was successfully developed and optimized.
DEVELOPMENT OF MICROPROPAGATION PROCEDURE
Procedure Flow Chart
Collection of suckers
Surface sterilization of suckers
Initiation of shoot bud cultures
Multiplication of shoots
Rooting of plantlets
Acclimatization of plantlets
Collection of sword-like suckers
Disease-free sword-like suckers of these two varieties were collected from Bangi Farm Resort, in Bangi, Selangor in July 2022 & March 2023.
The mother plants are true-to-type, fruit-bearing and free from diseases/pests.
Suckers were brought back to the lab as the starting materials/explants for surface sterilization process.
Surface sterilization of suckers
Surface sterilization process is the prerequisite in micropropagation of banana.
Explants must be fully sterilized from dirt, fungus, bacteria and any source of contaminants.
The cleaned explants were surface sterilized using 50% and 30% (v/v) commercial sodium hypochlorite solution with a few drops of Tween 20 for 20 minutes each.
Explants that are successfully sterilized and considered as 'clean cultures' were used as the starting materials for the bud initiation and multiplication of in vitro shoots/plantlets.
Initiation of shoot buds
Halved meristem tissues (approximately 1-2 cm in height) were cultured onto initiation medium; modified MS medium (Murashige & Skoog, 1962) supplemented with 5.0 mg/L 6-Benzylamino Purine (BAP) and 0.1 mg/l Naphthaleneacetic acid (NAA) for in vitro shoot buds.
Sub-culturing after 4-6 weeks or earlier depending on blackening of explants
2-4 new shoots initials developed after 8 weeks in initiation medium for both varieties.
Multiplication of shoots
The newly formed shoots or bud clusters were transferred onto multiplication medium; modified MS with 2.5 mg/l BAP + 0.1 mg/l NAA for proliferation and multiplication of in vitro shoots/plantlets.
Cultures were incubated in the incubation room at 24 °C with 16 hours photoperiod (3500 lux).
Rooting & Acclimatization of plantlets
For root induction, plantlets with pseudo-stem height of 5-6 cm were cultured in modified MS medium supplemented with 1 mg/l Indolebutyric acid (IBA)
Roots started to form after 10 days in culture.
After 3 weeks, the in vitro plantlets with the pseudo-stem height of 7-10 cm showed strong and sturdy rooting system and ready to be advanced for acclimatization phase.
CONCLUSION
From this RISE collaboration, Al Agrotech Trading managed to gain the know-how, experience and skills on the banana micropropagation procedure. Agensi Nuklear Malaysia technical team managed to successfully trained the collaborator in plant tissue culture technology. With the established procedure, continuous and sustainable supply of Variegated Hawaiian and Blue Java tissue culture seedlings could be obtained. This will ensure sustainable supply of these ornamental banana seedlings, the established micropropagation procedure offers attractive, reliable, rapid and continuous production of these rare banana seedlings.
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ENERGY DISPERSIVE X-RAY FLUORESCENCE (ED-XRF) ANALYSIS ON DEIONIZED WATER AND ACIDS USED FOR IMPURITIES REMOVAL FROM RARE EARTH-LOADED ORGANIC

NORHAZIRAH AZHAR, Roshasnorlyza Hazan, Jacqueline Kones, Khaironie Mohamed Takip, Nuraqilah Sapiee and Wilfred Sylvester Paulus

INTRODUCTION

In Malaysia, REE usually obtained from the by-products of tin mining industries called 'amang' [1]. In this paper, the focus is made on Malaysian xenotime mineral. Initially, the recovery process starts with cracking, leaching and selective precipitation of xenotime. Precipitated rare earth product in oxalate form was then purified further in the purification process. During purification, solvent extraction was done to extract elements of interest from the oxalate in acidic media. The extractant used in the preceding extraction process is tributyl phosphate (TBP) mixed with kerosene as diluents. After the extraction process, this REE-loaded TBP/Kerosene will be scrubbed to remove **impurities**. Scrubbing is a process of which unwanted elements [2] such as calcium, sulphur, potassium, sodium, chlorine, iron etc. will be removed from the solution.

Element	Concentration	Element	Concentration
Y	21.24%	Dy	0.181%
Mo	0.011%	Yb	0.223%
Sn	0.006%	Th	0.113%
Gd	0.060%	Nd	0.155%
Ca	0.058%	Al	0.890%
Fe	0.014%	P	0.042%
K	0.603%	S	0.010%
Ni	0.053%	Cl	0.108%

Scrubbing is crucial to improve stripping's efficiency by removing elements that may cause interference during stripping process afterwards. In this study, scrubbing of unwanted elements was done via HCl, HNO_3 and deionized water. Efficiency of scrubbing process will be measure via Energy Dispersive X-ray Fluorescence (ED-XRF) analysis and measured.

METHODOLOGY

1. Scrubbing media : HNO_3, HCl & Deionized water (DI)
2. Ratio of scrub media : loaded organic = 1:1
3. Scrub time = 15 minutes.
4. Acid concentration = 0.01, 0.1, 0.3, 0.5 and 0.7M (except for DI)

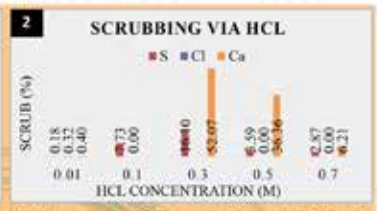
All the samples were analyzed via Energy Dispersive X-ray Fluorescence (ED-XRF) and before (initial reading) and after (final reading) scrubbing process.

The scrubbing efficiency (%) was calculated via **Equation 1**:

$$\text{Scrub (\%)} = \frac{\text{Final wt.\% of element} - \text{Initial wt.\% of element}}{\text{Initial wt.\% of element}} \times 100\% \quad (1)$$

Where,
Initial wt.% of element: Analysis of RE-loaded organic before scrubbing process.
Final wt.% of element: Analysis of RE-loaded organic after scrubbing process.

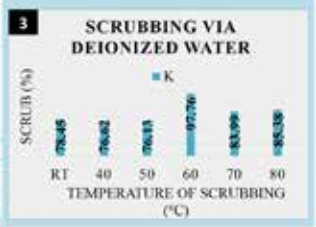
RESULT AND DISCUSSION



TOP **Figure 1** shows that at 0.7M HNO_3, about 50% of Cl was successfully removed from the RE-loaded organic despite becoming the least favorable concentration for S scrubbing. Lowest concentration of HNO_3 (0.01M) resulting in optimum Ca scrubbing. When the concentration increases, the percentage of Ca removed decreases. Conversely, S is only selective when HNO_3 is lower than 1.0M, with a 10.16% scrubbing. Sulphur appears very little or almost absent from the acid concentration higher than 3.0M.

Figure 2 shows that HCl unable to remove Cl from RE-loaded organic at every concentration except at 0.01M with percent scrubbing of 0.32%. Removal of S shows increasing trend from 0.01M to 0.3M and decrease afterwards. The scrubbing of C only achieves at concentration of 0.3M and reduces as the concentration increases. To conclude, optimum concentration for removal of Ca and S is at 0.3M HCl. However, HCl appears unsuitable for removal of Cl from TBP/Kerosene system.

BELOW The process of impurities removal via deionized water as in **Figure 3** shows that potassium (K) can be removed successfully in general, with percent scrubbing between 78 – 97%. The optimum condition is at 60°C, where 97% of K is removed from the RE-loaded organic.



CONCLUSION

The optimum concentration of HNO_3 for scrubbing of S at 0.1M, for Cl at 0.7 and Ca at 0.01M. On the other hand, the optimum HCl concentration for removing impurities, especially Ca and S, from the REE-loaded TBP/Kerosene system is at 0.3M HCl. The optimum condition for deionized water as scrubbing media is at 60°C.

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IMPORTANT REQUIREMENTS IN CULTURE MEDIA PREPARATION TO ENSURE QUALITY AND INTEGRITY OF MICROBIOLOGICAL LABORATORY TEST RESULTS

Nur Humaira' Lau Abdullah, Phua Choo Kwai Hoe, Mariani Deraman and Azania Shazlin Mohamad Razali

INTRODUCTION

Culture media is vital to microbiology for the production of reliable laboratory results. Accurate culture media preparation is one of the fundamental steps to ensure the integrity of microbiological test. There are points to be considered and requirements to be met in the preparation of culture media intended for microbiological analysis. The dehydrated media and supplements need to be handled as instructed by manufacturer. The water used for media preparation needs to meet certain requirements. The activity of weighing, dissolution, pH measurement, addition of enrichments and supplements, dispensing and storage need to follow good laboratory practice and manufacturer's instruction. This paper is aimed to provide information regarding the important points and requirements in culture media preparation in a microbiological laboratory to ensure quality and integrity of laboratory analysis results.

LABORATORY PREPARATION OF CULTURE MEDIA

1. Calculating, Weighing and Rehydration

- Follow manufacturer's instruction precisely.
- Calculate and weigh required amount carefully using calibrated balance with appropriate weight range.
- Use clean weighing containers and tool (spatula) to avoid introduction of foreign substances into media formulation (USP, 2011).
- Transfer the ingredients into clean container at least twice the volume being prepared (to avoid overflowing after addition of supplements or boiling over) (APHA, AWWA, WEF, 2022).
- Measure water using clean graduated measuring cylinders of borosilicate glass.
- Add volume of water specified rather than making up the volume (ISO, 2014).
- Discard excess ingredients taken.

2. Dissolution and Mixing

- Dissolve dehydrated media in water (repeated or continuous stirring following heating if necessary).
- Medium containing agar need soaking for several minutes before heating with mixing (ISO, 2014).
- Avoid Maillard reaction during autoclaving by preparing media component separately i.e. sugar separately prepared from amino acid.
- Avoid scorching or boil over (use boiling water bath) (APHA, AWWA, WEF, 2022).
- Label the media prepared with media name and date.

3. Adjustment of pH

- Usually not necessary if commercially manufactured media are used, provided water quality is good.
- If needed, adjust media pH before sterilization using sodium hydroxide solution of approximately 40 g/L (about 1 mol/L) or dilute hydrochloric acid of approximately 36.5 g/L (about 1 mol/L).
- In case pH adjustment after sterilization, use filter-sterilized acid /alkali solution (ISO, 2014).

4. Sterilization

- Sterilize prepared culture media on the day of preparation (limit proliferation of contaminants) (Cote, 2013).
- Follow the instructions given by media manufacturer.
- Sterilization by moist heat using autoclave or media preparator at 121°C maximum for minimum time specified. Larger volume of liquid require relatively long autoclaving time e.g. 2L requires 40 min at 121°C.
- Overheating can occur when large volume of medium (>1 L) in a container are processed in an autoclave (ISO, 2014). Media preparators is advisable for sterilization of large batches of media (>1 L) (Perry, 2019).
- Effect of culture medium overheating : pH drifting, darkening, precipitation, poor gel strength (Bhatia et al., 2015).
- Divide large volume of medium into several small portions (increase surface/volume ratio and heat exchange properties, reduce exposure time).
- Loosely tightened cap or lids during autoclaving (avoid explosion).
- Use autoclave tape to identify medium has been sterilized.
- After heating, allow medium to cool in a manner to prevent boiling over (use liquid mode, cool down programme)
- Effect of boiling over : liquid loss, cape and lids of container can blow off.
- Membrane filtration to sterilize delicate media components that cannot withstand autoclaving. Membrane filter with pore diameter of 0.2 µm effectively remove most bacterial and fungal contaminants. Individually packed sterile membrane filter (Figure 1(b) is available.
- Use filtering set-up attached to vacuum pump / filter assembly with syringe. Perform filtration in laminar flow hood or biosafety cabinet.

Dehydrated Culture Media and Supplements

- Store according to manufacturer's instruction (Seidman et al., 2021).
- Usually in cool (15-25C), dry place, protected from direct sunlight, heat sources and dust (APHA, AWWA, WEF, 2022).
- Hygroscopic and quickly deteriorate when exposed to moisture.
- Avoid repeated opening and closing of media bottle.
- Close media bottle tightly, seal cap or stored in dessicator (APHA, AWWA, WEF, 2022).
- Record date of first opening on bottle.
- Discard any dehydrated medium that shows obvious changes physically (colour change, caking, not free flowing).
- Not recommended to use expired media (APHA, AWWA, WEF, 2022).

Glassware

- Use borosilicate glassware.
- Volumetric glassware (Class A / Class B) (Figure 1(a)).
- Cleaning process must ensure removal of debris, foreign matter and detergent residue (to avoid entry of inhibitory substances into media) (ISO, 2014).
- Rewash if necessary.
- Final rinsing with purified water (ISO, 2014).
- Cover or store washed glassware with its bottom up to prevent dust settling inside (APHA, AWWA, WEF, 2022).

Water

- Use only purified water (distilled, demineralized, deionized, reverse osmosis or of equivalent quality free from substances likely to inhibit or influence growth of microorganisms under test conditions) (ISO, 2014).
- Recommended used as soon as produced.
- Store in tightly closed containers from inert material (neutral glass, polyethylene, etc.)
- Conductivity no more than 24 µScm^{-1} and preferably below 5 µScm^{-1} at 25°C (ISO, 1987).
- Microbial contamination not exceed 10^3 cfu/mL and preferably below 10^2 cfu/mL (ISO, 2014).

Figure 1: (a) Measuring cylinder of Class A and Class B; (b) Individually packed sterile membrane filter; (c) Allow plates to cool with lid slightly ajar in a laminar flow hood.

5. Addition of Supplements

- Add sterile supplements to culture medium just before use.
- Allow supplements to equilibrate to at least room temperature before adding into cooled agar medium (50-55°C).
- Cool broth culture medium to room temperature before adding supplements (Seidman et al., 2021).
- Dispense the medium immediately after thorough mixing (Perry, 2019).

6. Dispensing Sterile Media into Petri Dish (Solid Media)

- Dispense media in a dedicated, thoroughly clean preparation area using all aseptic precautions (Perry, 2019).
- Avoid pour agar medium at higher temperature (will cause excessive moisture in Petri dish because of more vapor).
- Pour media when cools to 45-50°C. Molten agar starts to solidify at about 42°C.
- Before pouring, swirl the cooled medium to adequately mix the agar at the bottom with the medium, gently to avoid bubble formation.
- If not pour immediately, put the medium in a 65°C water bath (Haidaris and Brownlow, 2004).
- Pour to obtain a thickness of at least 3 mm (15 – 20 mL for 90 mm diameter Petri dish). More is required if store or incubate beyond 72 h or incubation temperature is above 40°C (ISO, 2014).
- Swirl the container periodically and gently during pouring (ensure homogeneity and avoid bubble).
- Hold container slightly tilted (prevent airborne contaminants falling into container) (Seidman et al., 2021).
- Rotate Petri dish on even and horizontal surface (ensure even layer of agar). Allow plates to cool with lid slightly ajar (reduce moisture build-up on lids) (Figure 1(c)).
- Store plated media upside down in plastic bags in which original empty plates arrived.

7. Labelling

- Label all sterilized media (broth media, filled plates) after sterilization and dispensing.
- Specify media type, expiry date, storage condition (Sandle, 2015).

8. Storage and Shelf Life of Prepared Media

- Freshly prepared media are better than stored media.
- Use media within the given shelf-lives.
- Store prepared media from light and dessication.
- Use media containing labile supplements on the day of preparation (ISO, 2014).
- Bottled liquid media in air-tight containers may be stored for 2-4 months (dark, 2-8°C), shorter (room temperature) (Baird, 2003).
- Liquid media without antibiotics or labile ingredients can be stored for many weeks (cool, away from light) (Brideson, 2005).
- Store solidified medium inverted for no longer than 4 weeks (dark, 2-8°C).
- Avoid overdried or overlong-stored solidified media (inhibitory effect, small colonies, fail to recover 'stressed' inocula).
- Not recommended to store prepared agar plate below 2°C as negative temperatures may freeze the media (impact agar network, affect performance).
- Establish expiry date for the different prepared media (check physical, chemical and microbiological performance after defined storage time) (ISO, 2014).

CONCLUSION

The important requirements in culture media preparation in a microbiological laboratory highlighted in this paper can be used as a reference by laboratory staffs. But as there will be new technology / guideline / systems / requirements hitting the market or society, the information here is not exhaustive. Thus, continuous seeking of knowledge and competency improvement in culture media preparation is required. Above all, every laboratory staff needs to adhere to good laboratory practice as well as instructions by manufacturer in order to support quality and integrity of laboratory analysis results.

ACKNOWLEDGEMENTS

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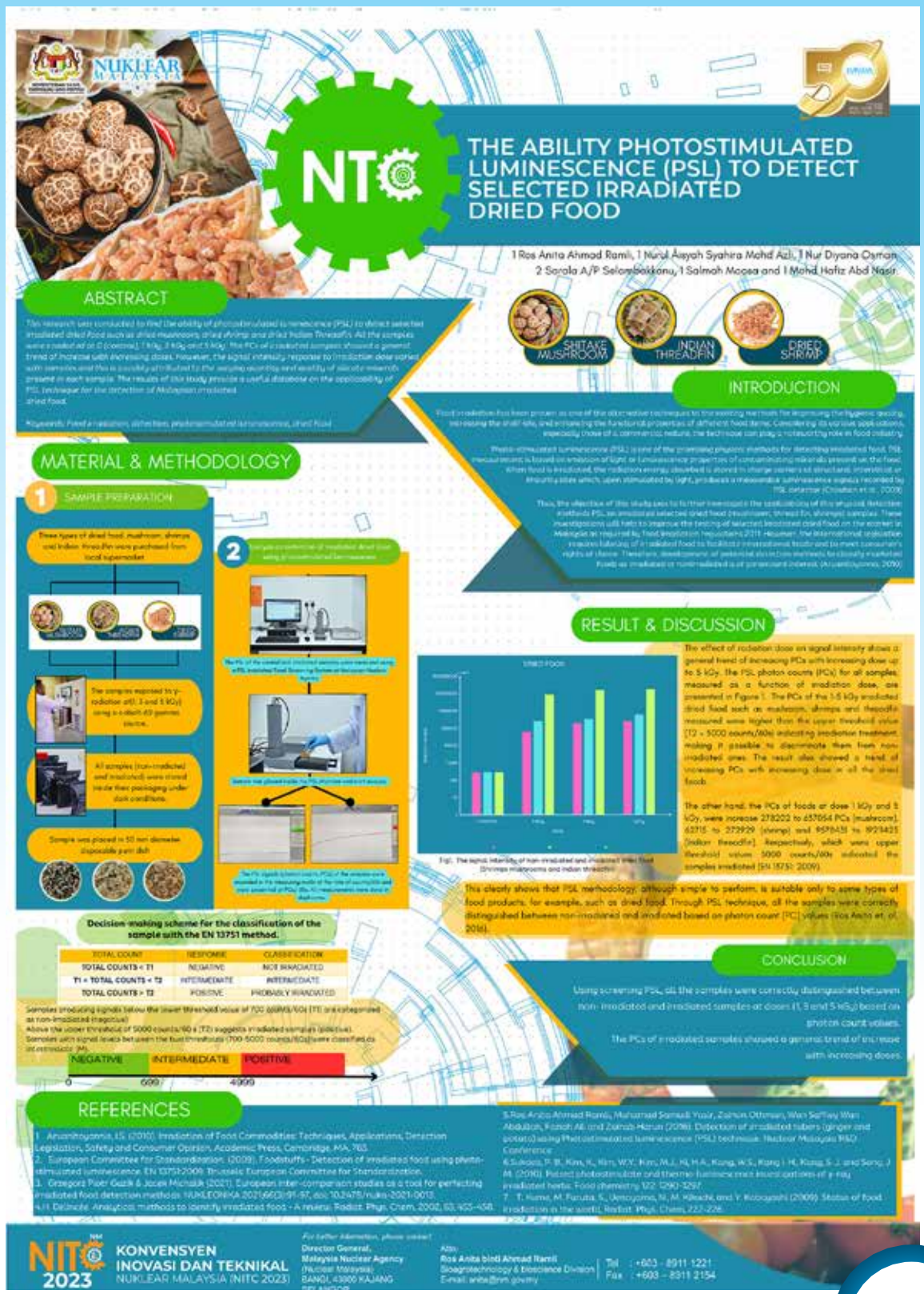
NUKLEAR MALAYSIA
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THE ABILITY PHOTOSTIMULATED LUMINESCENCE (PSL) TO DETECT SELECTED IRRADIATED DRIED FOOD
1 Ros Anita Ahmad Ramli, 1 Nurul Asyah Syahira Mohd Azli, 1 Nur Diyana Osman
2 Sarala A/P Selambakkanu, 1 Salmah Moosa and 1 Mohd Hafiz Abd Nasir
ABSTRACT
SHITAKE MUSHROOM
INDIAN THREADFIN
DRIED SHRIMP
INTRODUCTION
MATERIAL & METHODOLOGY
1 SAMPLE PREPARATION
Three types of dried food, mushroom, shrimps and Indian threadfin were purchased from local supermarket
The samples exposed to γ-radiation at(1, 3 and 5 kGy) using a cobalt-60 gamma source.
All samples (non-irradiated and irradiated) were stored inside their packaging under dark conditions.
Sample was placed in 50 mm diameter disposable petri dish
2
RESULT & DISCUSSION
Decision-making scheme for the classification of the sample with the EN 13751 method.
TOTAL COUNT | RESPONSE | CLASSIFICATION
TOTAL COUNTS < T1 | NEGATIVE | NOT IRRADIATED
T1 < TOTAL COUNTS < T2 | INTERMEDIATE | INTERMEDIATE
TOTAL COUNTS > T2 | POSITIVE | PROBABLY IRRADIATED
NEGATIVE
INTERMEDIATE
POSITIVE
0
600
4000
CONCLUSION
REFERENCES
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PRINCIPAL COMPONENTS ANALYSIS ON ¹H-NMRSPECTRA FOR METABOLITES CHANGE IN HUMAN URINE AFTER CONSUMPTION OF AJWA DATES (Phoenix dactylifera L.)

Sabri Nurul Elma, Mohd Sukri Hassan and Shamala Salvamani

ABSTRACT

Our previous study found potential health-promoting effects in Ajwa dates flesh due to the presence of phytochemicals. In this study, metabolomics study on the consumption of Ajwa dates flesh has been conducted on human urine samples using proton Nuclear Magnetic Resonance (¹H-NMR) with Principal Components Analysis (PCA). The real picture of the effects of Ajwa dates on human body had been investigated in all ¹H-NMR spectra using Chenomx NMR suite 8.2 and were compared with the reference spectra in the Human Metabolome Database (HMDB). Phytochemicals in Ajwa dates influenced the changes of metabolites in human body for 24 hours after the Ajwa dates intake. The combination of ¹H-NMR-based metabolomics with multivariate statistical analysis is a powerful approach for the study of metabolomics, which may help to uncover features of the biomarkers that are still hidden and allows the explanation of changes in metabolic pathways under different psychological conditions.

INTRODUCTION

Metabolomic analysis is normally performed on biofluids, like blood, serum, urine and feces samples (Zhu et al., 2023). Generally, multivariate data in metabolomics study is a large data that difficult to analyze manually. The combination of ¹H-NMR-based metabolomics with multivariate statistical analysis such as Principal Components Analysis (PCA) is a powerful approach for the study of metabolomics (Gu et al., 2007). PCA is a non-supervised multivariate data analysis technique and was used to visualize the multivariate data in grouping trends (Feng et al., 2016) and to reduce the complexity of the data sets (Park et al., 2016).

Date fruits are a rich source of vitamins, minerals, dietary fibers, energy, and easily digestible and absorbable sugars that instantaneously replenish and revitalize the body specially after fasting condition (Al-Okbi, 2022). Previous study showed the effect of dates flesh on diseases (Khan et al., 2017), as a potential cardioprotective agent (Alhaider et al., 2017) and in pregnancy (Al-Kuran et al., 2011). However, there are only few established journals reported on the effect of consuming dates fruits on the healthy human metabolic system. The aim of this study is to investigate the combination of ¹H-NMR-based metabolomics with PCA in the investigation of the role of Ajwa flesh on volunteers which are considered as healthy human as they have no history of exposure to severe diseases.

MATERIAL

Volunteers: 5 females and 5 males between 20 and 25 years old with body mass index of 20-25 were enrolled with informed written consent. This study was approved by the Human Ethics Committee (HEC) of Universiti Sains Islam Malaysia (USIM/REC/0616-14). Volunteers were required to follow the control diet. The sampling method of urine was tabulated in Table 1.

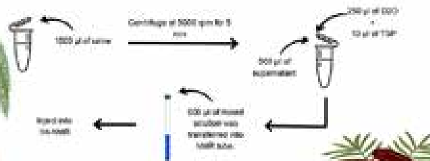
Table 1: Sampling of Urine Samples

	Day 0	Day 1	Day 2	Day 3
7 am	/	/	/	/
11 am		/		
3 pm		/		
7 pm	/	/	/	/

The urine samples were collected at 7 am as blank (0 hour) and then all volunteers were given 7 Ajwa dates to be consumed immediately, only on Day 1. All the collected urine were kept in -20 °C prior to analysis.

METHODOLOGY

Samples preparation and NMR analysis were performed as described by Walsh et al. (2007) with some modifications. Urine analysis was carried out on a NMR (BRUKER Corporation, United State) instrument at a frequency of 700 MHz for ¹H with a 5 mm triple resonance cold probe while Chenomx NMR suite 8.2 (Chenomx Inc., Edmonton, Canada) was used for spectral binning in multivariate data analysis. Pre-processing data has been done using normalization by maximum. Then, PCA was performed on ¹H-NMR spectrum of urine samples using Unscrambler 10.3 (CAMO Software, Norway).



RESULT & DISCUSSION

The ¹H-NMR spectra of urine samples for one volunteer from 0 hour to 24 hours is presented in Figure 1 (a). In the aliphatic region, citrate (2.57 and 2.72 ppm), trimethylamine-N-Oxide (3.27 ppm), taurine (3.42 and 3.25 ppm), alanine (1.48 ppm), lactate (1.32 ppm), malonate (3.10 ppm), N- acetylcysteine (2.06 ppm), glycine (3.55 ppm), Creatinine (3.05 and 4.05 ppm) and π-methylhistidine (3.33, 3.84, 4.02) shows significant different from blank to 24 hours. There is also significantly different in aromatic region (6.5 ppm – 9.0 ppm) where there are relatively small peaks from hippurate (7.53, 7.62 and 7.82 ppm) and π-methylhistidine (7.38 and 8.60 ppm) which had been identified in all the spectra.

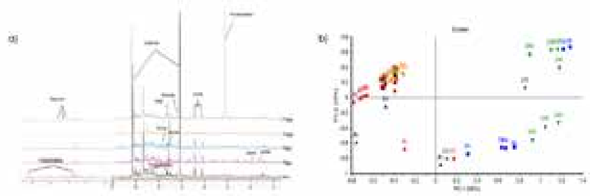


Figure 1: a) ¹H-NMR spectra for one volunteer from 0 hour to 24 hours b) Scores plot of ¹H-NMR data of urine samples (0 hour to 24 hours) for all volunteers

PCA model were used to assist in comprehending the clustering patterns of observation. The first principal component (PC1) and second principal component (PC2) accounted 58 % and 24 % of variance, respectively, was obtained. Scores plot in Figure 1 (b) illustrated a complete 24 hours cycle of the effect of Ajwa dates intake when the urinary metabolites in 24 hours after consuming Ajwa dates back to blank (0 hour). Therefore, routinely consume date fruits will never harmful on our health as proven that date fruits effect is flushed out within 24 hours from our body.

CONCLUSION

The real picture of the effects of Ajwa dates on human body had been investigated in all ¹H-NMR spectra using Chenomx NMR suite 8.2 and were compared with the reference spectra in the Human Metabolome Database (HMDB). Meanwhile, PCA model were used to assist in comprehending the clustering patterns of observation. Metabolomics approach using ¹H-NMR coupled with chemometrics is an effective tool that can be adept in order to further discover the change in human metabolites.

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PROSEDUR DAN PENENTUAN PARAMETER BAGI PENYARINGAN SIFAT MORFOLOGI SERTA AGRONOMI MUTAN UBI KAYU DI LADANG

Shakinah Salleh, Norazlina Noordin, Affrida Abu Hassan, Mustapha Akil, Zaiton Ahmad, Nor Hafiz Talib, Nur Hayati Irwan, Nashimatul Adadiah Yahya dan Mohamed Hasyraf Mat Nawi

PENGENALAN

Di Malaysia, **ubi kayu (*Manihot esculenta*)** merupakan salah satu tanaman utama dalam kategori akar dan umbisi yang boleh dimakan. Ia sesuai dituai selepas 9 hingga 12 bulan ditanam dan dijadikan sebagai bahan mentah dalam industri pemprosesan agro-makanan. Kebanyakan ubi kayu ditanam oleh petani secara kecil-kecilan menggunakan keratan batang. **Masalah utama** penanaman ubi kayu di Malaysia ialah kekurangan variasi genetik, antaranya disebabkan oleh keupayaan pembungaan yang lemah dan kadar multiplikasi yang rendah. Nuklear Malaysia sedang melaksanakan penyelidikan aruhan mutasi menggunakan sinaran gama ke atas kultur tisu ubi kayu bagi menambahbaik ciri-ciri agronomik seperti hasil yang tinggi, saiz akar yang bersesuaian dan juga tempoh matang awal serta bekalan anak benih yang bermutu tinggi. Pemilihan mutan baharu ubi kayu perlu melalui proses penyaringan di ladang dan **objektif kertas kerja** ini ialah untuk membangunkan prosedur dan menentukan parameter yang sesuai untuk penyaringan dan pemilihan mutan baharu tanaman ubi kayu.

KAEDAH PENCERAPAN SIFAT MORFOLOGI DAN AGRONOMI

DAUN

Usia Tanaman	Kriteria	Kaedah Pencerapan
3 bulan	i) Warna pucuk muda	**Pemerhatian warna** - Hijau muda / Hijau tua / Ungu-hijau / Ungu
6 bulan	i) Warna daun	**Pemerhatian warna** - Hijau muda / Hijau tua / Ungu-hijau / Ungu
	ii) Bilangan cuping daun	**Pengiraan cuping** - 3 cuping / 5 cuping / 7 cuping / 9 cuping / 11 cuping
	iii) Bentuk cuping daun tengah	**Pemerhatian bentuk** - Ovoid / Elliptic-lanceolate / Obovate-lanceolate / Oblong-lanceolate / Lanceolate / Linear / Pandurate / Linear-pyramidal / Linear-pandurate / Linear-hastatiobolate
	iv) Pengukuran panjang dan lebar cuping daun tengah serta tangkai daun	**Pengukuran** menggunakan pembaris
	v) Warna tangkai daun	**Pemerhatian warna** - Kuning-hijau / Hijau / Merah-hijau / Hijau-merah / Merah / Ungu

BATANG

Usia Tanaman	Kriteria	Kaedah Pencerapan
9 bulan	i) Warna batang	**Pemerhatian warna** - Oren / Hijau-kuning / Emas / Perak / Coklat cerah / Coklat gelap / Kelabu
	ii) Tablet pertumbuhan batang	**Pemerhatian bentuk** - Zig-zag / Lurus
	iii) Parut daun	**Pemerhatian bentuk** - Separa jelas / Jelas
	iv) Jarak antara parut daun	**Pengukuran** menggunakan pembaris - Dekat (≤ 8 cm) / Pertengahan (8-15 cm) / Jauh (≥ 15 cm)
Pokok matang dan sesuai dituai (Lebih dari 9 hingga 12 bulan)	i) Warna hujung cabang	**Pemerhatian warna** - Hijau / Hijau-ungu / Ungu
	ii) Tablet percabangan	**Pemerhatian cabang pertama** - Erect / Dichotomous / Trichotomous / Tetrachotomous
	iii) Tinggi pokok	**Pengukuran** dari permukaan tanah ke pucuk
	iv) Bentuk pokok	**Pemerhatian bentuk pokok** - Padat / Terbuka / Payung / Silinder
	v) Kewujudan bunga, buah, biji	**Pemerhatian** kewujudan bunga, buah dan biji

UBI

Usia Tanaman	Kriteria	Kaedah Pencerapan
Semasa penuaian	i) Bilangan ubi per pokok	**Pengiraan** jumlah semua ubi per pokok
	ii) Bilangan ubi komersil per pokok	**Pengiraan** jumlah semua ubi komersil (panjang > 20 cm dan berat > 200 g) dari setiap pokok ubi
	iii) Bentuk tangkai ubi	**Pemerhatian bentuk tangkai ubi** - Sessile / Pendunculate / Gabungan
	iv) Bentuk ubi	**Pemerhatian bentuk ubi** - Kon / Kon-silinder / Silinder / Tidak teratur
	v) Warna luaran ubi	**Pemerhatian warna** - Putih atau krim / Kuning / Coklat cerah / Coklat gelap
	vi) Tekstur luaran ubi	**Pemerhatian tekstur** - Licin / Kasar
	vii) Warna korteks	**Pemerhatian warna** - Putih atau krim / Kuning / Coklat cerah / Coklat gelap
	viii) Sifat korteks	**Pemerhatian sifat korteks** - Mudah / Sukar tanggal
	ix) Warna isi ubi	**Pemerhatian warna** - Putih / Krim / Kuning / Merah jambu
	x) Rasa ubi mentah	**Rasa dengan lidah** - Pahit / Manis / Pertengahan

KESIMPULAN

Prosedur yang dibangunkan ini boleh dijadikan sebagai panduan untuk menjalankan penyaringan mutan bagi projek biak baka mutasi tanaman ubi kayu atau tanaman-tanaman lain yang serupa pada masa akan datang. Prosedur ini juga akan memudahkan penyelidik mencirikan mutan dalam proses pendaftaran varieti baharu tumbuhan dengan Jabatan Pertanian Malaysia dan mendapatkan hak pembiak baka khususnya untuk mutan baharu ubi kayu.

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1. Fukuda, W.M.G., Guevara, C.L., Kawuki, R. and Ferguson, M.E. (2010). Selected morphological and agronomic descriptors for the characterization of cassava. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. 19 pp.
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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

PERSONAL RF ASSESSMENT: STUDYING THE EXPOSURE FROM VARIOUS RF SOURCES AND DEVICES

Shamesh Raj Parthasarathy, Muhammad Khairul Amir Hamid, Zulkifli Yusof, Amierah Hazimah Mohd Hashim and Muhammad Shaheir Abu Samah

INTRODUCTION

The world has witnessed many changes in terms technology. Many inventions have been made to make our daily task easier and more efficient. But most of these electrical and electronic devices radiates a type of non-ionizing radiation called Radio Frequency Electromagnetic Field (RF EMF) radiation. Although this type of radiation maybe not be as harmful as ionizing radiation, but it can still bring harm to the health and wellbeing of human society if not used properly. The purpose of this research is to assess the radio frequency that is being radiated from various radio frequency sources and devices such as Telecommunication structures, Smartphones, Smartwatches, WiFi Routers, Microwave ovens and compare the results with the guidelines stipulated by the International Commission of Non-Ionizing Radiation Protection (ICNIRP) and the Malaysian Communications and Multimedia Commission (MCMC).

METHODOLOGY

RESULT AND DISCUSSION

CONCLUSION

All measured RF power density were low and well below the limits published by ICNIRP and MCMC. The radio frequency radiation from the RF were considered safe for general public if used properly

REFERENCES

1. Mandatory Standard for Electromagnetic Field Emission from Radiocommunications Infrastructure, Determination No.5 of 2021
2. International Guideline: Guidelines for limiting exposure to electromagnetic fields (100kHz to 300 GHz) (2020), International Commission on Non-Ionizing Radiation Protection (ICNIRP)

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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NUKLEAR MALAYSIA

NTC

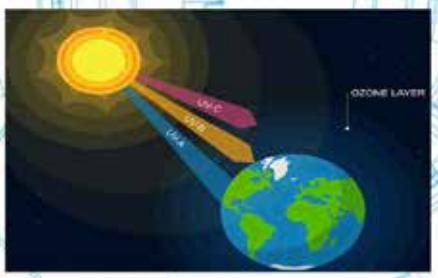
ENVIRONMENTAL SOLAR ULTRAVIOLET RADIATION (UVR): CASE STUDY OF SEVERAL LOCATIONS IN BANGI, CYBERJAYA & PUTRAJAYA

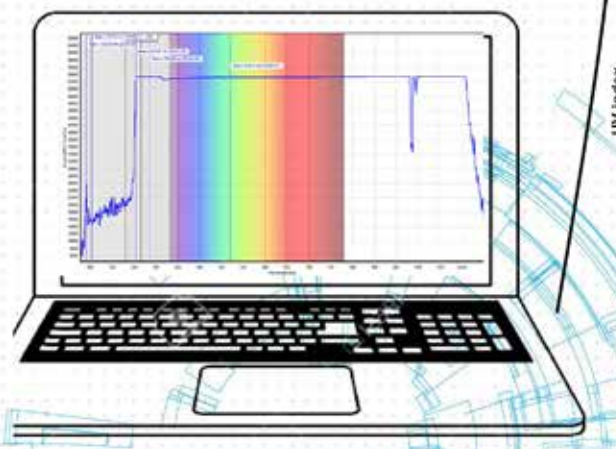
Shamesh Raj Parthasarathy, Amierah Hazimah Mohd Hashim, Zulkifli Yusof, Muhammad Khairul Amir Hamid and Ahmad Bazlie Abdul Kadir.

INTRODUCTION

UVR is classified into three major categories which are Ultraviolet A (UVA), Ultraviolet B (UVB), and Ultraviolet C (UVC). There are many benefits of UVR that includes the production of vital nutrient and vitamin D. However, overexposure may cause risks to humans. Sunburn, premature aging, and skin cancer are all risks to overexposure. (Centers for Disease Control and Prevention 2023).

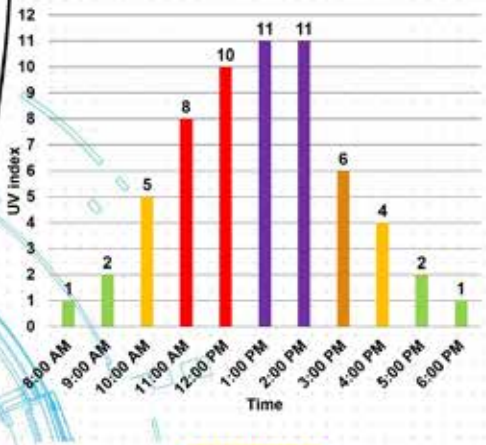
METHODOLOGY





RESULT AND DISCUSSION

Average UV index at Bangi, Cyberjaya and Putrajaya



CONCLUSION

https://www.who.int/news-room/questions-and-answers/item/radiation-the-ultraviolet-(uv)-index
https://www.skincheck.co.uk/blog/best-weather-to-get-sun-tan

In conclusion, the measurements of solar UV radiation showed that the intensities of UVR is the highest from 12:00 to 2:00pm. It is essential for the public to be advised on the hazards of solar UV radiation. The effect to the eyes is also seen to be more significant than that to the skin. As such, it will be wise to spend as minimal time as possible under the sun or to use protective clothing and sunscreens to minimize hazards to the UVR exposure during this time of the day.

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NUKLEAR MALAYSIA

NTC

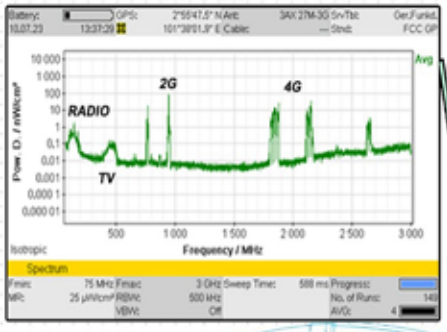
RADIO FREQUENCY SAFETY ASSESSMENT FROM BASE TRANSCEIVER STATIONS (BTS): COMPARISON AMONG DIVERSE TECHNOLOGY SPECTRUM

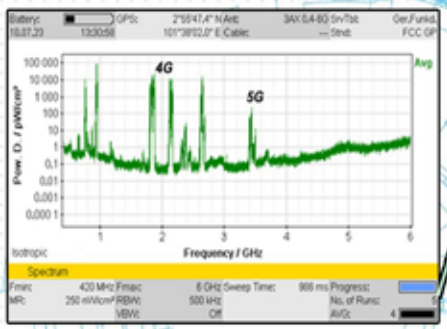
Shamesh Raj Parthasarathy, Muhammad Khairul Amir , Zulkifli Yusof, and Amierah Hazimah

INTRODUCTION

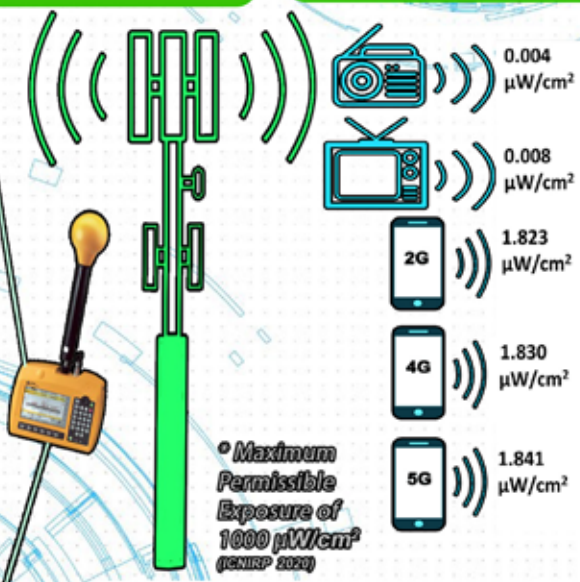
The purpose of this study is to measure the RF radiation from selected Base Transceiver Stations (BTS) and segregate each radiation level from the diverse technology spectrum, namely RF radiation level from the Radio, TV, mobile communication technology of 2G, 4G and 5G respectively. In addition, the recorded results were compared with the reference level stated in the guidelines published by International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Malaysian Communications and Multimedia Commission (MCMC).

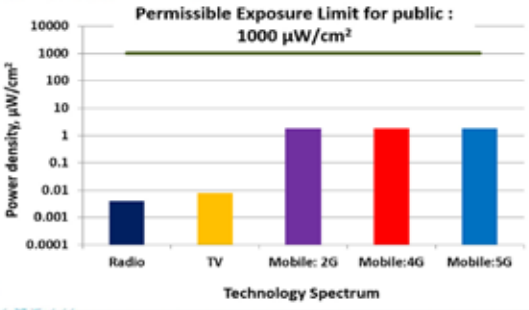
METHODOLOGY





RESULTS





CONCLUSION

All measured RF power density were low and well below the limits published by ICNIRP & MCMC , and the RF Radiation exposure from each technology spectrum were considered safe for general public.

NITC 23 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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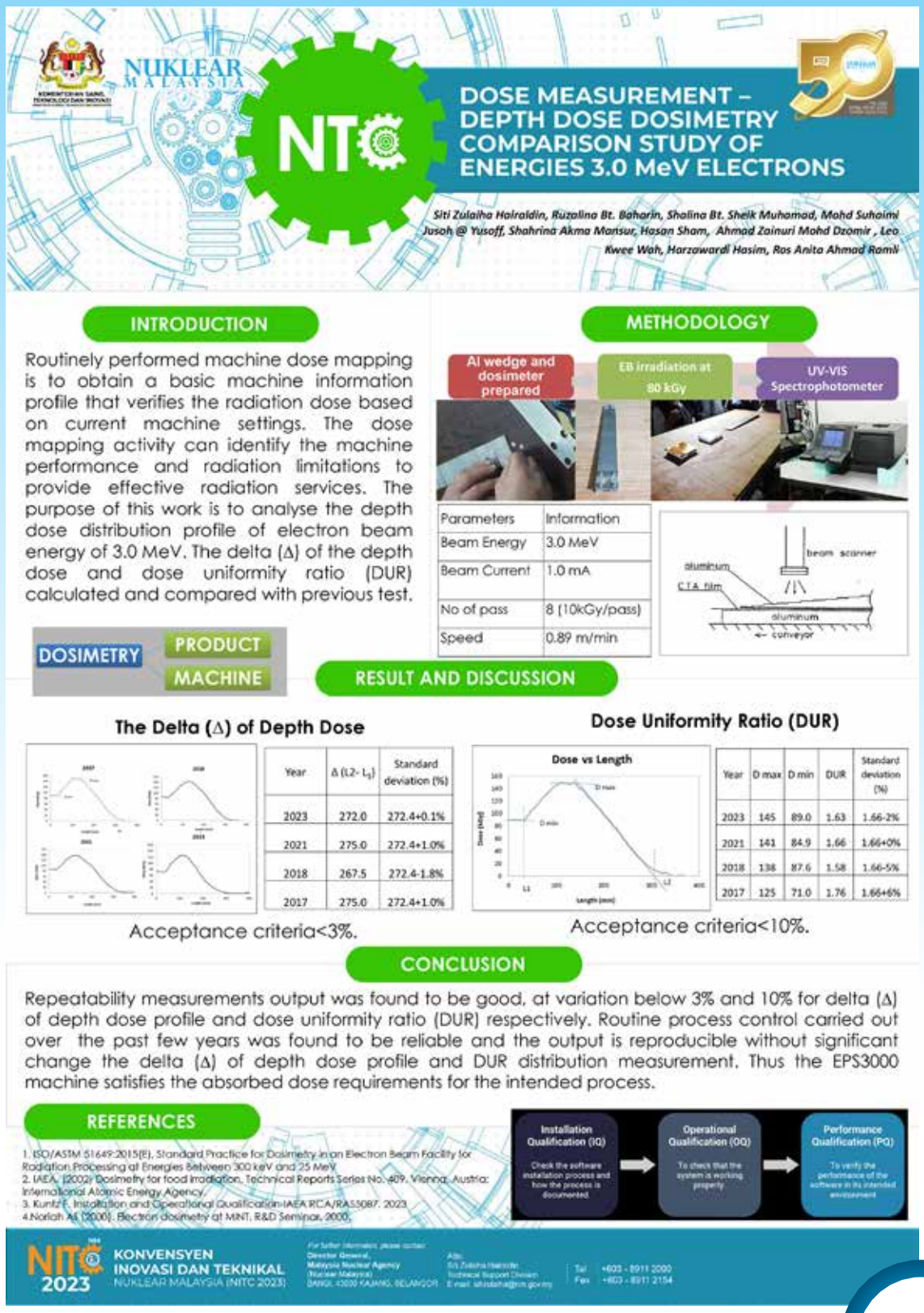

NUKLEAR MALAYSIA
NTC
DOSE MEASUREMENT – DEPTH DOSE DOSIMETRY COMPARISON STUDY OF ENERGIES 3.0 MeV ELECTRONS
Siti Zulaiha Hairaldin, Ruzalina Bt. Baharin, Shalina Bt. Sheik Muhamad, Mohd Suhaimi Jusoh @ Yusoff, Shahrina Akma Mansur, Hasan Sham, Ahmad Zainuri Mohd Dzomir , Leo Kwee Wah, Harzawardi Hasim, Ros Anita Ahmad Ramli
INTRODUCTION
Routinely performed machine dose mapping is to obtain a basic machine information profile that verifies the radiation dose based on current machine settings. The dose mapping activity can identify the machine performance and radiation limitations to provide effective radiation services. The purpose of this work is to analyse the depth dose distribution profile of electron beam energy of 3.0 MeV. The delta (Δ) of the depth dose and dose uniformity ratio (DUR) calculated and compared with previous test.
DOSIMETRY
PRODUCT
MACHINE
METHODOLOGY
Al wedge and dosimeter prepared
EB irradiation at 80 kGy
UV-VIS Spectrophotometer
Parameters | Information
Beam Energy | 3.0 MeV
Beam Current | 1.0 mA
No of pass | 8 (10kGy/pass)
Speed | 0.89 m/min
beam scanner
aluminium
CTA film
aluminium
conveyor
RESULT AND DISCUSSION
The Delta (Δ) of Depth Dose
Year | Δ (L2- L1) | Standard deviation (%)
2023 | 272.0 | 272.4+0.1%
2021 | 275.0 | 272.4+1.0%
2018 | 267.5 | 272.4-1.8%
2017 | 275.0 | 272.4+1.0%
Acceptance criteria<3%.
Dose Uniformity Ratio (DUR)
Dose vs Length
Year | D max | D min | DUR | Standard deviation (%)
2023 | 145 | 89.0 | 1.63 | 1.66-2%
2021 | 141 | 84.9 | 1.66 | 1.66+0%
2018 | 138 | 87.6 | 1.58 | 1.66-5%
2017 | 125 | 71.0 | 1.76 | 1.66+6%
Acceptance criteria<10%.
CONCLUSION
Repeatability measurements output was found to be good, at variation below 3% and 10% for delta (Δ) of depth dose profile and dose uniformity ratio (DUR) respectively. Routine process control carried out over the past few years was found to be reliable and the output is reproducible without significant change the delta (Δ) of depth dose profile and DUR distribution measurement. Thus the EPS3000 machine satisfies the absorbed dose requirements for the intended process.
REFERENCES
1. ISO/ASTM 51649:2015(E), Standard Practice for Dosimetry in an Electron Beam Facility for Radiation Processing at Energies Between 300 keV and 25 MeV
2. IAEA, (2002) Dosimetry for food irradiation, Technical Reports Series No. 409, Vienna, Austria: International Atomic Energy Agency.
3. Kuntz F, Installation and Operational Qualification-IAEA RCA/RAS5087. 2023
4.Norlah AS (2000). Electron dosimetry at MINT. R&D Seminar, 2000.
Installation Qualification (IQ)
Operational Qualification (OQ)
Performance Qualification (PQ)
NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

SEALED RADIOACTIVE SOURCES LEAK TEST USING BOILING LIQUID IMMERSION TEST METHOD

Syed Asraf Fahlawi Wafa, Azimawati Bt. Ahmad, Mohd Fazlie Bin Abdul Rashid, Hasbi Husein Bin Sulkifli, Noor Ezati Binti Shuib, Noor Fadilla Binti Ismail, Muhamad Zahidee B. Taat, Faizal Azrin B. Abdul Razalim, Raymond Yapp Tze Loong, Khairuddin B. Mohamad Kontol, Andy Kong Shin Shyen, Suzilawati Bt. Muhd Sarowi

INTRODUCTION

Assessing the sealed source's adherence to specified standards following testing hinges on the preservation of its integrity. For a given examination, this criterion establishes whether a source aligns with the requirements of a specific class. When a test relies on measuring radioactive material associated with the source to gauge capsule integrity, the key factor becomes the comparison between the activity removed from the source before and after the performance test. It's important to note that the quantity of activity extracted from the source after the test, unless it relates to the removable activity present before the test, does not serve as an indicator of leakage from the source's interior or necessarily suggest a breach in capsule integrity.

Various leak testing (integrity testing) methods are acceptable for assessing whether sealed sources meet or fail test specifications. However, it's essential to recognize that not all the listed leak test methods are suitable for every type of source. The selection of the most appropriate test or tests should be based on the specific configurations of the source. In situations involving multiple encapsulations, different leak test methods may be suitable for each encapsulation.

METHODOLOGY

RESULT AND DISCUSSION

Testing using this technique is more difficult and takes more time than the normal technique. However, this technique provides more effective and efficient results. The analysis showed that the source tested did not leak. The reading is below 185 Bq.

$$X = \frac{\Sigma(c_i - \bar{c})^2}{\bar{c}}$$

CONCLUSION

The sealed radioactive sources leak test is a crucial procedure to ensure the integrity and safety of sealed radioactive sources used in various applications, including medical, industrial, and research fields. Sealed Radioactive Sources Leak Test using the Boiling Liquid Immersion Test method is an effective and widely adopted approach to verify the integrity of sealed radioactive sources. This test takes advantage of the principle that if there is a leak in the source, the boiling liquid will provide a medium for the radioactive material to escape and become detectable. This basic technique will be one of the most important instruments to test and verify that nuclear fuel is in a safe condition.

REFERENCES

João Augusto Moura, Carla Daruich de Souza,et.all. Leakage test methodology development in iodine-125 seeds production, Progress in Nuclear Energy, Volume 62, January 2013, Pages 79-82; ISO-9978-2020, International Standard Radiation protection — Sealed sources — Leakage test methods

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

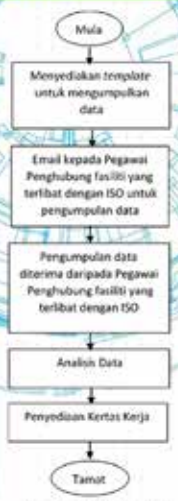
PEMANTAUAN PROGRAM KUALITI DI AGENSI NUKLEAR MALAYSIA (NUKLEAR MALAYSIA)

Aisya Raihan Abdul Kadir, Muhammed Zulfakar Zolkaffly & Azlinda Aziz

PENGENALAN

Agensi Nuklear Malaysia (Nuklear Malaysia) sehingga kini telah berjaya mengekalkan 11 pensijilan dan akreditasi kualiti di fasiliti-fasiliti yang terdapat di Nuklear Malaysia iaitu SINAGAMA, RAYMINTEX, Alurtron, Pusat Kecemerlangan Nuklear (CoNE), Pusat Pembangunan Teknologi Sisa (WasTeC), Makmal Radiokimia dan Alam Sekitar (RAS), Kumpulan Metrologi Sinaran (KMS), Kumpulan Sinaran Tidak Mengion (NIR), Pusat Teknologi Maklumat & Aplikasi (IT) dan PKP-BCMS. Objektif kertas kerja ini adalah untuk memantau Program Kualiti di Nuklear Malaysia dalam tempoh 2018 hingga 2022.

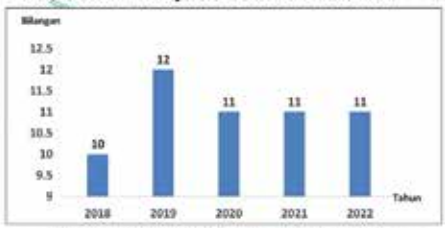
METODOLOGI



Rajah 1: Carta Alir

KEPUTUSAN & PERBINCANGAN

- **Memantau Pensijilan & Akreditasi Kualiti**



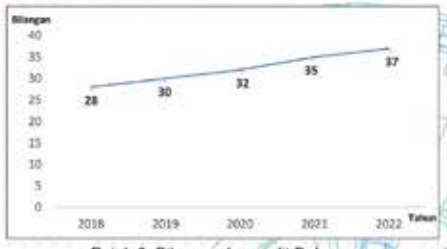
Rajah 2: Bilangan Pensijian & Akreditasi Kualiti

- **Memantau Perancangan Audit Tahunan**

Perancangan Audit perlu sediakan pada setiap tahun seperti yang digariskan dalam Prosedur Audit Dalaman Nuklear Malaysia (*Revision 14*). Pada setiap awal tahun, Bahagian Perancangan dan Hubungan Antarabangsa (BPA) telah menyediakan satu *template* dan akan dihantar kepada semua fasiliti yang mempunyai pensijilan/akreditasi kualiti bagi mendapatkan perancangan kualiti tahunan termasuk jangkaan tarikh audit dalaman, audit luar dan *Mangament Review meeting (MRM)*. Melalui perancangan audit ini, pihak BPA akan memantau perlaksanaan terutamanya audit dalaman bagi memastikan pelaksanaan audit dalaman dapat dilaksanakan pada tahun semasa.

- **Memantau Kompetensi Juruaudit Dalaman**

BPA sentiasa memantau kelayakan juruaudit dalaman dalam melaksanakan audit dalaman berdasarkan panduan yang digariskan dalam Prosedur Audit Dalaman. BPA telah menganjurkan sebanyak **12** kursus audit dalaman berkaitan pensijilan & akreditasi kualiti bagi meningkatkan kompetensi Juruaudit Dalaman.



Rajah 3: Bilangan Juruaudit Dalaman

- **Memantau hasil laporan audit dalaman**

FASILITI	2018		2019		2020		2021		2022	
	NC	OFI	NC	OFI	NC	OFI	NC	OFI	NC	OFI
SINAGAMA	7	18	10	9	4	3	3	12	2	19
ALURTRON	6	7	5	5	3	4	1	3	5	3
WASTEC	3	5	6	8	5	7	5	6	2	8
CONE	7	5	4	7	6	15	5	4	2	13
RAYMINTEX	4	7	8	8	4	3	2	8	2	3
KMS							5	4	2	11
KTP	3	4	8	9	5	3				
SSDL	4	8	9	10	4	6				
RAS	0	10	0	6	3	7	2	4	8	7
NIR			6	3	4	3	2	4	1	3
PKP-BCMS			5	23	x	x	22	24	12	20
PUSAT IT	4	8	10	20	x	x	5	22	2	18

Rajah 4: Bilangan NC dan OFI

Pelaksanaan Audit Dalaman turut memainkan peranan dalam membantu memberi penambaikan terhadap proses yang dijalankan oleh fasiliti bagi mengekalkan pensijilan dan akreditasi kualiti di fasiliti-fasiliti yang terlibat. Pihak BPA juga turut memantau *Non-Comformity (NC)* dan *Opportunities for Improvement (OFI)* yang berkaitan dengan audit dalaman dan membuat penambahbaikan melalui pengemaskinian Prosedur Audit Dalaman Nuklear Malaysia.

RUMUSAN

Bagi menyokong dan membantu aktiviti pengekalan pensijilan dan akreditasi kualiti fasiliti-fasiliti yang terlibat di Nuklear Malaysia, BPA akan sentiasa memantau pelaksanaan program kualiti terutamanya pelaksanaan audit dalaman. Hasil pemantauan program kualiti dalam tempoh 2018 hingga 2022 juga menunjukkan Nuklear Malaysia telah berjaya mengekalkan pensijilan dan akreditasi kualiti dan menunjukkan peranan audit dalaman dalam membantu fasiliti-fasiliti dalam mengekalkan pensijilan dan akreditasi kualiti di Nuklear Malaysia.

PENGHARGAAN

Setinggi penghargaan dan terima kasih ditujukan kepada kakitangan fasiliti-fasiliti yang terlibat dengan pensijilan dan akreditasi kualiti iaitu Pn. Syuhada (SINAGAMA), Pn. Siti Zulaiha (Alurtron), Pn. Siti Hajar (CoNE), Pn. Nurul Wahida (WasTeC), Dr. Chai Chee Keong (Raymintex), En. Norfaizal (RAS), En. John Konsoh (KMS), Pn. Wan Syazlin (NIR), Pn. Siti Nurbahyah (Pusat IT) dan Pn. Norasiah (PKP-BCMS).

RUJUKAN

Prosedur Audit Dalaman (*Revision 14*) bertarikh 27 Mei 2022

RADIOSENSITIVITY TEST OF IN VITRO REGENERATION TOMATO (*SOLANUM LYCOPERSICUM*) IN RADIATION MUTATION

Chong Saw Peng, Zaiton Ahmad, Norellia Bahari, and Shuhaimi Shamsudin

INTRODUCTION

Solanum lycopersicum known as tomato is a flowering plant of the nightshade family *Solanaceae* (OECD, 2017). Tomatoes are one of the most commonly consumed fruits around the world. One of the most significant problems in tomato cultivation is pests and diseases. Tomatoes are susceptible to a wide range of pests, including aphids, whiteflies, mites, and various types of caterpillars (Brezeanu et al., 2014). Mutation breeding of tomatoes has been widely studied for these few years through different methods such as physical, chemical, and insertional mutagenesis (Chaudhary et al., 2019) for their effectiveness in enhancing the fruit quality (Dutta et al., 2017) and obtaining the dwarf and fast growing cultivar (Pino-Nunes et al., 2009). A plant radiosensitivity test is a process used to determine the impact of radiation on plants. This test involves exposing plants to a known dose of radiation and observing the changes in growth and development (Caplin et al., 2018). Therefore, to study the plant mutation breeding in tomatoes in the future, a radiosensitivity test was conducted in this study to determine the LD_{50} of in vitro regeneration tomatoes.

METHODOLOGY

Plant Material:
The study used a highland tomato (Solanum lycopersicum) from F1 HY Tomato Malaysia 552.

Methods:

I. In vitro regeneration
   - Tomato seeds were used as an explant for *In vitro* regeneration.

II. Radiosensitivity Test
   - Tomato nodes were used for the radiosensitivity test.

III. Gamma Irradiation
   - Gamma-rays from Gamma Cell Biobeam GM8000.

IV. Experimental Design
   - Complete Randomized Design.

RESULT AND DISCUSSION

Figure 1. The in vitro tomato nodes were prepared in a petri dish (A) and placed in a polystyrene foam mould (B) and then placed inside a metal cylinder basket (C) to irradiate in the Gamma Cell Biobeam GM8000.

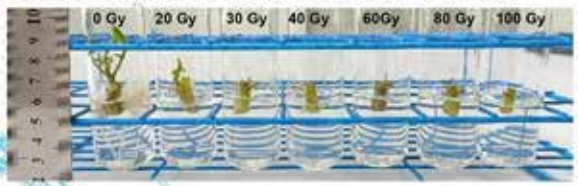


Figure 2. New shoots regenerated from the irradiated tomato nodes at different doses including 0, 20, 30, 40, 60, 80, and 100 Gy of gamma rays.

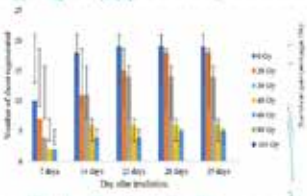


Figure 3. Data of the new shoots regenerated from the irradiated nodes after 7, 14, 21, 28, and 35 days of irradiation.

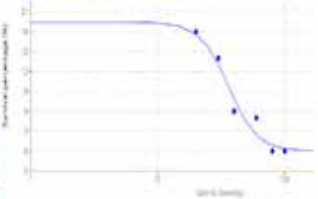


Figure 4. LD50 dose was determined through the radiosensitivity test of mutation breeding of tomato.

CONCLUSION

A radiosensitivity test is an important tool for understanding the impact of radiation on plants and developing strategies to mitigate the effects of radiation on crops and the environment. Radiation LD_{50} is a standard measure of the lethal dose of radiation required to cause death in 50% of a plant population. The LD_{50} for survival percentage for in vitro regenerated tomatoes was 36.3 Gy. In conclusion, gamma radiation can have both positive and negative effects on plant cells depending on the dose of radiation exposure.

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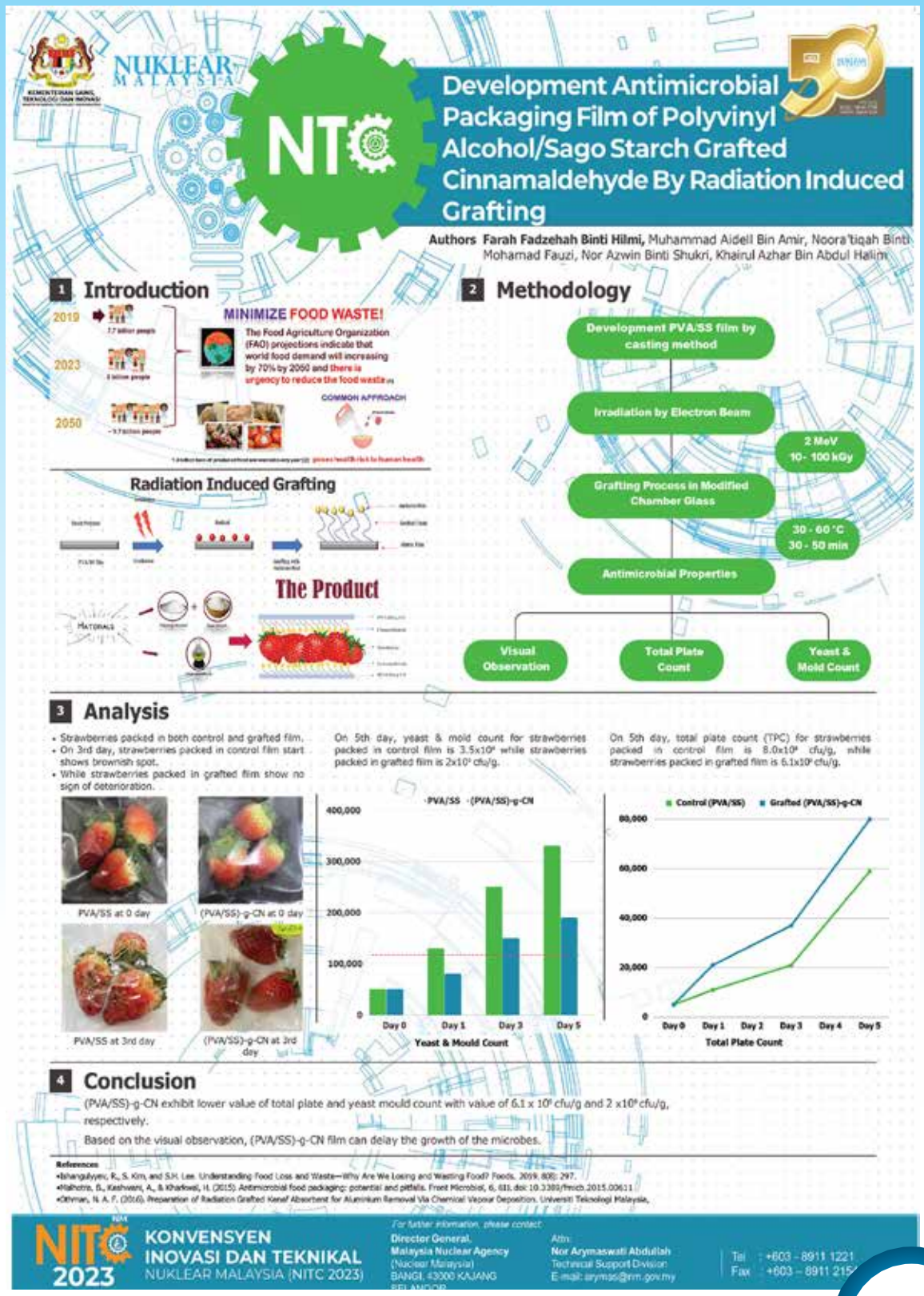
NUKLEAR MALAYSIA
NTC
Development Antimicrobial Packaging Film of Polyvinyl Alcohol/Sago Starch Grafted Cinnamaldehyde By Radiation Induced Grafting
Authors Farah Fadzehah Binti Hilmi, Muhammad Aidell Bin Amir, Noora'tiqah Binti Mohamad Fauzi, Nor Azwin Binti Shukri, Khairul Azhar Bin Abdul Halim
1 Introduction
2019
2023
2050
MINIMIZE FOOD WASTE!
The Food Agriculture Organization (FAO) projections indicate that world food demand will increasing by 70% by 2050 and there is urgency to reduce the food waste
COMMON APPROACH
Radiation Induced Grafting
The Product
2 Methodology
Development PVA/SS film by casting method
Irradiation by Electron Beam
2 MeV
10 - 100 kGy
Grafting Process in Modified Chamber Glass
30 - 60 °C
30 - 50 min
Antimicrobial Properties
Visual Observation
Total Plate Count
Yeast & Mold Count
3 Analysis
• Strawberries packed in both control and grafted film.
• On 3rd day, strawberries packed in control film start shows brownish spot.
• While strawberries packed in grafted film show no sign of deterioration.
On 5th day, yeast & mold count for strawberries packed in control film is 3.5x10⁶ while strawberries packed in grafted film is 2x10⁵ cfu/g.
On 5th day, total plate count (TPC) for strawberries packed in control film is 8.0x10⁶ cfu/g, while strawberries packed in grafted film is 6.1x10⁵ cfu/g.
PVA/SS at 0 day
(PVA/SS)-g-CN at 0 day
PVA/SS at 3rd day
(PVA/SS)-g-CN at 3rd day
PVA/SS
(PVA/SS)-g-CN
400,000
300,000
200,000
100,000
0
Day 0
Day 1
Day 3
Day 5
Yeast & Mould Count
Control (PVA/SS)
Grafted (PVA/SS)-g-CN
80,000
60,000
40,000
20,000
0
Day 0
Day 1
Day 2
Day 3
Day 4
Day 5
Total Plate Count
4 Conclusion
(PVA/SS)-g-CN exhibit lower value of total plate and yeast mould count with value of 6.1 x 10⁵ cfu/g and 2 x10⁵ cfu/g, respectively.
Based on the visual observation, (PVA/SS)-g-CN film can delay the growth of the microbes.
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NITC 2023
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)
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NUKLEAR MALAYSIA

NTC

FEASIBILITY STUDY OF DC POWER SUPPLY FOR AC LOAD BASED OF RADIATION SURVEY METER MAINTENANCE EQUIPMENT

Syirrazie Bin Che Soh@Shaari; Saipo Bahari B. Abdul Ratan; Mohd Hazri B. Mohd Salleh; Izuhan bin Ismail; Mohamad Azwan Nizam Bin Mohd Nasir; Saiful Bahri Bin Saim;

INTRODUCTION

Essential of mobility maintenance equipment to serve quick diagnostic on site for a radiation survey meter requires mobile DC Power Supply such as battery. Since the equipment are AC loads, DC to AC signal converter is required to fulfill this purpose. However, supplying AC load with DC causes losses of 5% to 15% during conversion of DC to AC signal. Other than that, 1.5 to 2% losses of transformer during step up voltage from low AC voltage to 240V AC voltage. Therefore, this study is purposely to determine power consumption of AC loads. AC loads in this study are referred to module devices such as oscilloscope, digital multimeter, pulser and scalar rate meter. Knowing this, the expected battery capacity could be determined sufficiently.

Figure 1: DC Power Supply for AC Load

METHODOLOGY

Figure 2: Single Loop AC Circuit Diagram

Practically, this experimental circuit is set up completely with external and internal distribution board (DB) as shown in Figure 3. This to ensure that experiment is conducted in safe condition for people and equipment as well.

Power consumption of AC load is determined through measuring AC current flowing in a AC loop circuit at constant 240Vac as shown in Figure 2. Then the power consumption could be expressed through the following equation:

$$S_L(VA) = V.I$$

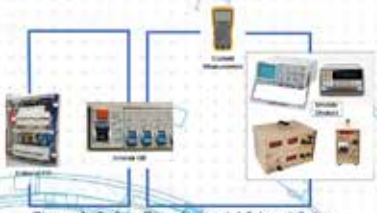

Figure 3: Safety Experimental AC Load Setup

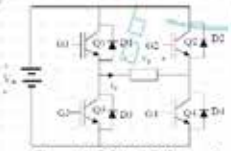

Figure 4: DC to AC Converter

Figure 5: Transformer

Reflected to the gathered power consumption, capacity of DC power supply could be determined by using the following equation:

$$S_C = \frac{S_L}{(1 - i\%)}$$

Considering $i\%$ is percentage losses for both core and converter losses of 2% and 15% respectively. Core loss is refer to transformer loss while converter is refer to losses during conversion DC to AC signal.

RESULT AND DISCUSSION

Table 1: Parameter for DC Power Supply Design

No	Devices Module	I_L (mA)	S_L (VA)	S_C (VA)	I_C (mA)
1	Scalar Rate	21.67	5.20	6.27	26.11
2	Pulser	33.00	7.92	9.54	39.76
3	Digital Multimeter	72.00	17.28	20.82	86.75
4	Oscilloscope	486.00	116.64	140.53	585.54
	Total	612.67	147.04	177.16	738.16

Total power consumption for all AC loads that presenting as devices module as shown in Table 1 is 177.16VA. Thus, current capacity to design one (1) hour battery as DC power supply is 738.16 A.

Then, subject to sustainability to supply voltage for related AC loads, Table 2 shows that Current Capacity for Battery corresponding to operating period to supply AC loads with DC power supply. Capacity of this DC supply is relatively proportional with operating period of AC loads.

Table 2: Battery DC Power Supply Design

No.	Operating Period, t (Hour)	Current Capacity for Battery, I_C (mAh)
1	1	738.16
2	2	1476.32
3	3	2214.48
4	4	2952.64
5	5	3690.8
6	6	4428.96
7	7	5167.12
8	8	5905.28

CONCLUSION

The maximum core and converter losses are considered become dataset in this study is to ensure design battery to supply AC is sufficient and has effective operating voltage for longer period. This could ensure that supplying AC loads with DC supply is possible. The longer operating period to supply AC loads, require the larger current capacity of Battery.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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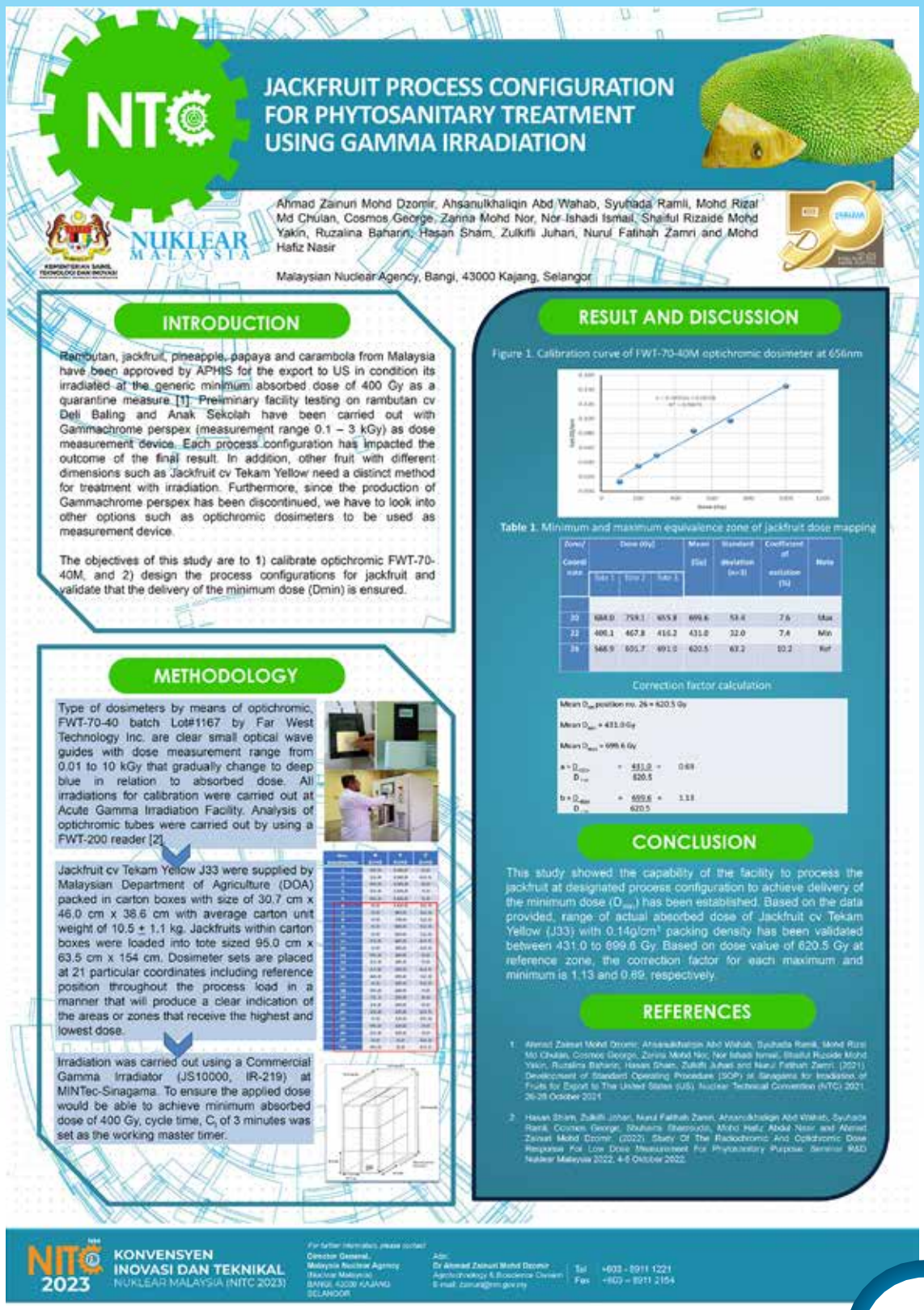
JACKFRUIT PROCESS CONFIGURATION FOR PHYTOSANITARY TREATMENT USING GAMMA IRRADIATION
Ahmad Zainuri Mohd Dzomir, Ahsanulkhaliqin Abd Wahab, Syuhada Ramli, Mohd Rizal Md Chulan, Cosmos George, Zarina Mohd Nor, Nor Ishadi Ismail, Shaiful Rizaide Mohd Yakin, Ruzalina Baharin, Hasan Sham, Zulkifli Juhari, Nurul Fatihah Zamri and Mohd Hafiz Nasir
Malaysian Nuclear Agency, Bangi, 43000 Kajang, Selangor
INTRODUCTION
Rambutan, jackfruit, pineapple, papaya and carambola from Malaysia have been approved by APHIS for the export to US in condition its irradiated at the generic minimum absorbed dose of 400 Gy as a quarantine measure [1]. Preliminary facility testing on rambutan cv Deli Baling and Anak Sekolah have been carried out with Gammachrome perspex (measurement range 0.1 – 3 kGy) as dose measurement device. Each process configuration has impacted the outcome of the final result. In addition, other fruit with different dimensions such as Jackfruit cv Tekam Yellow need a distinct method for treatment with irradiation. Furthermore, since the production of Gammachrome perspex has been discontinued, we have to look into other options such as optichromic dosimeters to be used as measurement device.
The objectives of this study are to 1) calibrate optichromic FWT-70-40M, and 2) design the process configurations for jackfruit and validate that the delivery of the minimum dose (Dmin) is ensured.
METHODOLOGY
Type of dosimeters by means of optichromic, FWT-70-40 batch Lot#1167 by Far West Technology Inc. are clear small optical wave guides with dose measurement range from 0.01 to 10 kGy that gradually change to deep blue in relation to absorbed dose. All irradiations for calibration were carried out at Acute Gamma Irradiation Facility. Analysis of optichromic tubes were carried out by using a FWT-200 reader [2].
Jackfruit cv Tekam Yellow J33 were supplied by Malaysian Department of Agriculture (DOA) packed in carton boxes with size of 30.7 cm x 46.0 cm x 38.6 cm with average carton unit weight of 10.5 ± 1.1 kg. Jackfruits within carton boxes were loaded into tote sized 95.0 cm x 63.5 cm x 154 cm. Dosimeter sets are placed at 21 particular coordinates including reference position throughout the process load in a manner that will produce a clear indication of the areas or zones that receive the highest and lowest dose.
Irradiation was carried out using a Commercial Gamma Irradiator (JS10000, IR-219) at MINTec-Sinagama. To ensure the applied dose would be able to achieve minimum absorbed dose of 400 Gy, cycle time, C, of 3 minutes was set as the working master timer.
RESULT AND DISCUSSION
Figure 1. Calibration curve of FWT-70-40M optichromic dosimeter at 656nm
Table 1. Minimum and maximum equivalence zone of jackfruit dose mapping
Correction factor calculation
CONCLUSION
This study showed the capability of the facility to process the jackfruit at designated process configuration to achieve delivery of the minimum dose (D_{min}) has been established. Based on the data provided, range of actual absorbed dose of Jackfruit cv Tekam Yellow (J33) with 0.14g/cm³ packing density has been validated between 431.0 to 699.6 Gy. Based on dose value of 620.5 Gy at reference zone, the correction factor for each maximum and minimum is 1.13 and 0.69, respectively.
REFERENCES
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

KAJIAN AWAL : PEMBANGUNAN SISTEM PENGURUSAN SIJIL BAGI PROGRAM-PROGRAM LATIHAN ANJURAN PUSAT KECEMERLANGAN (CoNE)

Harni Safina binti Haron, Nor Hadzalina binti Sukarseh , Siti Nurbahyah binti Hamdan

PENGENALAN

Pusat Kecemerlangan Nuklear (CoNE)diberi tanggungjawab melaksanakan program-program latihan dalam bidang teknologi nuklear dan teknologi berkaitan dalam usaha meningkatkan kemahiran yang diperlukan, meningkatkan dan mewujudkan kesedaran keselamatan yang lebih tinggi serta mewujudkan tenaga kerja yang kompeten untuk memainkan peranan yang lebih besar dalam agenda pembangunan nasional di Malaysia. Secara puratanya seramai 2,000 orang dilatih setiap tahun dari 7 sektor latihan di Nuklear Malaysia. Setiap pelatih yang telah menamatkan program latihan dengan jayanya akan menerima sijil kehadiran yang bercetak salinan keras dan ditanda tangani oleh Ketua Pengarah. Bermula dari 1996 sehingga tahun 2022 sebanyak 56,197 salinan sijil yang telah dikeluarkan dan disimpan oleh pihak CoNE. Penyediaan dan Penyimpanan sijil yang masih manual telah menimbulkan kekangan dan masalah seperti carian sijil sukar dilakukan, kerosakan dan ralat sijil tinggi, serta kehilangan rekod sijil disebabkan pengurusan terhadap sijil-sijil yang kurang bersistematik.

Maka itu, satu usaha penambahbaikan terhadap pengurusan, pengeluaran dan capaian sijil yang bersistematik dan paperless sedang dibuat melalui kajian pembangunan sebuah sistem pengurusan sijil menyeluruh (E-sijil) untuk di gunapakai selaku penyedia/penganjur latihan di Nuklear Malaysia. Melalui pembangunan sistem ini, dijangka akan meningkatkan kecekapan pengurusan sijil, penciptaan sijil dan capaian rekod sijil secara dalam talian terhadap semua program latihan yang telah dihadiri oleh pelatih individu mahu pun agensi/syarikat.

METODOLOGI

Rekabentuk kajian ini adalah menggunakan kaedah kuantitatif untuk mengukur tahap penyediaan dan pengurusan sijil di Agensi Nuklear Malaysia. Responden dalam kajian ini dipilih secara rawak dan soal selidik dikemukakan secara temu bual kepada 5 orang responden daripada 3 bahagian di Agensi Nuklear Malaysia iaitu Bahagian Sumber Manusia (BSM), Bahagian Pengkomersilan Teknologi (BKT), Bahagian Pengurusan Maklumat (BPM). kaedah kedua adalah secara pemantauan pada sistem e-client dan sistem e-tuition sedia ada. Pemantauan ini dibuat untuk melihat kesesuaian sistem-sistem ini boleh dinaik taraf dan elemen e-sijil dapat digabungkan pada kedua-dua sistem tersebut.

DAPATAN PERBINCANGAN

Berdasarkan analisis terhadap perolehan data daripada proses temu bual mendalam dan pemerhatian turut serta (sistem e-client dan e-tuition) yang dijalankan, terdapat dua elemen utama yang dikenalpasti iaitu limitasi pengurusan sijil dan penyesuaian diri terhadap teknologi dan adaptasi teknologi. Rajah di bawah menjelaskan antara faktor-faktor masalah yang di kenalpasti.

Melalui analisis yang diperolehi , pembangunkan sistem e-sijil yang komprehensif berasaskan 'web-based' sangat membantu masalah sedia ada dan bersifat one-stop sistem untuk kedua-dua pihak pelanggan dan pihak pengguna dalaman(staf Nuklear Malaysia). Sistem ini membantu inventori rekod sijil yang lebih tersusun, mengurangkan risiko kehilangan rekod sijil, kerosakan sijil dan penyimpanan sijil yang bersistematik. Melalui sistem ini juga dapat membantu dalam memudahkan penyimpanan data sijil, pencarian semula sijil atau rekod-rekod berkaitan aktiviti latihan yang dihadiri serta membantu dalam menyemak ketulenan sijil. Cadangan sistem ini akan menerapkan kawalan keselamatan pada sistem dan sekuriti penjanaan sijil secara digital agar tidak disalahguna oleh mana-mana pihak berkaitan.

KESIMPULAN

Hasil daripada data kajian awal yang diperolehi ini, pembangunan sistem e-sijil secara web-based ini sangat menyokong kepada inovasi pengurusan dan penyediaan sijil yang lebih professional disamping meningkatkan kecekapan staf yang menguruskan latihan lebih bersistematik seiring dengan teknologi IOT dan pendigitalan perkhidmatan terkini yang membawa perkhidmatan Kerajaan yang cekap dan efisien.

RUJUKAN

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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

PERKHIDMATAN PENYENGGARAAN SECARA SEMI KOMPREHENSIF PERALATAN KUASA TANPA GANGGUAN (UPS) DI AGENSI NUKLEAR MALAYSIS

Izuhan Ismail, Mohd Ghazali Bachok, Ramzah Mohamed, Saiful Bahri Saim

PENGENALAN

APA ITU PENYENGGARAAN SEMI KOMPREHENSIF UPS

- Merujuk kepada penyelenggaraan UPS yang merangkumi penyelenggaraan pencegahan (PM) mengikut jadual, semakan kerosakan, penyelenggaraan pembaikan kerosakan (CM) serta pembekalan alat ganti yang berkaitan.

OBJEKTIF

Kontrak penyenggaraan (UPS) telah dilaksanakan dengan tujuan :-

- Memastikan peralatan sentiasa berkeadaan baik, memaksimakan jangkahayat operasi peralatan dan mengurangkan kekerapan gangguan dalam operasi (*downtime*).
- Menangani masalah-masalah yang dikenal pasti wujud (mengurangkan dan mengawal kos dan masa yang diperlukan oleh penyelenggaraan).

PELAKSANAAN

Kontrak terkini adalah untuk tempoh 2 tahun iaitu bermula 01 Ogos 2022 hingga 31 Julai 2024 :-

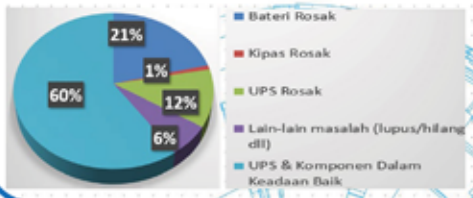
- Bilangan UPS terlibat adalah sebanyak 109 unit yang merangkumi saiz 1KVA sehingga 30KVA
- Tempoh/Kekerapan PM = Sukuan (8 Kali) / Tahunan (2 kali)
- Tempoh/Kekerapan CM = Mengikut keperluan / laporan kerosakan yang dijumpai semasa kerja PM.

AMP & VOLT TEKNOLOGI SDN BHD

SKOP PENYELENGGARAAN PENCEGAHAN BERJADUAL

- ✓ Pemeriksaan visual UPS dan bateri.
- ✓ Pemeriksaan operasi kipas penyejuk. dan pemantauan penggera & LED sistem.
- ✓ Penilaian fungsi (Mod pintasan) dan pemeriksaan suis berfungsi dengan betul.
- ✓ Penilaian suhu & pengudaraan UPS yang betul dan merekodkan data.
- ✓ Pengukuran elektrik dengan alat ujian yang betul. (penguji bateri).
- ✓ Pemeriksaan dan pengetatan sambungan bateri, litar DC dan kabel input - output AC.
- ✓ Penyelenggaraan bateri (pembersihan & penyingkiran sisa elektrolit).

LAPORAN KEADAAN UPS YANG DISELENGGARA (SEHINGGA OGOS 2023)



KESIMPULAN

Aktiviti penyenggaraan semi komprehensif seperti ini haruslah diteruskan secara konsisten untuk tahun seterusnya bagi memastikan peralatan ups tidak mengalami kerosakan yang kronik dan operasi penyelidikkan di nuclear tidak terganggu.

IMPAK/KEBAIKAN PENYENGGARAAN SEMI KOMPREHENSIF UPS

Dengan pelaksanaan penyenggaraan semi komprehensif yang teratur beberapa impak positif dapat diperhatikan :

- Jangka hayat peralatan ups adalah lebih lama.
- Gangguan ke atas operasi harian adalah minima.
- Keboleh harapan ke atas peralatan adalah tinggi.
- Mengurangkan kos senggaraan dalam jangka masa panjang.

RUJUKAN

❑ Kontrak Perkhidmatan Penyenggaraan Semi Komprehensif Peralatan UPS Selama Dua (2) Tahun Untuk Agensi Nuklear Malaysia.

NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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IONIZING RADIATION DETECTION ALGORITHM FOR CMOS SENSOR FROM CONSUMER CAMERA DEVICE

Megat Harun Al Rashid Megat Ahmad, Nashihah Ab Karim, Lahasen@Normanshah Dahing, Hearie Hassan, Roslan Yahya, Suhairy Sani, Ismail Mustapha, Nor Pa'iza Mohamad Hasan and Shaharuddin Sayuti

INTRODUCTION

Inexpensive and readily available consumer camera device with CMOS sensor has been shown able to detect ionizing radiation[1] event that can be observed as clustering of bright pixels on the detector image frame.

Figure 1: The webcam used for capturing ionizing events in a movie frame.

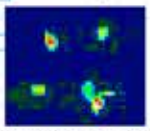

Figure 2: Cluster of bright pixels captured on a movie frame (enlarged area).

These bright cluster of pixels are quite similar in appearance to bright celestial objects in astronomical image observation. Similar method for detecting these astronomical objects therefore can be applied to detect ionizing events on CMOS image frame. The Laplacian of Gaussian (*LoG*) algorithm is one of the technique quite commonly used for astronomical objects identification by edge detection.

In this work, we applied the *LoG* to identify the central pixel position for each ionizing events on the CMOS image frame. The information on ionizing event position not only allows us to quantify it but also provide a reference area coordinate for further data processing, in particular with regards to computation of charge collection values that may be useful to discriminate energy spectrum.

Source (Nuclide)	Energies, keV (photons/100 disintegration)
^{241}Am	59.54 (35.92), 26.34 (2.31), 33.20 (0.12), *11.89-22.2 (37.66)

MATERIAL AND METHODS

The description of CMOS sensor used and experimental procedure were the same in previous report[1] with modifications *i.e.* the CMOS sensor instead functioned as a camera in which a movie of ionizing events was first taken for each radiation exposure before data processing and this resulted in more data frame per exposure time. The movie recording cycle was about 3.3 seconds (total of 99 frames or 30 frames/second). Three measurements were carried out for each source to detector distance of 0 to 5 cm. Noise removal from all image data frames were done by subtracting each pixel values with the frame median value. The source of radiation used was ^{241}Am (100 μCi). The movie was later processed frame by frame using the *LoG* function in *scikit-image* python library to detect bright cluster of pixels or blobs and their respective coordinates. Further computations were carry out to obtain charge collection value by summing all pixel values for each blobs that were then discriminated into bins or channels. The software tool for experimental control and details of data processing can be found in Ref[2].

RESULTS AND DISCUSSION

The thin layer of the CMOS indicates that the probability of any ionizing event is very low as most gamma photons, especially the high energy ones, may just pass through the active semiconductor depletion region. The ^{241}Am source used with its relatively low energy gamma photons allowed higher ionizing event to be captured for better statistics.

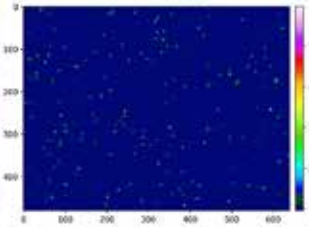

Figure 3: Summation of all ionizing events of all frames for a measurement at 5 cm source to detector distance.

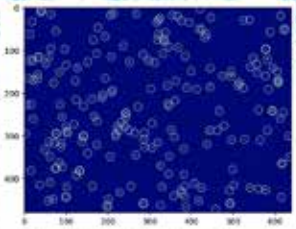

Figure 4: *LoG* identification of these ionizing events coordinates (shown as enlarge rings).

The output of *LoG* algorithm in *scikit-image python* library provides a list of image coordinates (center of rings as shown in Figure 4). In reference to these coordinates taken as center to an area, charge collection value was then calculated by summing all pixel intensities in the pixel area of 441 (21 x 21). Summation value for all the bright pixels inside the cluster area which was then regarded as charge collection value were then discriminated into channels to obtain a ^{241}Am spectrum for evaluation.

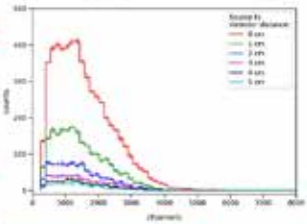

Figure 5: Spectra of ^{241}Am

Two visible peaks can be discerned in Figure 5 spectra for 0 and 1 cm source to detector distances. These peaks are at around 700 and 1300 of charge collection values. At much larger source to detector distances, no discernible peaks can be seen because of insufficient ionization events and thus poor statistics. These two peaks perhaps represent gamma energy at 59.5 and 11-22 keV.

CONCLUSION

Identification and quantification of ionizing gamma events on CMOS sensor in a consumer webcam can be attained using the *LoG* algorithm. Thereon, charge collection values can be computed and gamma spectrum be built for the gamma source. CMOS from webcam however may not be able to discriminate the gamma spectrum efficaciously. This is because of the low probability deposition of ionizing event on the thin CMOS sensitive region.

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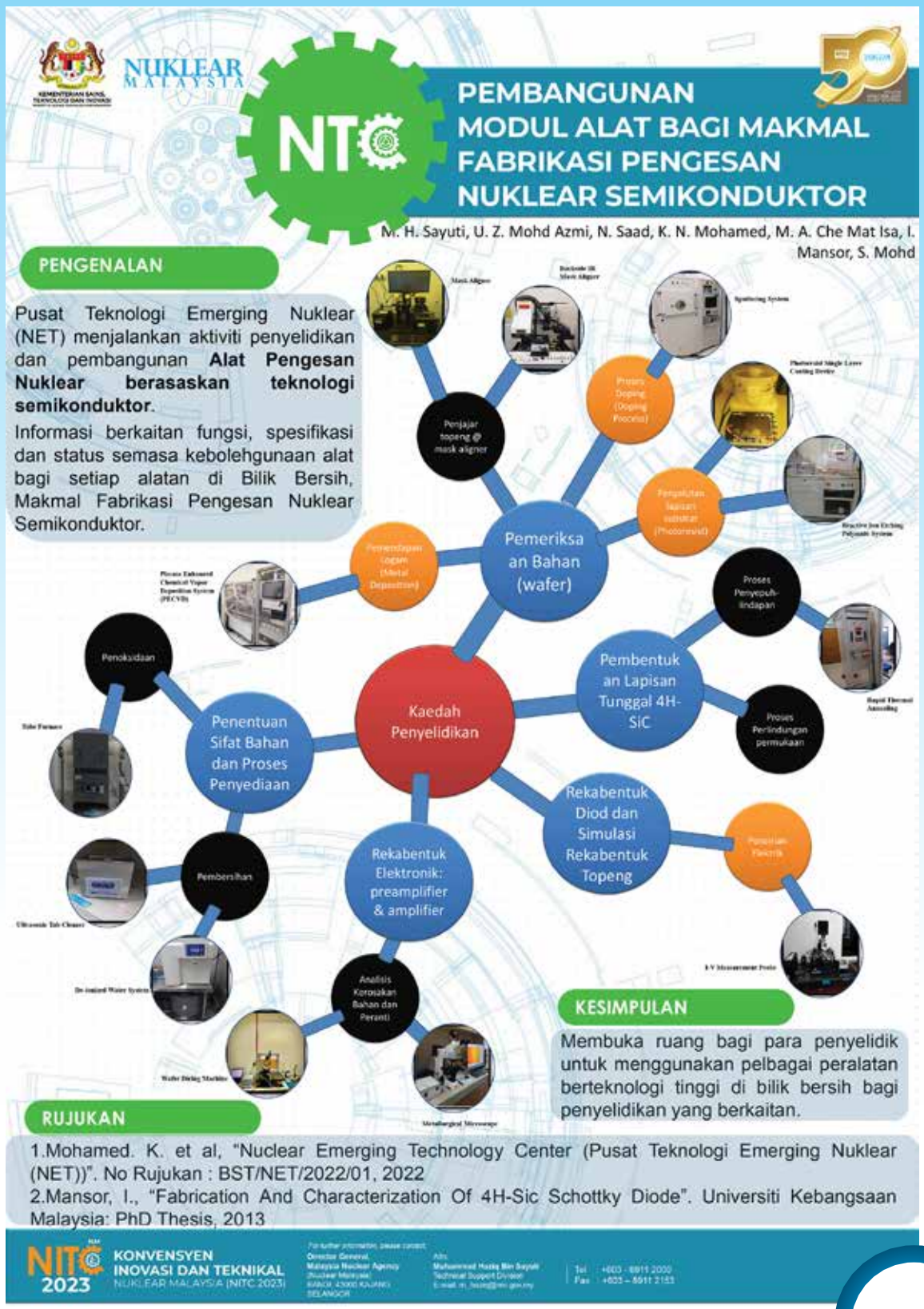
2) https://github.com/puspati2lon/cmos-radiation-detector

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)


NUKLEAR MALAYSIA
NTC
PEMBANGUNAN MODUL ALAT BAGI MAKMAL FABRIKASI PENGESAN NUKLEAR SEMIKONDUKTOR
M. H. Sayuti, U. Z. Mohd Azmi, N. Saad, K. N. Mohamed, M. A. Che Mat Isa, I. Mansor, S. Mohd
PENGENALAN
Pusat Teknologi Emerging Nuklear (NET) menjalankan aktiviti penyelidikan dan pembangunan **Alat Pengesan Nuklear berasaskan teknologi semikonduktor**.
Informasi berkaitan fungsi, spesifikasi dan status semasa kebolehgunaan alat bagi setiap alatan di Bilik Bersih, Makmal Fabrikasi Pengesan Nuklear Semikonduktor.
Kaedah Penyelidikan
Pemeriksaan Bahan (wafer)
Penentuan Sifat Bahan dan Proses Penyediaan
Pembentukan Lapisan Tunggal 4H-SiC
Rekabentuk Diod dan Simulasi Rekabentuk Topeng
Rekabentuk Elektronik: preamplifier & amplifier
Penoksidaan
Pembersihan
Proses Penyepuh-lindapan
Proses Perlindungan permukaan
KESIMPULAN
Membuka ruang bagi para penyelidik untuk menggunakan pelbagai peralatan berteknologi tinggi di bilik bersih bagi penyelidikan yang berkaitan.
RUJUKAN
1.Mohamed. K. et al, "Nuclear Emerging Technology Center (Pusat Teknologi Emerging Nuklear (NET))". No Rujukan : BST/NET/2022/01, 2022
2.Mansor, I., "Fabrication And Characterization Of 4H-Sic Schottky Diode". Universiti Kebangsaan Malaysia: PhD Thesis, 2013
NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

WAFER SINGULATION BY CNC DICING MACHINE FOR WAFER CUTTING APPLICATION IN NUCLEAR MALAYSIA

M.H. Sayuti, U.Z. Mohd Azmi, N. Saad, K.N. Mohamed, M.A. Che Mat Isa, S. Mohd and I. Mansor

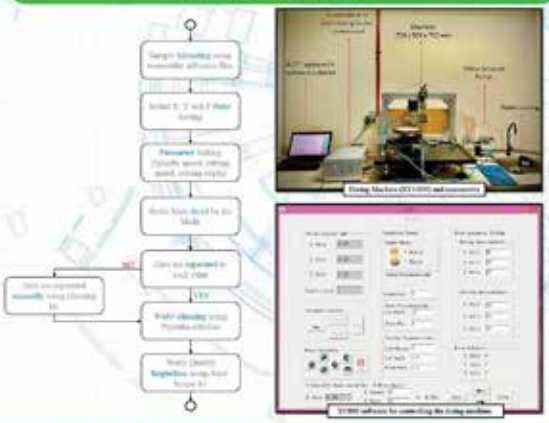
INTRODUCTION

Fabrication of electronic components in micro and nanoscale nowadays are due to the miniaturization of the electronic devices. Thus, wafer singulation plays an early and vital role in the quality of the final product.

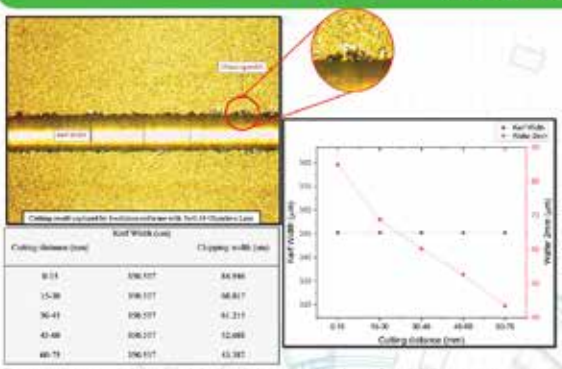
In order to have bulkier quantity and great quality of chips the precision in wafer cutting is the main focus. Moreover, todays silicon wafers are getting more thinner; very fragile, can caused crack and larger size of chipping during the cutting process.

This study was aimed to give an overview on the complete process of wafer singulation which is a part of process in developing the radiation semiconductor detector.

METHODOLOGY



RESULT & DISCUSSION



Based on this multiple Y graph, kerf width generated by the diamond blade were remain uniformly with value of 350.537 um. While the chipping width were dramatically decreased along the cutting street.

Five different locations captured for the cutting analysis.

In the transient stage, the wafer is being cut with impact force and abrasion force from the diamond grits of the blade while only abrasion force during the steady stage; final part of cutting street which resulting to the minimal chipping *(Lin & Cheng, 2014)*.

There must be an optimal parameter to reduce the impact force so that the uniform cutting can be produced on both stages of the cutting street *(Shen et al., 2019)*

Nevertheless, parameters setup are still depending on the wafer type of materials, thickness and also its diameter.

CONCLUSION

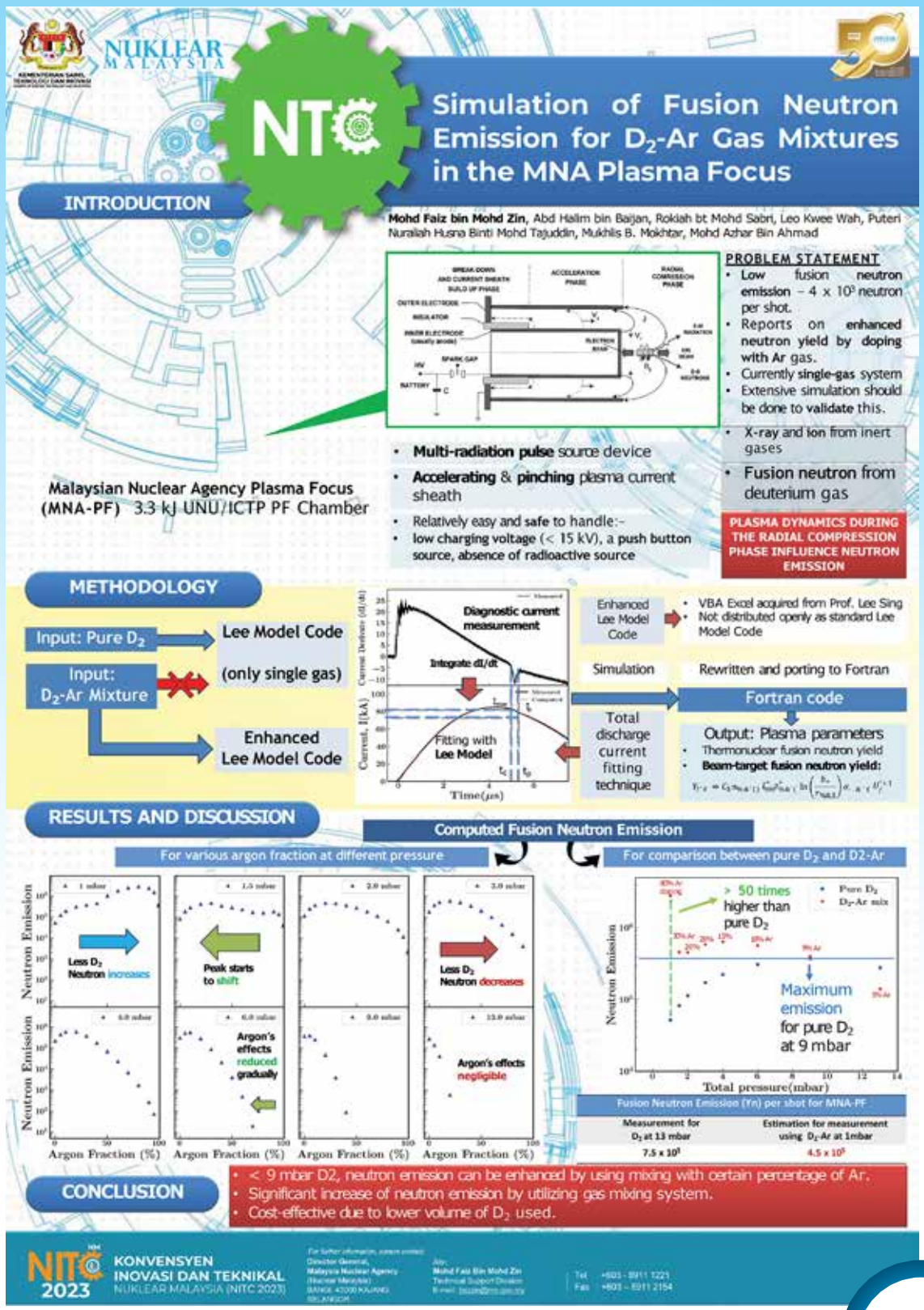
The optimal parameter for a wafer dicing needs to be study time to time as the evolving of the wafer specification itself.

Also to study how to decrease the dicing street *(Chiew et al., n.d.)* so that many devices can be installed in a wafer to be used for various types of semiconductor fabrication purposes including; Schottky Diode (radiation detector).

REFERENCES

1. *Lin, J. W., & Cheng, M. H. (2014). Investigation of chipping and wear of silicon wafer dicing. Journal of Manufacturing Processes*
2. *Chiew, Y. H., Liong, J. Y., & Tan, F. F. (n.d.). Mechanical Dicing Challenges and Development on 50um Saw Street with Wafer Backside Coating (WBC).*

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)


NUKLEAR MALAYSIA
NTC
Simulation of Fusion Neutron Emission for D2-Ar Gas Mixtures in the MNA Plasma Focus
INTRODUCTION
Mohd Faiz bin Mohd Zin, Abd Halim bin Baijan, Rokiah bt Mohd Sabri, Leo Kwee Wah, Puteri Nuraliah Husna Binti Mohd Tajuddin, Mukhlis B. Mokhtar, Mohd Azhar Bin Ahmad
PROBLEM STATEMENT
Low fusion neutron emission ~ 4 x 10³ neutron per shot.
Reports on enhanced neutron yield by doping with Ar gas.
Currently single-gas system
Extensive simulation should be done to validate this.
Malaysian Nuclear Agency Plasma Focus (MNA-PF) 3.3 kJ UNU/ICTP PF Chamber
Multi-radiation pulse source device
Accelerating & pinching plasma current sheath
Relatively easy and safe to handle:-
low charging voltage (< 15 kV), a push button source, absence of radioactive source
X-ray and ion from inert gases
Fusion neutron from deuterium gas
PLASMA DYNAMICS DURING THE RADIAL COMPRESSION PHASE INFLUENCE NEUTRON EMISSION
METHODOLOGY
Input: Pure D2
Lee Model Code
Input: D2-Ar Mixture
(only single gas)
Enhanced Lee Model Code
Diagnostic current measurement
Integrate dI/dt
Fitting with Lee Model
Current Derivative (dI/dt)
Current, I(kA)
Time(μs)
Enhanced Lee Model Code
VBA Excel acquired from Prof. Lee Sing
Not distributed openly as standard Lee Model Code
Simulation
Rewritten and porting to Fortran
Fortran code
Total discharge current fitting technique
Output: Plasma parameters
Thermonuclear fusion neutron yield
Beam-target fusion neutron yield:
RESULTS AND DISCUSSION
Computed Fusion Neutron Emission
For various argon fraction at different pressure
For comparison between pure D2 and D2-Ar
Neutron Emission
Less D2 Neutron increases
Peak starts to shift
Less D2 Neutron decreases
Argon's effects reduced gradually
Argon's effects negligible
Argon Fraction (%)
> 50 times higher than pure D2
Pure D2
D2-Ar mix
Maximum emission for pure D2 at 9 mbar
Total pressure(mbar)
Fusion Neutron Emission (Yn) per shot for MNA-PF
Measurement for D2 at 13 mbar
7.5 x 10³
Estimation for measurement using D2-Ar at 1mbar
4.5 x 10⁵
CONCLUSION
< 9 mbar D2, neutron emission can be enhanced by using mixing with certain percentage of Ar.
Significant increase of neutron emission by utilizing gas mixing system.
Cost-effective due to lower volume of D2 used.
NITC 2023
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

INTRODUCTION OF FRESH AIR INTAKE IN CENTRALISED AIR-CONDITIONING SYSTEM IN BLOCK 18 AND 19 AGENSI NUKLEAR MALAYSIA

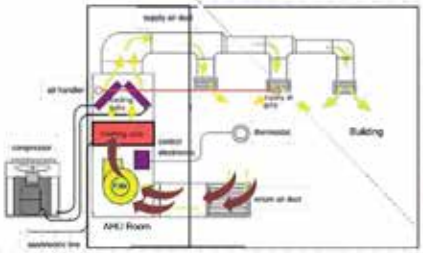
Mohamad Suhaimi Yahaya[1], Muhammad Ariff Ismail[1], Nordin Salleh[1], Muhammad Azli Shariff[2] and Mohd Abdul Karim Kamaruddin[2]

[1]Agensi Nuklear Malaysia
[2]MPTEC Enterprise

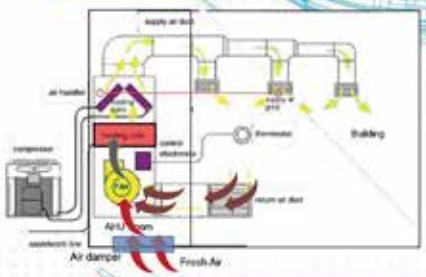
INTRODUCTION

- Most of the building in Bangi Complex, Agensi Nuklear Malaysia use centralized air-conditioning with recirculating of air from the building. Air ducts are used to distribute cooled air throughout the building.
- During pandemic of Covid-19, the centralized air conditioning potentially spread the virus throughout the building. Hence, Ministry of Health Malaysia had recommended to use fresh air to control the spread of covid-19
- To maintain appropriate indoor air quality, ventilation is important in eliminating contaminants like coronavirus.

BEFORE



AFTER



OBJECTIVE

- To describe the important of fresh air intake in centralized air conditioning system in order to reduce the spread of covid-19

DISCUSSION

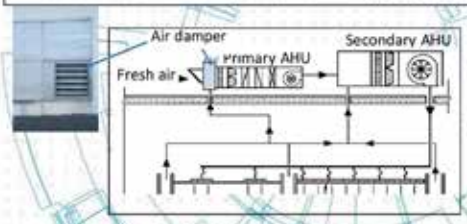
- To maintain appropriate indoor air quality, ventilation is important in eliminating contaminants like coronavirus.
- Ventilation system has been improved, reduce the risk of Covid-19 spread among the staff.
- Block 18 and 19 have been selected to use fresh air intake because:
  - There is an existing primary AHU that can be utilized to cool down the fresh air
  - Initial design of the ACMV system that use fresh air for laboratory before been converted to office.

ADVANTAGES

- More clean air from outside
- Reduce the spread of fume, odor, virus from inside the building because fresh air dilute these indoor pollutants

DISADVANTAGES

- Increase air conditioning load
- Increase temperature inside the building
- Reduce air indoor quality



CONCLUSION

By introducing the fresh air intake to supply air in centralized air conditioning system, it is believed that the spread of the Covid-19 and other virus will be effectively controlled and did not affect working comfort.

NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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DETERMINING THE CAUSE OF THE GROWTH OF FUNGUS ON THE WALLS IN BLOCK 34 AND THE MEASURES TAKEN TO PREVENT IT

Mohamad Suhaimi bin Yahaya, Nordin bin Salleh, Mohd Khafidz bin Shamsuddin, Mohamad Fazreen bin Abdul Mutalib, Sabriansah bin Sahudi dan Nalla Sevam A/L Jeganathan

INTRODUCTION

Fungus@mold has been reported growth badly on the wall in Block 34 can cause health problem among the workers. Fungus growth is mostly caused by high humidity and poor ventilation system in the building.

Sneeze

Cough

Stuffy Nose

OBJECTIVE

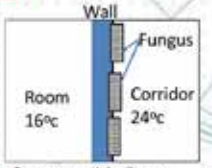
To identify the root cause of fungus growth and to take action to overcome it

METHODOLOGY

RESULT AND DISCUSSION

ROOT CAUSE OF FUNGUS GROWTH

- High humidity
- Room too cold
- Poor ventilation system



Fungus growth badly near to adjacent wall at 24 hrs air conditioned room, low temp

MEASURES TAKEN

- Clean and repaint with anti-fungus paint
- Resetting the air conditioning system
- Improve the ventilation system

Layout of block 34 with installation of 3 nos exhaust fan at suitable locations

Air-conditioning setting has been set at 23-25 degC

3 Nos Exhaust Fan have been installed to improve the ventilation and running by timer 2 times per day at different time (1 hour each)

Fungus has been cleaned up and repaint the wall with anti-fungus paint

CONCLUSION

The efforts taken have successfully removed the fungus on the wall and also prevented the growth of the fungus from happening again.

NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

MENGENALPASTI PUNCA KEROSAKANDAN PELAKSANAAN KERJA BAIK PULIH LIF DI BLOK 57 AGENSI NUKLEAR MALAYSIA

Mohamad Suhaimi Yahaya[1], Mohd Khafidz Shamsuddin[1], Nordin Salleh[1], Mohamad Fazreen Abdul Mutalib[1], Mohd Fabli Abu[1], Abdul Hafid Mohamad[2] dan Muhammad Syukri Azean[2]

[1]Agensi Nuklear Malaysia
[2]Glarie (M) Elevator Sdn. Bhd.

PENGENALAN

- Lif penumpang jenama Dover di Blok 57 telah dipasang pada tahun 2010, dilaporkan mengalami kerosakan pada bulan Mei 2022
- Lif beroperasi selari dengan Akta Kilang dan Jentera 1967 (Akta 139) dan diselenggara oleh Firma Yang Kompeten (FYK) berdaftar dengan Jabatan Keselamatan dan Kesihatan Pekerjaan Malaysia (JKKP)
- Lif dilaporkan mengalami gegaran yang kuat semasa naik dan turun yang boleh mendatangkan kemalangan dan ketakutan

Pusat Kecemerlangan Nuklear, Blok 57

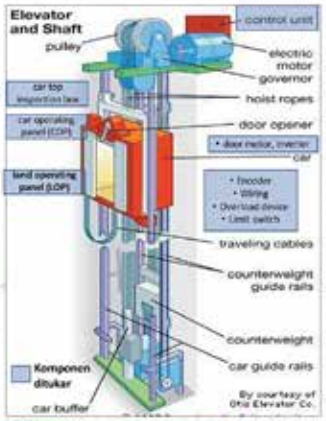
OBJEKTIF

Mengenal pasti punca kerosakan lif penumpang di Blok 57 dan mengambil tindakan untuk membaik pulih kerosakan

KAEDAH

PERBINCANGAN

- FYK yang dilantik: Glarie Elevator (M) Sdn. Bhd. telah menjalankan pemeriksaan setelah menerima aduan kerosakan mendapati *drive card* pada papan kawalan (PC *Board*) telah rosak.
- Fungsi drive card: mengawal operasi lif
- FYK telah cuba menghubungi pembekal dalam dan luar negara, namun gagal memperoleh drive card yang baharu di pasaran kerana pengeluar tidak lagi mengeluarkan komponen tersebut (part *obsolete*).
- Fungsi drive card: mengawal operasi lif
- Bagi membolehkan lif dapat beroperasi FYK telah mencadangkan semi modernization dibuat dengan menggantikan panel kawalan serta kelengkapan berkaitan
- Peruntukan RM97,000.00 dimohon dengan Unit Kewangan, BKP dan diluluskan
- Kebanyakan komponen yang perlu ditukar ditempah dan diperbuat dari China mengambil masa hampir 3 bulan untuk diterima.
- Kerja pembaikan bermula pada 28hb Januari 2023 dan telah siap pada 17hb Februari 2023.



Drive card yang rosak

Panel kawalan baharu

KESIMPULAN

Punca Kerosakan: masalah drive card pada papan kawalan (PC Board).
Tindakan diambil: mengganti baharu panel kawalan dengan kos sebanyak RM97,000. Lif beroperasi dengan baik dan selamat.

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

SEQUENTIAL DETERMINATION OF Pb-210/Po-210 IN SEDIMENT SAMPLE

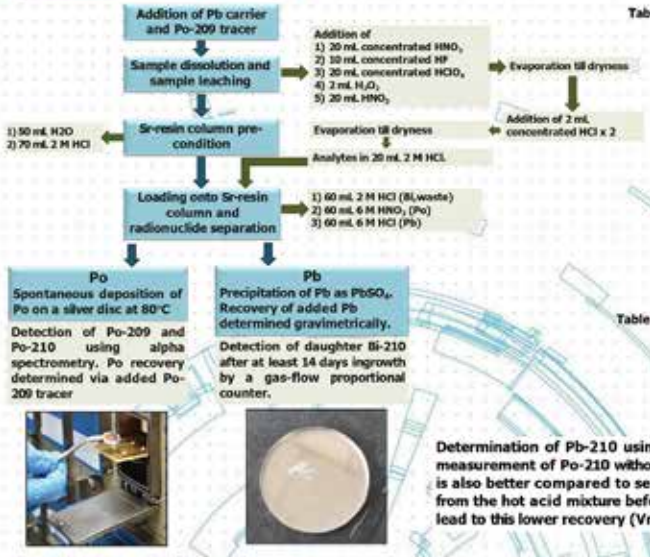
Nooradilah Abdullah, Yii Mei Wo, Norfaizal B. Mohamed @ Muhammad, Mohd Zuhair Bin Mohd Sanusi, Nurul Assyikeen Bt. Md. Jaffary, Noor Fadzilah Bt. Yusof, Mohd Tarmizi Bin Ishak, Mohamad Noh Bin Sawon and Muhammad Izzat Muammar Bin Ramli

INTRODUCTION

Pb-210 is well-known as environmental radiotracer in various processes such as sediment resuspension (Baskaran et.al., 2020), carbon and nitrogen cycle quantification (Yang et.al., 2011) and particle cycling (Zhong et.al., 2023). The half-life of Pb-210 is 22.3 years which can be used for dating on material from a year up to 150 years old. The origin of Pb-210 can be divided into two, unsupported Pb-210 which formed in the atmosphere due to the decay of Rn-222 and the other is supported Pb-210 which formed from the decay of Rn-222 arising from the natural Ra-226 contained in the sediments. Another source of Pb-210 could be from anthropogenic sources such as from waste.

A number of analytical techniques are available for the measurement of Pb-210 based on different chemical and physical principles, namely gamma spectrometry, alpha spectrometry and beta counter and spectrometry. They differ concerning the reachable detection limit, selectivity, analytical error reproducibility and stability against different chemical composition and levels of others natural radionuclides. In this study, Pb-210 was determined sequentially with Po-210 by chemical separation using Sr-resin.

METHODOLOGY



RESULT AND DISCUSSION

Table 1: Activity Concentration of Pb-210 and Po-210 Analysed in IAEA-385

Rep.	Pb-210 (Bq/kg)	Recovery (%)	Po-210 (Bq/kg)	Recovery (%)	Po-210 (Bq/kg) (without resin)	Recovery (%)
1	33.32	55.9	30.32	77.8	28.00	98.6
2	31.69	62.0	25.14	51.4	28.81	97.0
3	30.86	63.8	33.05	38.0	30.10	91.8
4	31.99	65.8	27.39	25.1	30.80	104.7
5	33.35	59.6	26.44	59.0	29.30	88.9
6	32.36	67.4	30.55	37.7	28.30	90.4

Table 2: Information values for activity concentrations of Pb-210 and Po-210 as reported in RS_IAEA-385[Rev.04] / 2019-10-23

Radionuclide	Certified value (Bq/kg)	Expanded uncertainty (Bq/kg)
Po-210	29	2
Pb-210	28.5	1.9

Determination of Pb-210 using this method is found to be reliable. On the other hand, measurement of Po-210 without using Sr resin is more accurate and precise. The recovery is also better compared to separation of Po-210 by using Sr resin. Losses of Po-209 tracer from the hot acid mixture before dissolution of Po-210 from the sediment is complete may lead to this lower recovery (Vrecek et.al., 2003).

CONCLUSION

Sequential determination of Pb-210 and Po-210 by radiochemistry separation using Sr resin tend to reduce the recovery of Po-209 tracer as compared to analysis of Po-210 without Sr resin separation. However, this method is still a useful tool to determine both radionuclides.

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Yang, W.F., Huang, Y.P., Chen, M., Qiu, Y.S., Li, H.B., Zhang, L. (2011). Carbon and nitrogen cycling in the Zhubi coral reef lagoon of the South China Sea as revealed by 210Po and 210Pb. *Marine Pollution Bulletin*, 62(5), 905-911.

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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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BRINE SHRIMP LETHALITY ASSAY: A SIMPLE PRELIMINERY TOXICITY STUDY

Nurmaziah Mohammad Shafie, Dr Zainah Adam, Azfar Hanif Abd Aziz, Nor Azizah Marsidi, Daryl Jesus Arapoc, Rosniza Razali, Veshalini Kasiraja, Abang Abdul Rahim Ossen, Hazlina Ahmad Hassali.

INTRODUCTION

Brine shrimp lethality assay (BSLA)

- Simple procedure, low cost, rapid, robust, ability to screen many samples
- Test materials: Plant extracts, isolated or chemically synthesized compounds, heavy metals, pesticides, medicinal drugs etc
- Toxic compounds can cause mortality to brine shrimp larvae (nauplii).

Objective of the study

To assess the toxicity of test material towards nauplii to provide preliminary data for further toxicological investigations.

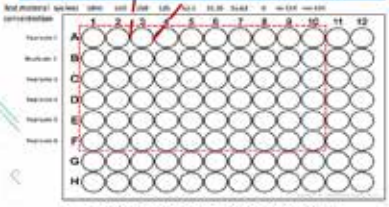
Case study: Chalcone

- Lab synthesized
- Phenolic compound
- Available from various natural sources/ chemically synthesized
- Reported pharmacological properties include antioxidant, anti-inflammatory, antimicrobial, anticancer, and antidiabetic activities.

METHODOLOGY

A. Brine shrimp preparation

B. Brine shrimp lethality assay procedure



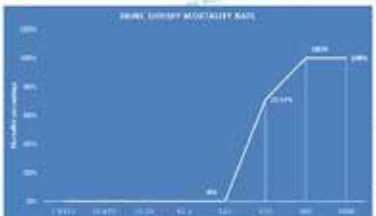
1. Test material preparation i.e., chalcone.
2. 100 µL test material + 100 µL brine shrimp media containing 10-15 nauplii.
3. Incubate 24 hours.

C. Toxicity determination

1. $\%\ \text{Death} = \frac{\text{Number of dead nauplii}}{\text{Number of dead nauplii + Number of live nauplii (Total number of nauplii)}} \times 100$

2. LC_{50} value, which is the concentration of the test material that causes 50% mortality of brine shrimp nauplii.

RESULT AND DISCUSSION



- $LC_{50} \leq 100$ µg/ml = strong toxicity activity
- LC_{50} 100 µg/ml - 500 µg/ml = moderate toxicity
- LC_{50} 500 µg/ml - 1000 µg/ml = weak toxicity
- $LC_{50} \geq 1000$ µg/ml = non-toxic

- No mortality for control (5% DMSO solvent). Solvent did not contribute to the observed toxic effect of the chalcone on the nauplii at high concentrations
- Factors of concern: Brine shrimp eggs quality; type of solvent; pH (pH5 > pH solvent < pH8)
- Possible mechanism of action: Oxidative stress; DNA damage; interference with developmental processes
- Include positive control e.g. potassium dichromate & vincristine sulphate.

CONCLUSION

Based on the BSLA results, chalcone exhibits **moderate toxicity** with half-maximal lethality concentration (LC_{50}) 233.2633 µg/mL. BSLA primarily provides a preliminary assessment of toxicity and may not directly correlate with the toxicity of chalcone in mammals or humans. Thus, further studies exploring the underlying mechanisms of chalcone toxicity using mammalian models would be required to validate and provide a more comprehensive assessment of the toxic effects.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

GLOBAL RADIUM-226 MANAGEMENT INITIATIVE: RETRIEVAL OF CEMENTED RADIUM NEEDLES

IBRAHIM Zaidi, PHILIP Esther, NWA Khairuddin, BA'AN Rohyiza, HCK Ahmad, AHMAD Azimawati, SAROWI Suzilawati, HARUN Nazran, KW Siang, IBRAHIM Azmi, SUJAN Fathi, YAHAYA Nurul Syazwani, MASHOR Nariman, AA Nizammuddin, JAAFAR Zahiruddin, AR Na'imullah, ZULKIPLI Azam, KMN Annas, ISMAIL Faris

ABSTRACT

The Global Radium-226 Management Initiative coordinated by the IAEA focuses on recycling of radium-226 as an effort to wisely manage legacy radium sources such as radium needles used for targeted alpha therapy in nuclear medicine. The accumulation and storage of legacy radium sources without any further purpose may pose long-term management concern if not managed safely and effectively. With a considerably huge numbers of legacy radium sources in its possession, Malaysia has decided to participate in this program to support the sustainable management of these radium sources. The Canadian National Laboratory (CNL) is interested in cooperating with Malaysia in recycling of the legacy radium sources. The legacy radium sources were mostly conditioned in stainless steel capsules and stored in the interim storage facility. 100 pieces of radium needles with a total activity of 157 mCi were conditioned in two cemented drums. This paper shares the working procedures for demolishing the cemented drums to retrieve the radium needles for transfer to CNL. Protection against occupational exposure is also described.

RETRIEVAL PROCEDURE

This mission is a collaboration between Waste Technology Development Centre (WasTeC) and the Health Physics Group (KFK).

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NUKLEAR MALAYSIA

NTC

REKABENTUK LITAR DAN SISTEM KAWALAN BAGI KOTAK PROTOTAIP SINARAN ULTRALEMBAYUNG (UV)

Siti Hajar Said, Muhammad Hannan Bahrin, Anwar Abdul Rahman, Mohd Zaid Hassan, Mohd Rizal Mamat, Azraf Azman, Wan Ismail Wan Yusof, Muhamad Nor Atan, Dr. Sofian Ibrahim & Noor Mohd Rizwan Brahin

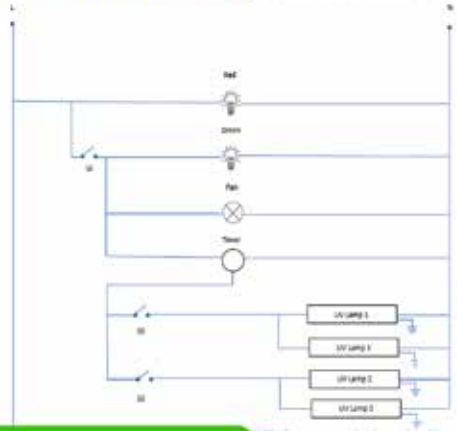
ABSTRAK

Komponen elektrik dan rekabentuk litar adalah komponen utama dalam pembangunan prototaip kotak sinaran ultralembayung (UV). Antara komponen elektrik adalah terdiri daripada lampu UV, *ballast* untuk lampu UV, lampu penunjuk, kipas, suis pengehad, peranti penetapan masa, penggera, palam dan soket. Spesifikasi untuk setiap komponen elektrik ini dikenalpasti pada peringkat awal semasa merekabentuk sistem kawalan dan litar. Kertas kerja ini akan membincangkan rekabentuk litar, sistem kawalan, spesifikasi komponen elektrik yang terdapat di dalam kotak sinaran UV dan juga manual mengendalikan kotak sinaran UV.

PENGENALAN

Kotak LembayUVng 1 (UVGI) telah digunakan untuk kajian awal kesan sinaran UV-C terhadap formulasi pemvulkanan getah asli. Hasil daripada kajian tersebut, sinaran UVC terbukti berkesan dan berupaya untuk mengubah ketumpatan pautan silang getah, sifat fizikal dan sifat mekanikal getah. Oleh yang demikian, pihak Pusat Khidmat Iradiasi – Raymintex telah berminat untuk membuat kajian lanjutan pemvulkanan lateks dengan meminta pihak Pusat Pembangunan Loji dan Prototaip (PDC) untuk merekabentuk, memfabrikasi dan memasang dua (2) kotak ultralembayung UVA (315–400 nm) dan ultralembayung UVC (200 to 280 nm)

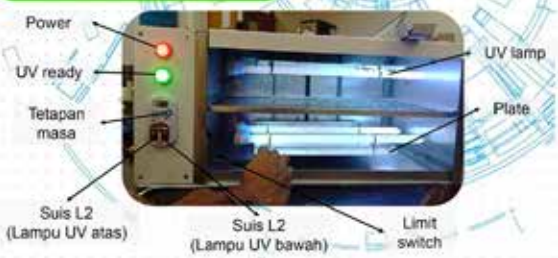
REKABENTUK LITAR



SENARAI KOMPONEN

NO	NAMA KOMPONEN	KUANTITI
1	LAMPU INDICATOR MERAH	1
2	LAMPU INDICATOR HIJAU	1
3	KIPAS	1
4	TIMER	1
5	LIMIT SWITCH	1
6	SUIS LAMPU	2
7	BALLAST LAMPU	4
8	LAMPU UV	4
9	BEKALAN KUASA	1
10	KABEL PVC 1.5mm (MERAH,BIRU,HITAM,HIJAU)	4

OPERASI



1. Apabila bekalan kuasa (power supply) dihidupkan, lampu merah iaitu lampu 'POWER' akan menyala dan kipas juga akan berpusing.
2. Setelah pintu latex UV box ditutup, lampu hijau iaitu lampu 'UV READY' akan menyala.
3. Tetapkan masa yang dikehendaki pada timer menggunakan simbol 'CLOCK' dan 'HOUR' untuk tetapan jam dan symbol 'CLOCK' dan 'MIN' untuk tetapan minit.
4. Tekan suis lampu L1 untuk lampu atas, suis lampu L2 untuk lampu bawah dan tekan kedua-dua suis untuk lampu atas dan bawah.
5. Tekan butang CTD pada pemasa (timer) untuk memulakan kiraan masa.
6. Buzzer pada timer akan berbunyi setelah mencapai tahap masa yang ditetapkan dan lampu UV akan padam.

REKABENTUK KOTAK

KESIMPULAN

Penggunaan kotak sinaran UV telah diuji dan berupaya digunakan untuk kajian pemvulkanan lateks.

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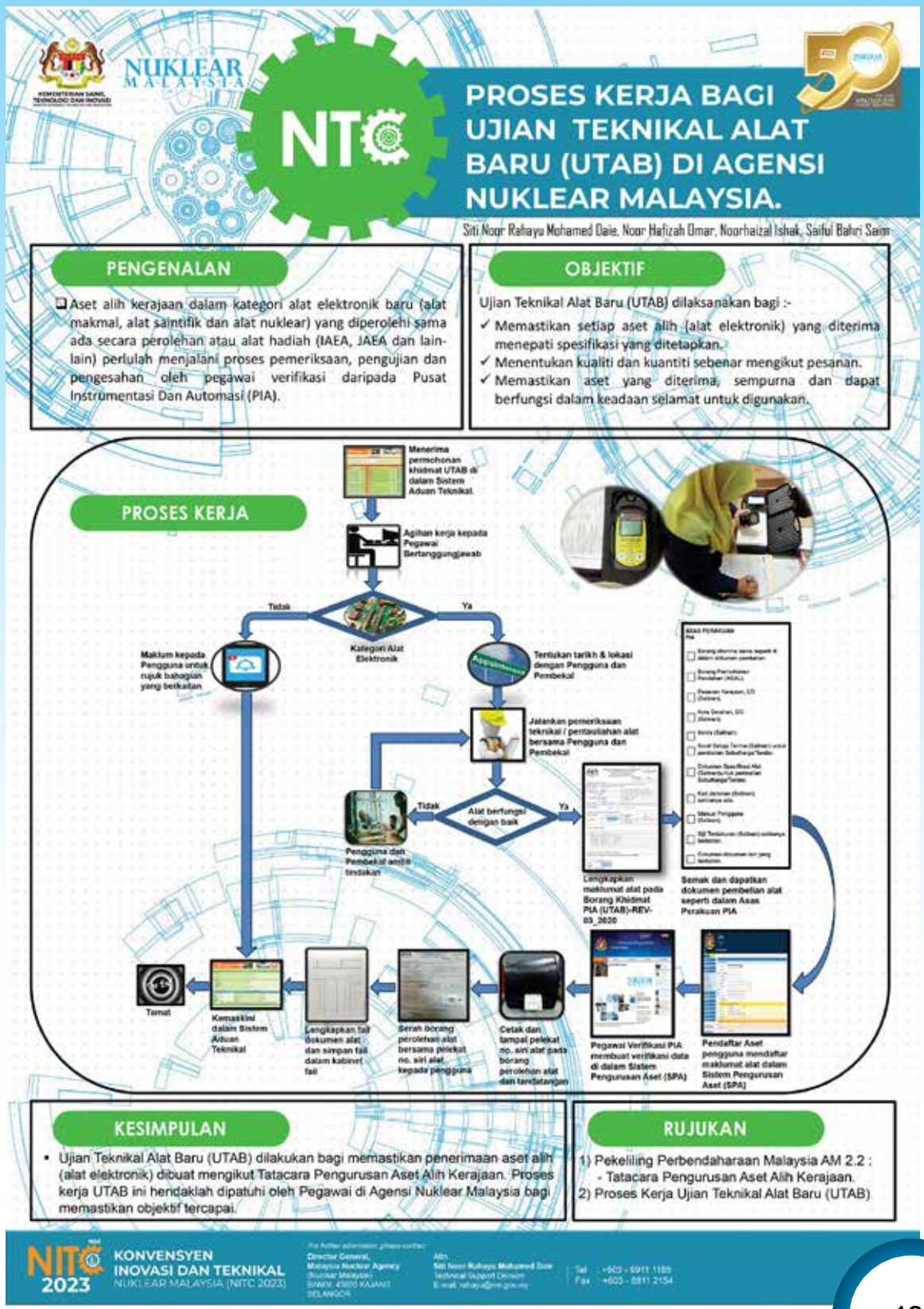
NUCLEAR TECHNICAL CONVENTION (NTC)



NUKLEAR MALAYSIA

NTC

X-RAY BEAM UNIFORMITY MEASUREMENT FOR CALIBRATION OF KVP METER USE IN QUALITY CONTROL TEST OF MEDICAL DIAGNOSTIC X-RAY SYSTEM

Wan Hazlinda Ismail, Mohamad Al Rasyidin Mohamed Najib, Asmahani Ibrahim, Mafuzah Abdul Majid, Azuhar Ripin, Dr, Mohd Khalid Matori

INTRODUCTION

Calibration of kVp meter use in quality control test measurement of medical diagnostic x-ray is also considered important since the kilovoltage of an x-ray imaging system affect the x-ray output in term of dose to patient and contrast to image. Therefore, it is essential to calibrate the kVp meter accordingly. Two methods that are usually employed in kVp meter calibration are the invasive and non-invasive calibration method. In this study, we investigate the uniformity of the standard x-ray beam use for calibration because it will influence the uncertainty of the kVp meter measurement.

METHODOLOGY

A medical x-ray system, Toshiba Diagnostic Radiography X-Ray System Model KXO-50S (figure 1) was used as the standard beam. Whereas a solid-state detector, RTI Piranha 657 dose probe was used to measure the dose in mGy. The size of detector is 2.0 cm x 4.5 cm x 0.74 cm and detector active size is 1 cm x 1 cm. Two field size of 10 cm x 10 cm standard field size and a larger field size of 30cm x 30cm was considered in this study. For 10 cm x 10 cm field size 25 points was measured with an interval distance of 2 cm as shown in figure 2. In addition, 47 points was measured 30 cm x 30 cm field size with interval distance of 2 cm and 4 cm as shown in figure 3. Source to detector distance was fixed at 100cm as shown in systematic diagram in figure 4. X-ray output was set at 80kV, 320mA and 0.2 seconds.

Figure 1: Toshiba Diagnostic Radiography X-Ray

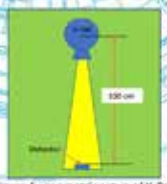


Figure 4 : geometric setup of X-Ray and detector

Figure 2: X-ray field size 10 cm x 10 cm

Figure 3: X-ray field size 30 cm x 30 cm

RESULT AND DISCUSSION

From the results, it shows that the uniformity of 10 cm x 10 cm x-ray beam along the cathode-anode axis variation are 3.4% and 4.1% within the centre 5cm x 5cm and 8cm x 8cm respectively as shown in in figure 5. Whereas its uniformity variation perpendicular to the cathode-anode axis are 1.0% and 1.8% within the centre 8 cm x 8 cm and 5 cm x 5 cm respectively. For field size of 30 cm x 30 cm the uniformity variation of x-ray beam is 12.7 %, 9.5 % and 4.8 % with in the centre 28 cm x 28 cm, 20 cm x 20 cm and 10 cm x 10 cm respectively along the cathode-anode axis. While the uniformity variation of x-ray beam perpendicular to the cathode-anode axis are 2.3 %, 1.8 % and 0.5 % with in the centre 28cm x 28cm, 20cm x 20 cm and 10 cm x 10cm respectively as shown in in figure 6.

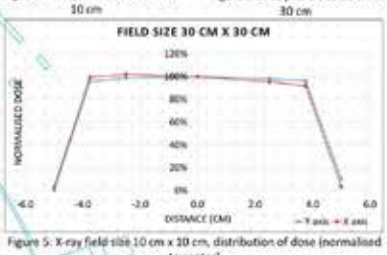


Figure 5: X-ray field size 10 cm x 10 cm, distribution of dose (normalised to center)

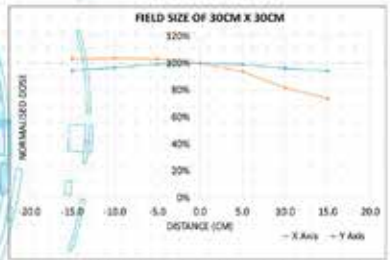


Figure 6: X-ray field size 30 cm x 30 cm, distribution of dose (normalised to center)

CONCLUSION

The uniformity of the x-ray beam is less crucial using the invasive calibration method. However, for the non-invasive method the position of the kVp meters in the x-ray field should be carefully considered since both reference and calibrated kVp meter are exposed simultaneously in the beam.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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PENGALAMAN & CABARAN KEROSAKAN PERALATAN UTAMA UNTUK KHIDMAT TENTUKURAN DI MAKMAL FIZIK PERUBATAN

Asmaliza Hashim, Asmahani Ibrahim, Shahrul Azlan Azizan, Nur Shahriza Zainuddin, Muhammad Yusri Yahaya, Mohamad Al Rasyidin Mohamed Najib, Md Khairusalih Md Zin, Mohd Muzammil Abd Jalil, Mafuzah Abdul Majid, Ahmad Nasir Yusof, Mohd Khalid Matori, Mohd Taufik Dollah, Rozita Kudus

PENGENALAN

Makmal Fizik Perubatan (MPL):
- Makmal standard tentukuran bagi peralatan ujian kawalan mutu (QC *test tools*) radiologi diagnostik
- Mendapat akreditasi MS ISO/IEC 17025:2005 dari tahun 2013
- Bergabung dengan SSDL pada tahun 2019 bagi pematuhan standard MS ISO/IEC 17025:2017

Peralatan Utama:
- Philips MG165 X-Ray System - punca sinaran X-ray bagi tujuan tentukuran dos
- Telah dipasang di MPL pada 1997
- Kesemua komponen penting mesin X-ray pernah mengalami kerosakan dan pernah diganti
- 2021 - komponen generator telah mengalami kerosakan diikuti dengan tiub X-ray pada 2022

Bagi meneruskan kelangsungan perkhidmatan tentukuran di MPL, MPL telah bekerjasama dengan SSDL dengan menggunakan mesin X-ray di Blok 19

KEROSAKAN

1. Komponen generator terbakar:
   - Disebabkan oleh kilat akibat sistem pembumian alat tidak sempurna

2. *"Tube arcing"*:
   - Disebabkan oleh "tube ageing"

PENYELESAIAN

1a. Penambahbaikan sistem pembumian:
- Menambah "earth chambers", "copper jacketed steel core rods", "copper tape"

1b. Pinjaman komponen generator daripada SSDL (sistem di Blok 37): E2, E3, E4 card, "cooling fan"

2. Perolehan tiub X-ray baru:
- tiub x-ray baru telah dipasang pada Julai 2023

CABARAN SEMASA PROSES PEMBAIKAN DAN TENTUKURAN DI SSDL BUNKER 19

1. Proses pembaikan komponen yang dilakukan di luar NM
   - Proses pinjaman komponen sistem X-ray daripada SSDL di Blok 37 ke Blok 32

2. Blok yang berlainan:
   - Blok 32 ke Blok 19

3. Logistik:
   - mengangkut peralatan MPL dan pelanggan dari Blok 32 ke Blok 19

4. Makmal MPL vs SSDL:
   - MPL – *calibration cart* direkabentuk untuk tentukuran peralatan radiologi diagnostik
   - SSDL - *calibration cart* direkabentuk untuk tentukuran peralatan perlindungan sinaran (meter tinjau)

5. Peruntukan kewangan untuk menggantikan komponen yang rosak dan sistem yang baru

KESIMPULAN

- Khidmat tentukuran akan terjejas dengan kerosakan peralatan utama.
- *Alternate site* daripada makmal / unit / bahagian lain boleh digunakan untuk meneruskan perkhidmatan tentukuran.
- Sumber peruntukan diperlukan untuk menggantikan komponen/peralatan utama yang berusia.

Ini bagi memastikan aktiviti perkhidmatan tentukuran tidak tergendala/terjejas.

NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

PREPARATIVE LIQUID CHROMATOGRAPHY (PREP-LC): IMPURITIES REMOVAL TECHNIQUE

R. Razali, Z. Adam, D. Jesus Arapoc, N. Mohamad Shafie, A.H. Abd Aziz, A. A. R. Ossen, N. A. Marsiddi, H. Ahmad Hassali and V. Kasiraja

INTRODUCTION

CHALCONE

- Organic compounds that belong to flavonoid group
- Consists of two aromatic rings connected by three carbon α,β-unsaturated carbonyl system
- Used as intermediates in the synthesis of flavonoids, which exhibit a wide range of biological activities

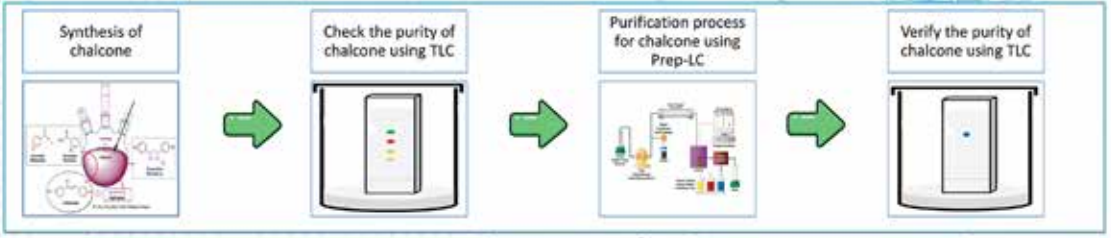
Chalcone powder with molecular mass 236 g/mol and molecular formula $C_{15}H_{12}O$

PREPARATIVE LIQUID CHROMATOGRAPHY (PREP-LC)

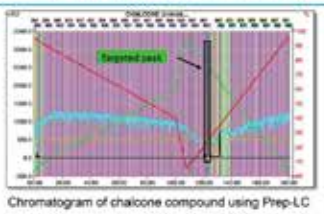
- A separation technique to isolate, purify and collect specific compounds from mixture to obtain larger quantities of desire substances
- Commonly used in the pharmaceutical, biotechnology, and chemical industries to isolate and purify compounds for further use or analysis

Preparative Liquid Chromatography (Prep-LC) System

METHODOLOGY

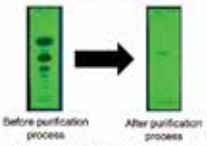


RESULTS & DISCUSSION



Chromatogram of chalcone compound using Prep-LC

- Good separation with high, sharp and symmetrical peak results using mobile phases A (0.1% trifluoroacetic acid in H_2O) and B (0.1% trifluoroacetic acid in ACN) with the gradient as follows: a) 0 min 95% A; b) 8 min 90% A; c) 100 min 40% A; d) 108 min 5% A and e) 90 min 5% A.
- Trifluoroacetic was used as a modifier to improve peak shape and prevent the peak tail



The purity of the chalcone was verified using Thin Layer Chromatography (TLC)

- TLC test on the chalcone compound before the purification process - many bands were produced on the TLC plate
- TLC test on the chalcone compound after the purification process – only one band was produced on the TLC plate

CONCLUSION

This report presents the purification of chalcone using preparative liquid chromatography. Overall, the purification of chalcone using preparative liquid chromatography requires careful optimization of the chromatography conditions to achieve the desired purity and yield. It is important to choose a suitable stationary and mobile phase and to monitor the elution profile to ensure that the chalcone is eluted as a single peak.

ACKNOWLEDGEMENT

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NTC 23 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

A BIBLIOMETRIC ANALYSIS ON THE RESEARCH TRENDS OF DUST EXPLOSIONS FROM YEAR 2001 TO 2023

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INTRODUCTION

Dust explosions pose enduring hazards, historically causing substantial harm to people, property, and the environment. These events involve combustible dust-air mixtures igniting and have perplexed experts due to unexpected ignition sources. Such explosions span various industries and often lead to secondary blasts. Despite an increased focus on dust explosions, comprehensive bibliometric analysis in this field is limited. Bibliometrics offers an objective view of research trends, contributors, and emerging topics. This study uses bibliometric analysis and advanced information visualization to provide valuable insights into dust explosion research. Examining literature distribution, knowledge foundations, research frontiers, and key focus areas, this analysis aids researchers in this domain.

METHODOLOGY

1. Data Source: Scopus
'dust explosion' as the keyword, a timeframe from 2001 to 2023, English language, and document types including articles, proceedings papers, open access materials and narrow it down to 244 results

2. Analysis tool: RStudio
to conduct data analysis and visualization of literature information, covering countries, institutes, co-cited sources, and keywords, thereby revealing patterns and connections within academic research

RESULT AND DISCUSSION

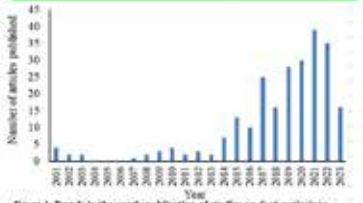

Figure 1: Trends in the yearly publication of studies on dust explosions

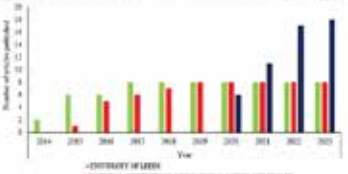

Figure 3: Top 3 institutions in dust explosion research

Journal	IF	TP	h-index
Journal of Loss Prevention in the Process Industries	3.9	41	13
Environmental Health Perspectives	10.4	1	1
Journal of Hazardous Materials	14.4	9	8
Process Safety and Environmental Protection	7.8	41	7
Nature	69.5	1	1
Fuel	8.9	9	4
Fuel Processing Technology	9.1	3	3
Biomass and Bioenergy	6.7	4	4
International Journal of Environmental Research and Public Health	4.6	4	4
International Journal of Chemical Engineering	2.6	2	2

Table 1: Top 10 journals publishing on dust explosion research

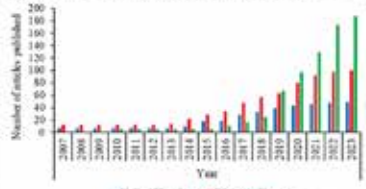

Figure 2: Articles each year on dust explosion research from the top 3 countries

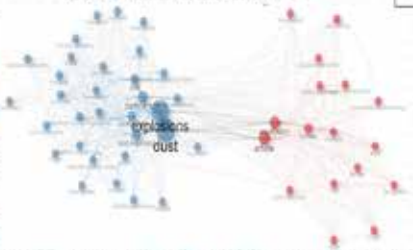

Figure 4: Top Keywords Present in Publications. Colors refer to different clusters or related topics. The bigger the size of the circle is, the greater frequency of the keyword. The closer the circles are, the more often the two keywords found in the same publications

- China, United States of America, and United Kingdom are the major contributors in this field
- Henan Polytechnic University, Delft University of Technology and National Institute for Occupational Safety and Health are the top institutions that are carrying out the dust explosion research
- 2021 is the most annual scientific production regarding dust explosions followed by the year 2022 and 2017
- Journal of Loss Prevention in the Process Industries, Powder Technology, Journal of Hazardous Materials, and Process Safety and Environmental Protection are the major sources of publications related to dust explosions
- The research topic of dust explosions mainly evolves into three aspects: explosion characteristics and influencing factors, explosion suppression, and types of dust particles

CONCLUSION

Our bibliometric analysis sheds light on the evolving landscape of dust explosion research. There has been a significant increase in research articles during this period, with China, United States, and United Kingdom leading in research productivity. International collaboration among institutions is essential for advancing this field. Key journals and prolific authors have been identified, aiding researchers in navigating the literature. Emerging trends encompass the study of particle size effects, the exploration of new materials for dust explosion mitigation, and the application of numerical simulation techniques. These insights are crucial for researchers and stakeholders seeking to enhance safety measures in industries susceptible to dust explosions.

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NUKLEAR MALAYSIA

NTC

SIMULATION ON PERFORMANCE OF MALAYSIA NUCLEAR AGENCY – PLASMA FOCUS (MNA-PF) WITH VARIATION LENGTH OF INNER ROD ELECTRODE FOR PLASMA FOCUS DEVICE

Abd Halim bin Baijan, *Mohd Faiz bin Mohd Zin, Rokiah bt Mohd Sabri, Leo Kwee Wah,Dr, Puteri Nuraliah Husna Binti Mohd Tajuddin, Azhar Bin Ahmad, Mukhlis B. Mokhtar, Mohammad Karimi bin Manawir and Mohd Noor Shafeek bin Jaafar.*

ABSTRACT

Malaysia Nuclear Agency-Plasma Focus (MNA-PF) device with a typical inner rod electrode would give approximately 3 kJ of energy. A different length of electrode would give a different focusing factor thus a different energy would be produced. This simulation would give a rough idea on different length electrode would do to the energy of the plasma focus.

INTRODUCTION

Plasma focus device uses a strong magnetic field to compress a plasma at the end of the anode which is called a "pinch" with a slight distance from the anode. The MNA-PF is a Mather type plasma focus follows the UNU/ICTP PFF model with the energy of between 2 kJ to 3 kJ. The UNU/ICTP PFF is a UNU Training Programme On Plasma And Laser Technology which was conducted from October 1985 to April 1986 at the University of Malaya [1].

Comparing the design of two type of plasma focus which is Filipov and Mather type, the Mather type design has a longer electrode than the Filipov type, thus it would give a strong focusing action. The strong focusing action is important on producing a strong neutron yield [2].

EXPERIMENTAL SETUP

The schematic drawing of plasma focus device basically is shown in Figure 1. The anode which is in the middle of the circular brass plate is attach to the positive terminal of the capacitor. The 6 cathode rods were attached to the brass plate which is grounded to the earth terminal.

The inner and 6 outer electrodes was made from copper with a diameter of approximately 20 mm and 9.4 mm respectively. The distance between the inner and the outer was approximately 40mm. The length of the electrodes was 15 cm. These parameters were fixed and the result of the plasma focus experiment obtained as it is. In order to know what the result might be if the parameter were different a simulation by using a fitting software called Lee Code were done. The variation of the electrode length vary from 10 cm, 15 cm and 20 cm will be simulate.

Picture 1: Plasma Focus in Malaysia Nuclear Agency

Picture 2: Electrodes of Plasma Focus device

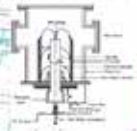

Figure 1: The Schematic Diagram of Plasma Focus device [3].

Lee Code Simulation

Figure 2: Screen shot of Lee Code program RADPFV5.15FIB

RESULT AND DISCUSSION

Output for argon as filling gas							
Anode length (cm)	Parameters						
	*Stored Energy, E_0 (kJ)	*Maximum current, I_{max} (kA)	*Minimum pinch radius, r_{min} (cm)	*Temperature at pinch (10^6 K)	*Ion density at pinch (10^18/cm^3) (Argon ion)	*Duration of plasma pinch (ns)	*Number of ions per shot (10^12) (Argon ion)
10 (computed)	2.16	81	0.06	0.84	8.4	19.7	9.2
15 (Mean)		85	0.09	0.8	8.5	19.7	9.2
20 (computed)		82	0.07	0.39	9.8	38.4	4.8

Result for the Argon gas simulation

Output for deuterium as filling gas						
Anode length (cm)	Parameters					
	Stored Energy, E_0 (kJ)	Maximum current, I_{max} (kA)	Minimum pinch radius, r_{min} (cm)	Temperature at pinch (10^6 K)	*Duration of plasma pinch (ns)	*Neutron yield, Y_n
10 (computed)	2.94	86	0.035	0.28	39.7	5183
15 (Mean)		88	0.036	0.3	39	5168
20 (computed)		88	0.058	0.27	41.4	684

Result for the Deuterium gas simulation

CONCLUSION

The energy produced for Argon gas with capacitor charging voltage of 13 kV and 30uF would gave 2.16 kJ. The variation length of the electrode shows the significant variation of pinch parameters of plasma. The pinch temperature would be reduced when the electrode length was longer. For 20 cm electrode the pinch temperature was 0.59 x 10^6 K. While for the 10 cm and 15 cm electrode the pinch temperature was around 0.8x10^6 K. The numbers of ion per shot also gave quite big difference when the electrode length was longer. For 20 cm electrode the number of ions per shot was 6.8x10^{12} ions, Whereas 10 cm and 15 cm electrode length the number of ions per shot were around 9.7x10^{12} and 9.2x10^{12} ions respectively.

Deuterium gas simulation with capacitor charging voltage of 14 kV and 30uF produced the energy of 2.94 kJ. The pinch temperature of the 20 cm electrode for Deuterium gas simulation also showed a significant decreased. The 20 cm electrode was 0.27x10^6 K and for the 10 cm and 15 cm electrodes were 0.28x10^6 K and 3.0x10^6 K respectively. The neutron yield per shot simulation showed the 20 cm electrode length gave the lowest neutron yield which is 684 neutrons only whereas for the 10 cm and 15 cm electrode length the neutron yield were 5183 and 5168 neutrons per shot respectively. The neutron yield was the most important parameter for activation and transmutation experiment.

ACKNOWLEDGEMENTS

We would like to thanks to Accelerator Development Centre staff and colleague for all the help and effort on producing this paper. We also would like to express our gratitude to Malaysia Nuclear Agency on providing us all the needs we need.

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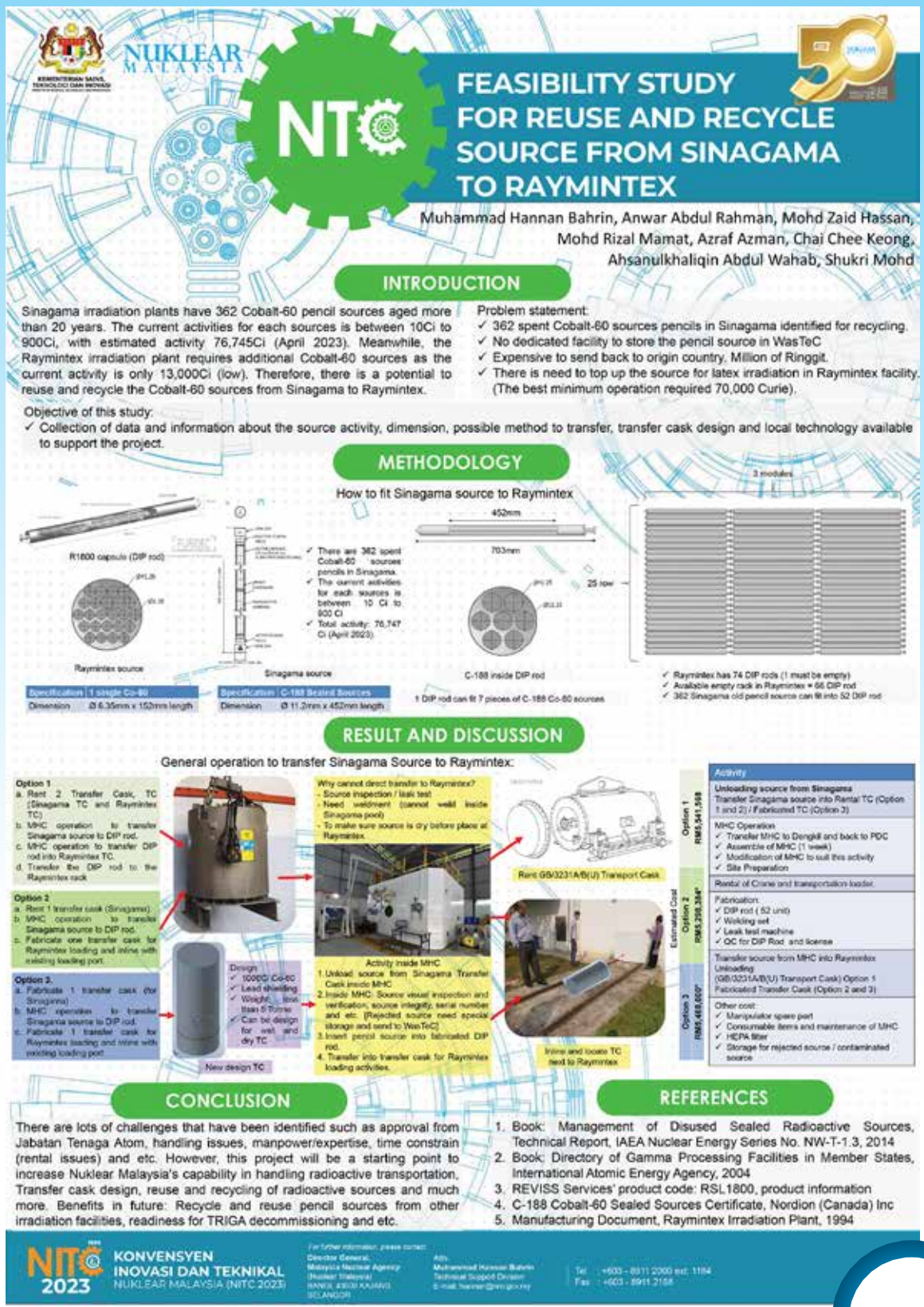
NUKLEAR MALAYSIA
NTC
FEASIBILITY STUDY FOR REUSE AND RECYCLE SOURCE FROM SINAGAMA TO RAYMINTEX
Muhammad Hannan Bahrin, Anwar Abdul Rahman, Mohd Zaid Hassan, Mohd Rizal Mamat, Azraf Azman, Chai Chee Keong, Ahsanulkhaliqin Abdul Wahab, Shukri Mohd
INTRODUCTION
Sinagama irradiation plants have 362 Cobalt-60 pencil sources aged more than 20 years. The current activities for each sources is between 10Ci to 900Ci, with estimated activity 76,745Ci (April 2023). Meanwhile, the Raymintex irradiation plant requires additional Cobalt-60 sources as the current activity is only 13,000Ci (low). Therefore, there is a potential to reuse and recycle the Cobalt-60 sources from Sinagama to Raymintex.
Problem statement:
✓ 362 spent Cobalt-60 sources pencils in Sinagama identified for recycling.
✓ No dedicated facility to store the pencil source in WasTeC
✓ Expensive to send back to origin country. Million of Ringgit.
✓ There is need to top up the source for latex irradiation in Raymintex facility. (The best minimum operation required 70,000 Curie).
Objective of this study:
✓ Collection of data and information about the source activity, dimension, possible method to transfer, transfer cask design and local technology available to support the project.
METHODOLOGY
How to fit Sinagama source to Raymintex
R1800 capsule (DIP rod)
Raymintex source
Sinagama source
452mm
703mm
25 row
3 modules
✓ There are 362 spent Cobalt-60 sources pencils in Sinagama.
✓ The current activities for each sources is between 10 Ci to 900 Ci
✓ Total activity: 76,747 Ci (April 2023)
C-188 inside DIP rod
1 DIP rod can fit 7 pieces of C-188 Co-60 sources
✓ Raymintex has 74 DIP rods (1 must be empty)
✓ Available empty rack in Raymintex = 66 DIP rod
✓ 362 Sinagama old pencil source can fit into 52 DIP rod
RESULT AND DISCUSSION
General operation to transfer Sinagama Source to Raymintex:
Option 1
a. Rent 2 Transfer Cask, TC (Sinagama TC and Raymintex TC)
b. MHC operation to transfer Sinagama source to DIP rod.
c. MHC operation to transfer DIP rod into Raymintex TC.
d. Transfer the DIP rod to the Raymintex rack
Option 2
a. Rent 1 transfer cask (Sinagama)
b. MHC operation to transfer Sinagama source to DIP rod.
c. Fabricate one transfer cask for Raymintex loading and inline with existing loading port.
Option 3.
a. Fabricate 1 transfer cask (for Sinagama)
b. MHC operation to transfer Sinagama source to DIP rod.
c. Fabricate 1 transfer cask for Raymintex loading and inline with existing loading port
Design
✓ 1000Ci Co-60
✓ Lead shielding
✓ Weight: less than 5 Tonne
✓ Can be design for wet and dry TC
New design TC
Why cannot direct transfer to Raymintex?
- Source inspection / leak test
- Need weldment (cannot weld inside Sinagama pool)
- To make sure source is dry before place at Raymintex
Activity inside MHC
1. Unload source from Sinagama Transfer Cask inside MHC
2. Inside MHC: Source visual inspection and verification, source integrity, serial number and etc. (Rejected source need special storage and send to WasTeC)
3. Insert pencil source into fabricated DIP rod.
4. Transfer into transfer cask for Raymintex loading activities.
Rent GB/3231A/B(U) Transport Cask
Inline and locate TC next to Raymintex
Activity
Unloading source from Sinagama
Transfer Sinagama source into Rental TC (Option 1 and 2) / Fabricated TC (Option 3)
MHC Operation
✓ Transfer MHC to Dengkil and back to PDC
✓ Assemble of MHC (1 week)
✓ Modification of MHC to suit this activity
✓ Site Preparation
Rental of Crane and transportation loader
Fabrication:
✓ DIP rod (52 unit)
✓ Welding set
✓ Leak test machine
✓ QC for DIP Rod and license
Transfer source from MHC into Raymintex
Unloading
(GB/3231A/B(U) Transport Cask) Option 1
Fabricated Transfer Cask (Option 2 and 3)
Other cost
✓ Manipulator spare part
✓ Consumable items and maintenance of MHC
✓ HEPA filter
✓ Storage for rejected source / contaminated source
Option 1 RM5,541,598
Option 2 RM5,208,384*
Option 3 RM5,469,600*
Estimated Cost
CONCLUSION
There are lots of challenges that have been identified such as approval from Jabatan Tenaga Atom, handling issues, manpower/expertise, time constrain (rental issues) and etc. However, this project will be a starting point to increase Nuklear Malaysia's capability in handling radioactive transportation, Transfer cask design, reuse and recycling of radioactive sources and much more. Benefits in future: Recycle and reuse pencil sources from other irradiation facilities, readiness for TRIGA decommissioning and etc.
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NTC 2023
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

SPENT FUEL DISPOSAL SCENARIOS OPTION FOR REACTOR TRIGA PUSPATI (RTP)

Muhammad Khairul Ariff bin Mustafa, Julia binti Abdul Karim, Tonny anak Lanyau, Mohd. Fairus bin Abdul Farid, Ahmad Nabil bin Ab Rahim, Phongsakorn a/l Prak Tom, Na'im Syauqi bin Hamzah, Rohyizah binti Ba'an, Kang Wee Siang

INTRODUCTION

RTP has been in safe operation since 1982. For over 40 years, various experiments and utilizations has been conducted in RTP. RTP used standard TRIGA fuel element (FE). The fuels have been remained in the reactor core since it first criticality. When reactor need to be decommissioned, all the FE will be removed from the reactor and will be managed as the spent fuel also categorized as high-level waste (HLW). As Malaysian did not participate in Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (FRR-SNF-AP), Nuklear Malaysia has responsibility to manage all the spent fuel in facility. These scenarios have been modelled in BRIDE Tool (Back end Research reactor Integrated Decision-making Evaluation) introduced to Malaysia by IAEA in 2022 as a pilot project. BRIDE tool is a decision-making tool and the output may help the government to select the best option for the nuclear spent fuel disposal in the country.

METHODOLOGY

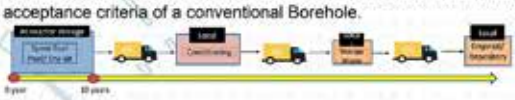
- BRIDE is a multi-attribute utility methodology and can be used to compare options for research reactor (RR) spent nuclear fuel (RRSNF) disposition, combining factors that are non-economic with the cost estimate to determine the optimum option.
- The steps comprise screening of an initial scenario set to eliminate scenarios that are not viable and weighing the remaining scenarios against cost and several non-economic factors to arrive to a preferred scenario.
- BRIDE is structured such that the strengths and potential weaknesses of each scenario, along with measures that can remediate weaknesses, are identified during the evaluation.

RESULT AND DISCUSSION

- **Scenario 1** – Direct Disposal in Borehole/ Geologic Repository. After the reactor stops operating and a cooling period of 5 years at the reactor site, SNF is transported to its immediate disposal of SNF in a Deep Borehole facility.

- **Scenario 2** - Interim Storage, Borehole/ Geologic Repository. After a cooling period of 5 years at the reactor spent fuel, the SNF is placed in a dry storage for 10 years, followed by transportation to disposal in a Deep Borehole facility.

- **Scenario 3** – Conditioning and Borehole. During dry storage, a conditioning facility is built to bring the SNF into a simplified form. Efforts would be made so that the conditioned form meets the acceptance criteria of a conventional Borehole.



- **Scenario 4** – Reprocess and receive ILW. Engage the commercial reprocessing services of a third party who would return the equivalent intermediate level waste in a conditioned form.

- **Scenario 5** – Transfer of waste. Engage the commercial reprocessing services of a third party to take full possession of the SNF, without waste return.

CONCLUSION

- RTP has been in operation for more than 4 decade.
- All the spent fuel will be managed by the Nuklear Malaysia.
- BRIDE Tool will help government to choose the best option including the costing for managing the spent fuel.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

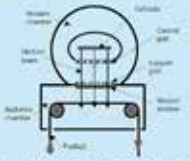
NTC

PROGRESS ON TROUBLESHOOTING AND RESTORATION OF THE CURETRON LOW VOLTAGE ELECTRON BEAM ACCELERATOR

Khairul Azhar Abdul Halim, Ahmad Zuhdi Mohd On, Abdul Muizz Mohd Sani, Mohammad Karimi Manawir, Mohd Noor Shafeek Jaafar, Naurah Mat Isa and Leo Kwee Wah

INTRODUCTION

The Curetron machine, acquired in 1991, played a vital role in radiation processing research for Malaysian Nuclear Agency until it became inoperable in 2012 due to a vacuum system breakdown. This presentation highlights the troubleshooting and repair efforts, including extensive maintenance work, carried out since 2016.



A low-energy electron beam (EB) accelerator operates by generating free electrons through heated tungsten cathode in a vacuum. These electrons are accelerated and deflected to an exit window. In the radiation chamber, they become electron beams that interact with the product.

TROUBLESHOOTING AND MAINTENANCE PROGRESS

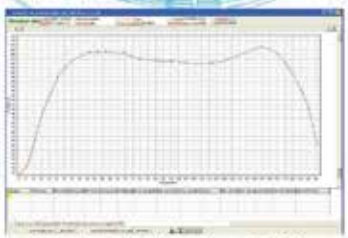
Electron gun

Inside vacuum chamber

Filament assembly

Replacement of broken filament assembly

Testing Curetron functionality using makeshift dosimeter due to faulty sample transport mechanism



Curetron able to achieve 60 kGy

Vacuum system

Serviced rotary pump

Reestablishing cooling of turbo molecular pump

Replacement of vacuum gauges & titanium foil window

Sample transport mechanism

Sample transport remain faulty, require further maintenance

Conveyor & PLC

Bypass PLC interlocks via MELSEC MEDOC software

Conveyor restored

Pneumatics

Upgrade to 2 hp air compressor and replacement of all brittle pneumatics hoses and faulty pneumatic valves

CONCLUSION

In summary, significant progress has been made in repairing the Curetron machine, addressing vacuum, cooling, and conveyor system issues. Repair work involved fixing vacuum leaks, reconnecting cooling, and replacing components, including the electron gun. However, the machine remains non-functional due to issues encountered at sample transport mechanism, and further maintenance is required. The repair challenges highlight the importance of ongoing maintenance and expertise for electron beam accelerators. Future efforts should focus on resolving remaining issues and investing in technical expertise for a complete restoration of the Curetron machine.

NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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RADIATION METROLOGY GROUP (KMS); TECHNICAL SERVICE ACHIEVEMENTS THROUGHOUT ITS ESTABLISHMENT

M. K. Matori, H. Salleh, A. B. A. Kadir, W. H. Ismail, A. Ripin, H. Sham, J. K. Sangau, A. Hashim, T. Dolah, N. M. Isa, T. A. T. Ahmad, N. Abdullah, R. A. Rahim, N. F. S. A. Hamid

INTRODUCTION

The Radiation Metrology Group (KMS), established in 2015, is the result of a merger between the Medical Physics Laboratory (MPL) and the Standard Secondary Dosimetry Laboratory (SSDL) where the objective of the merger is to provide quality technical services in radiation metrology on par with international laboratories. MPL and SSDL laboratories are laboratories recognized as national standard laboratories for ionizing radiation to meet the requirements of Act 304 (Atomic Energy Licensing Act 1984), Act 514 (Occupational Safety and Health Act 1994), and Act 675 (National Measurement System Act 2007). Nuklear Malaysia is the only government agency responsible for providing facilities for ionizing radiation standards, class H license services, and offering various dosimetry services such as calibration of radiation measuring devices and personal dosimetry in this country.

MATERIAL & METHOD

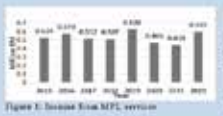
The KMS is a group under the Radiation Safety and Health Division (BKS) that is heavily involved in providing technical services and training in the field of radiation metrology. BKS provide technical support services to domestic and foreign customers. Table 1 show the technical services offered by the MPL and SSDL respectively.

Table 1: Services offered by the Radiation Metrology Group (KMS)

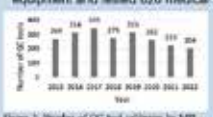
MPL	SSDL
i. Calibration Services; • dosimeters used in diagnostic radiology ii. Testing and verification; • all types of Medical X-ray modalities and irradiation room (MOH class H license) iii. Radiation Protection Service; • PPE integrity testing • Radiation protection monitoring iv. Nuclear Medicine Calibration Service; • Thyroid counter calibration • Dose calibrator v. Medical Physics Consultation.	i. Calibration Services; • Calibration of Survey Meters and Dosimeters (Protection Level) • Calibration of Ionization Chambers (Protection Level and Therapy Level) • Calibration of Personal Dosimeter (Pocket & Alarm) ii. Supply and evaluation of Personal and Area Dosimeter Services; • TLD Service • OSL Service iii. High Dose Dosimetry Services; • Ceric-cerous dosimeter service • Fricke dosimeter service iv. SSDL Service Quality Assurance; • National Inter Laboratory Dose Comparison • ISO Quality Management System Consultant

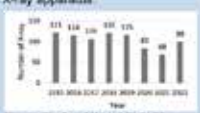
RESULT AND DISCUSSION

Figures 1 and 2 show the annual income achievement for services obtained for MPL and SSDL for 2015 – 2022. The Covid-19 pandemic affected MPL and SSDL's income in 2020. RM 24.84 million earned from KMS during the eight years established KMS. KMS customer's from overseas include Indonesia, Nepal, India, Philippines, Singapore, Thailand, Brunei, Sri Lanka, and UAE.



2015 - 2022, MPL calibrated 2207 diagnostic radiology test equipment and tested 828 medical X-ray apparatus.

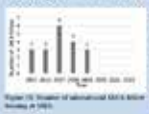


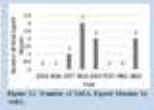


In 2015 - 2022, MPL calibrated 433 dose calibrator devices and tested 723 X-ray rooms.

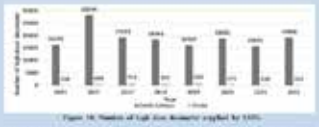
2015 - 2022, SSDL supplies OSL-type personal dosimeters of 1372297 units, 116907 units of TLD type, 106496 units of TLD type chip, and 7742 units of nanodot type.

2015 - 2022, a total of 19 IAEA fellows undergo training at SSDL, and SSDL officers conduct 8 IAEA Specialist missions.





2015 - 2022, SSDL supplied 151746 high-dose dosimeters of Cedric Cerros type and 3953 units of Fricke type.



2015 - 2022, SSDL has calibrated 26609 units of survey meters and 875 dosimeters for radiotherapy use.

2015 - 2022, over 150 students underwent industrial training programs, implementing final year projects for Bachelor's programs, master's and Ph.D. projects, and PGEC projects. KMS must continue moving forward, including planning to expand measurement capabilities in radiation dosimetry to the primary level (PSDL). In RMK-12, some additional equipment has been and will be acquired to upgrade the existing laboratory facilities as the National Radiation Metrology Center and be equipped with equipment and facilities to meet customers' growing needs.

CONCLUSION

KMS as a Designated Institute (DI) in ionizing radiation measurement shows the recognition of KMS as a national reference center for ionizing radiation standards in Malaysia and one of the highest revenue-generating service centers in NUKLEAR MALAYSIA.

ACKNOWLEDGEMENTS

Appreciation and gratitude to all employees and former staff of the Radiation Metrological Group (KMS). Do not forget the former KMS manager before Tn Hj Muhammad Jamal Md Isa and Ts Dr Husaini Salleh.

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KONVENSYEN INOVASI DAN TEKNIKAL

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NUKLEAR MALAYSIA

KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI

PENGIRAAN MASA IRADIASI BUAH NANGKA

(Irradiation Time Calculation for Jackfruits)

Mohd Rizal Bin Md Chulan, Syuhada Binti Ramli,
Wan Muhammad Ikram Bin Wan Ibrahim, Cosmos George, Zarina Binti Mohd Nor,
Shaiful Rizaidi Bin Mohd Yakin, Nor Ishadi Bin Ismail, Ahsanul Khaliqin Bin Abdul Wahab.

PENDAHULUAN

- Penyinaran buah segar seperti buah nangka termasuk juga di dalam proses penyinaran makanan. Oleh itu ianya tertakluk di bawah Akta Makanan 1983 (Peraturan-Peraturan Iradiasi Makanan 2011)
- Dos sinaran yang diperlukan bagi proses penyinaran buah-buahan segar mesti mengikut panduan yang telah ditetapkan seperti mana yang terdapat di dalam Jadual Ketiga Kelas 2 (Buah-buahan dan Sayur-sayuran Segar), Akta makanan 1983 (Peraturan-peraturan Iradiasi Makanan) mengikut tujuan rawatan dijalankan.
- Di dalam penyinaran buah nangka ini, tujuan rawatan adalah untuk kawalan kurantin (membunuh segala serangga) pada buah tersebut. Jadi, dos sinaran yang diperlukan adalah antara 0.15 kGy hingga 1.0 kGy.
- Untuk kemudahan sinaran gama di MINTec-SINAGAMA, dos sinaran untuk tote komersial ditentukan oleh masa iradiasi untuk satu pusingan untuk 18 kedudukan. Oleh itu masa iradiasi ini perlu ditentukan atau dikira untuk mendapatkan dos terserap yang diperlukan untuk satu pusingan.
- Kaedah yang digunakan untuk pengiraan tersebut adalah dengan menggunakan prinsip perlindungan sinaran dimana dos yang terhasil berkadaran dengan masa. Untuk pengiraan tersebut, nilai perkadaran dos telah didapati daripada pemetaan dos sinaran satu rak punca Co-60 dengan menggunakan 'dummy'.

METODOLOGI

Pemetaan Dos 'Dummy'

PENGIRAAN MASA IRADIASI SATU KEDUDUKAN TOTE
(Dos terhasil ∝ masa)
Dos = kadar dos X masa

Penyinaran Buah Nangka

KEPUTUSAN DAN PERBINCANGAN

<u>Pengiraan Masa Iradiasi Satu Kedudukan Tote</u>

Daripada Pemetaan Dos 'dummy',
Kadar dos terhasil = 3.95 kGy/pusingan untuk masa, t_{18} = 324 minit (untuk 18 kedudukan)
Oleh itu, Dos = kadar dos X t_{18}
0.5 kGy = 3.95 kGy/324 minit X t_{18}
Maka, t_{18} = 41.013 minit (untuk 18 kedudukan)
maka masa untuk 1 kedudukan, t_1 = **2 minit 17 saat**

<u>Penyinaran Buah Nangka</u>

	Dose (Gy)											
	Average			Standard deviation			Actual			Reference		
	Tote 1	Tote 2	Tote 3	Tote 1	Tote 2	Tote 3	Tote 1	Tote 2	Tote 3	Tote 1	Tote 2	Tote 3
D_{min}	512.7	486.0	517.8	53.2	51.9	49.4	409.1	411.5	416.2	568.9	601.7	691.0
	Average = 505.5			Average = 51.5			Average = 412.3					
D_{max}	668.7	651.6	665.4	40.1	47.4	28.5	747.4	759.1	700.4			
	Average = 663.9			Average = 38.7			Average = 735.6					
Uniformity (U)							1.83	1.84	1.68	Average = 620.5		
							Average = 1.78					

Daripada Jadual di atas, didapati julat untuk dos terserap adalah antara 0.41 kGy dan 0.74 kGy.
Sumber dari Product Dose Mapping Report oleh Dr. Ahmad Zainuri.

- Pemetaan Dos 'dummy' mesti dilakukan dahulu sekiranya terdapat perubahan pada parameter penyinaran biasa seperti bilangan rak punca digunakan supaya ianya boleh dijadikan sebagai rujukan.
- Pengiraan masa iradiasi ini perlu dilakukan kerana dos terserap yang telah ditetapkan untuk satu pusingan iaitu lebih kurang 3 kGy adalah berbeza dari dos terserap (dos minimum 0.5 kGy) yang diperlukan untuk penyinaran buah Nangka dan begitu juga bilangan rak punca yang digunakan berbeza iaitu 2 unit rak punca untuk penyinaran biasa berbanding satu unit rak punca untuk penyinaran buah Nangka.
- Oleh kerana aktiviti punca telah berkurang dan dari jadual "Timer Setting Change Control" didapati masa perlu ditambah lebih kurang 5 saat [15/9/22 (0:06:53) dan 15/10/22 (0:06:58)] dan juga oleh kerana masa yang perlu diambil untuk pergerakan tote, maka masa penyinaran untuk satu (1) kedudukan untuk buah nangka dicadangkan ialah 3 minit.
- Penggunaan dosimeter yang berbeza di dalam proses pemetaan dos dummy (dosimeter ceric-cerous) dan penyinaran buah Nangka (dosimeter opti-chromic) adalah kerana terdapat julat dos yang berbeza di antara kedua-dua dosimeter. Dosimeter ceric-cerous mempunyai julat dos antara 1.0 kGy hingga 1000 kGy di mana ianya lebih sesuai digunakan untuk penyinaran dos yang tinggi seperti di dalam pemetaan dos dummy. Manakala dosimeter opti-chromic mempunyai julat dos antara 10 Gy hingga 10 kGy di mana ianya lebih sesuai untuk penyinaran dos yang rendah seperti di dalam penyinaran buah Nangka.

KESIMPULAN

Daripada pengiraan masa iradiasi untuk satu kedudukan tote dan keputusan bacaan dos terserap untuk penyinaran buah Nangka, didapati masa yang dicadangkan iaitu 3 minit berjaya menghasilkan julat dos terserap antara 0.41 KGy dan 0.74 kGy. Ini memenuhi julat dos terserap untuk buah segar (Nangka) untuk tujuan kawalan kurantin iaitu antara 0.15 kGy dan 1.0 kGy.

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NUKLEAR MALAYSIA
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Influence of preservatives on the stability of CarraPGP
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INTRODUCTION
Product stability is crucial in product development process which investigated through storage study. The storage study determines product shelf life, product safety and efficacy, optimal storage condition and assuring the product overall quality for consumers. The factors of time and storage conditions including temperature, humidity, light exposure, and atmospheric pressure possibly influence the product stability.
The low molecular weight k-carrageenan solution (CarraPGP) which has potential as plant growth promoter is developed through radiation processing technology at Nuclear Malaysia. The gamma radiation induces chain-scission reaction of k-carrageenan to produce low molecular weight k-carrageenan. As a shorter-chain of complex carbohydrate-based substance, the CarraPGP has high tendency to deterioration during storage.
This study was conducted to observe the influence of sodium benzoate (E211) and EDTA, respectively on the stability of CarraPGP over time and storage conditions. The E211 and EDTA were added into the CarraPGP at concentrations of 500, 750 and 1000 ppm, respectively. Then the CarraPGPs were placed at (i) outside the building with direct sunlight exposure, (ii) in dry and dark room and (iii) in cool and dry room. The sampling of CarraPGP samples was carried out every two months for 6 months. The stability of the preserved CarraPGPs were evaluated in terms of pH value, viscosity and microscopic image of particle size and distribution.
METHODOLOGY
Preparation of CarraPGP
Addition of E211: 500 ppm, 750 ppm, 1000 ppm
Addition of EDTA: 500 ppm, 750 ppm, 1000 ppm
The sample bottles were placed at, from left (i) outside the building, direct sunlight exposure; (ii) in dry and dark room (iii) in cool and dry room.
Sampling for assessment every 2 months for 6 months
Sample evaluation on pH, viscosity (by rheometer) and microscopic image (by microscope).
RESULTS/OBSERVATIONS
SODIUM BENZOATE
EDTA
Basic salt preservative
Acid-based preservative
Initial pH range of CarraPGP
5.60 – 5.90
4.00 – 4.70
E211 basic-salt preservative and EDTA is acidic preservative, respectively. Addition of EDTA reduces the CarraPGP pH significantly compared to E211 insignificantly affect the CarraPGP pH (initial pH 5 – pH 6).
Content (ppm) of preservatives influences the pH stability of CarraPGP.
pH insignificantly influenced by storage ambient.
The microscopic image of CarraPGP particles with presence of E211 500 ppm (left) and EDTA 1000 ppm (right) respectively, after kept for 3 and 6 month at 3 different conditions.
The viscosity of CarraPGP with E211 500 ppm and EDTA 1000 ppm respectively, after stored at 3 different conditions after 3 and 6 months compare to initial viscosity.
CONCLUSION
E211 and EDTA are classified as food preservatives which reported as suitable for carrageenan preservation. The addition of E211 and EDTA at 500 and 1000 ppm, respectively preserve the stability of CarraPGP after kept at 3 different storage conditions.
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NUKLEAR MALAYSIA

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KIMPALAN KAPSUL DAN BEKAS PENYIMPANAN BAHAN RADIOAKTIF DSRS

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PENGENALAN

Malaysia adalah salah sebuah negara yang menggunapakai kaedah lubang gerek untuk melupuskan bahan radioaktif terkedap terpakai (DSRS). Sebelum memasukkan bahan radioaktif kedalam lubang gerek, kaedah yang dipanggil pengkondisian dijalankan terlebih dahulu keatas DSRS tersebut. Kaedah ini melibatkan susunan proses yang terdiri daripada proses pemilihan bahan radioaktif, pengkelasan mengikut jenis yang sama dimasukkan kedalam satu kapsul, dikimpal, pengujian kebocoran dan akhir sekali dimasukkan kedalam bekas penyimpanan sebelum dikimpal semula. Proses ini menggunakan pelbagai kit peralatan yang ditempah khas oleh Agensi Tenaga Atom Antarabangsa (IAEA) dan ditempatkan didalam sebuah kontena kapal. Kit peralatan yang dipanggil *Mobile Tool Kit Facility* (MTKF) ini dipinjam daripada IAEA oleh Malaysia. Salah satu proses didalam MTKF adalah proses kimpalan keatas kapsul radioaktif dan bekas penyimpanan. Proses kimpalan ini menggunakan peralatan kimpalan yang dibangunkan khas untuk projek lubang gerek, lanya adalah proses yang mengambil masa paling lama didalam kemudahan MTKF tersebut. Set mesin ini terdiri daripada dua bahagian iaitu mesin kimpalan *Tungsten Inert Gas* (TIG) dan mesin pengapit yang memutarkan kapsul dan bekas untuk proses kimpalan. Sistem kawalan kualiti dibina bersama mesin TIG bagi memastikan kualiti kimpalan yang adalah seperti yang telah ditetapkan iaitu 3mm bagi kapsul dan 6mm penuh bagi bekas penyimpanan. Peralatan ini hanya boleh dikendalikan oleh pengimpal bertauliah sahaja. Proses kimpalan ini melalui proses kawalan kualiti yang ketat supaya kapsul dan bekas penyimpanan daripada besi tahan karat (SS316) tersebut memenuhi piawaian antarabangsa yang ditetapkan.

KAEDAH

1. Proses mengenalpasti jenis kapsul dan bekas serta pemeriksaan kualiti

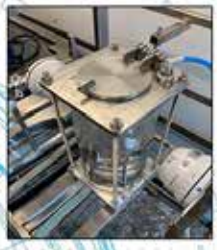
2. Pembersihan kapsul dan penutup

3. Kimpalan dilakukan secara automatik dan diawasi oleh pengimpal bertauliah.

4. Pemantauan berterusan semasa kimpalan melalui kamera dan paparan

5. Proses penyejukan dan pembersihan

6. Keputusan data kimpalan untuk tujuan kawalan kualiti



7 Ujian kebocoran (kapsul sahaja)

KEPUTUSAN

Kapsul dan bekas penyimpanan yang telah siap dikimpal sebelum dimasukkan kedalam lubang gerek.

KESIMPULAN

Proses kimpalan memainkan peranan penting untuk memastikan kebarangkalian kebocoran kapsul dan bekas penyimpanan adalah sangat rendah semasa ditanam didalam lubang gerek. Sebanyak 42 kapsul dan bekas penyimpanan telah berjaya dikimpal. Impak kepada kepada negara adalah kepakaran untuk melaksanakan kerja kerja kimpalan bahan radioaktif bagi tujuan selain pelupusan bahan radioaktif seperti guna semula bahan radioaktif untuk industri, kesihatan dan juga penyelidikan.

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NUKLEAR MALAYSIA

PENYENGGARAAN TETINGKAP SEL AKTIF MUDAH ALIH (MHC)

Muhamad Nor Atan, Muhammad Hannan Bahrin, Anwar Abdul Rahman, Mohd Zaid Hassan, Mohd Rizal Mamat, Azraf Azman, Wan Ismail Wan Yusof

Sel Aktif Mudah Alih (MHC)

PENGENALAN

Larutan Zink Bromida ($ZnBr_2$) digunakan sebagai perisai sinaran bagi tetingkap Sel Aktif Mudah Alih (MHC). Antara kriteria utama pemilihan larutan ini adalah larutan ini jernih, berketumpatan tinggi dan sesuai digunakan sebagai perisai sinaran.

Kenapa tetingkap MHC perlu diselenggara?

- ✓ Larutan menjadi keruh (selepas 2 tahun)
- ✓ Tahap penglihatan terganggu semasa mengendalikan MHC
- ✓ Penyenggaraan salutan cat pada tetingkap
- ✓ Pemeriksaan kebocoran pada tetingkap

Tetingkap MHC keruh

PROSES PENYENGGARAAN

1. Memindahkan $ZnBr_2$ ke dalam drum HDPE

2. Membuka *screw* dan menukar *gasket* tetingkap dalam dan luar

3. Membersihkan tetingkap dan mengecat* lapisan dalam tetingkap

*Nippon Black Arrocoat + Hardener

4. Memasang semula tetingkap dalam dan luar

5. Mengepam dan menapis* larutan $ZnBr_2$ sebelum masuk semula ke tetingkap

*Filter polypropylene: 25µm, 5µm, 0.2µm

HASIL PENYENGGARAAN

Tetingkap MHC menjadi lebih jernih

Pengendali menggunakan *Manipulator* MHC

KESIMPULAN

Penyenggaraan tetingkap MHC perlu dilakukan untuk memastikan larutan $ZnBr_2$ kekal jernih dan tidak menggangu tahap penglihatan pengendali MHC. Larutan $ZnBr_2$ tidak boleh disimpan didalam tetingkap dalam tempoh yang lama kerana sifat $ZnBr_2$ yang menghakis dan mudah teroksida. Oleh yang demikian, larutan $ZnBr_2$ perlulah dipindahkan semula ke drum penyimpanan setelah selesai penggunaanya.

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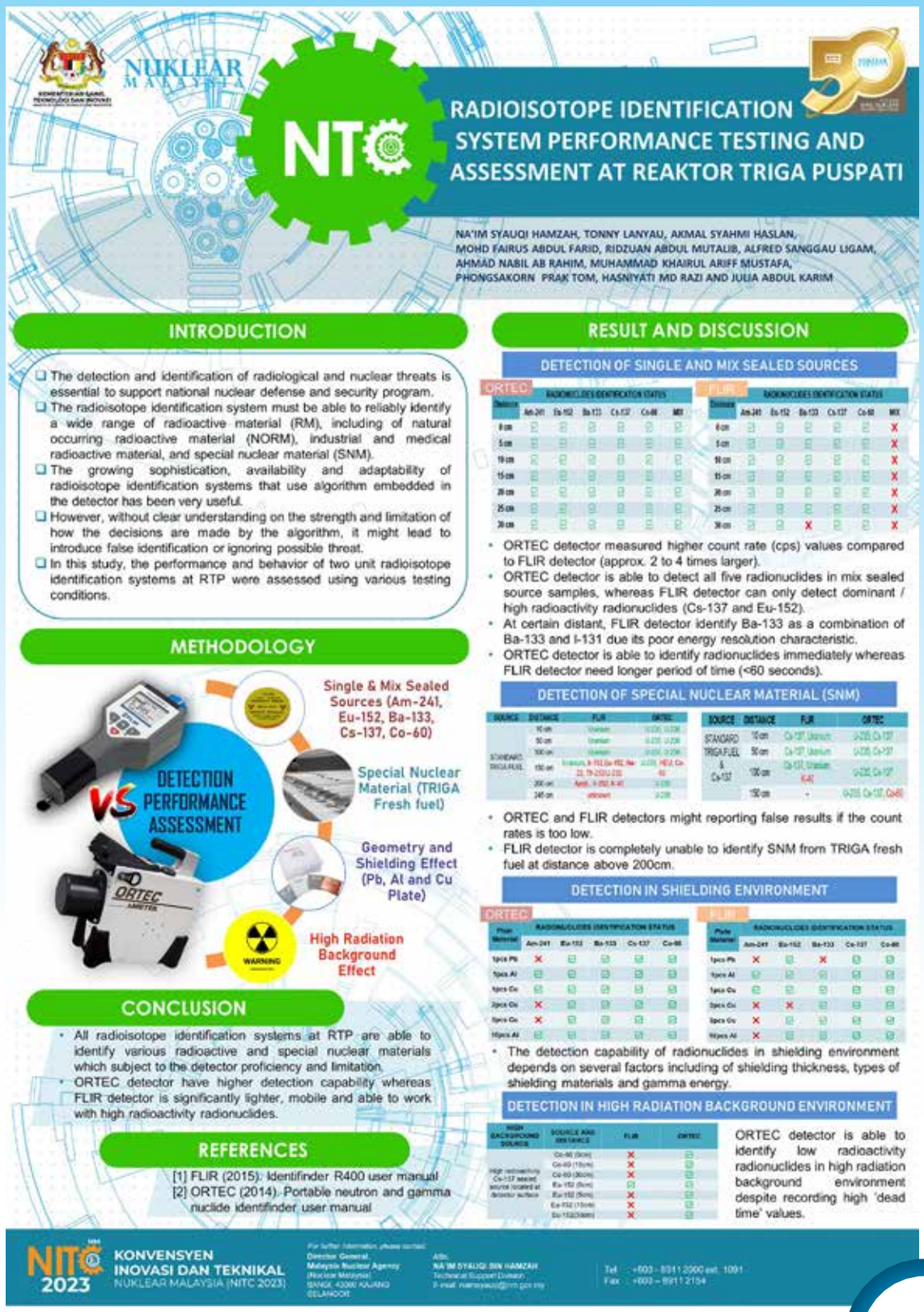

RADIOISOTOPE IDENTIFICATION SYSTEM PERFORMANCE TESTING AND ASSESSMENT AT REAKTOR TRIGA PUSPATI

NA'IM SYAUQI HAMZAH, TONNY LANYAU, AKMAL SYAHMI HASLAN, MOHD FAIRUS ABDUL FARID, RIDZUAN ABDUL MUTALIB, ALFRED SANGGAU LIGAM, AHMAD NABIL AB RAHIM, MUHAMMAD KHAIRUL ARIFF MUSTAFA, PHONGSAKORN PRAK TOM, HASNIYATI MD RAZI AND JULIA ABDUL KARIM

INTRODUCTION

- The detection and identification of radiological and nuclear threats is essential to support national nuclear defense and security program.
- The radioisotope identification system must be able to reliably identify a wide range of radioactive material (RM), including of natural occurring radioactive material (NORM), industrial and medical radioactive material, and special nuclear material (SNM).
- The growing sophistication, availability and adaptability of radioisotope identification systems that use algorithm embedded in the detector has been very useful.
- However, without clear understanding on the strength and limitation of how the decisions are made by the algorithm, it might lead to introduce false identification or ignoring possible threat.
- In this study, the performance and behavior of two unit radioisotope identification systems at RTP were assessed using various testing conditions.

METHODOLOGY

CONCLUSION

- All radioisotope identification systems at RTP are able to identify various radioactive and special nuclear materials which subject to the detector proficiency and limitation.
- ORTEC detector have higher detection capability whereas FLIR detector is significantly lighter, mobile and able to work with high radioactivity radionuclides.

REFERENCES

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[2] ORTEC (2014). Portable neutron and gamma nuclide identifinder user manual

RESULT AND DISCUSSION

DETECTION OF SINGLE AND MIX SEALED SOURCES

ORTEC

Distance	Am-241	Eu-152	Ba-133	Cs-137	Co-60	MIX
0 cm	☑	☑	☑	☑	☑	☑
5 cm	☑	☑	☑	☑	☑	☑
10 cm	☑	☑	☑	☑	☑	☑
15 cm	☑	☑	☑	☑	☑	☑
20 cm	☑	☑	☑	☑	☑	☑
25 cm	☑	☑	☑	☑	☑	☑
30 cm	☑	☑	☑	☑	☑	☑

FLIR

Distance	Am-241	Eu-152	Ba-133	Cs-137	Co-60	MIX
0 cm	☑	☑	☑	☑	☑	X
5 cm	☑	☑	☑	☑	☑	X
10 cm	☑	☑	☑	☑	☑	X
15 cm	☑	☑	☑	☑	☑	X
20 cm	☑	☑	☑	☑	☑	X
25 cm	☑	☑	☑	☑	☑	X
30 cm	☑	☑	X	☑	☑	X

- ORTEC detector measured higher count rate (cps) values compared to FLIR detector (approx. 2 to 4 times larger).
- ORTEC detector is able to detect all five radionuclides in mix sealed source samples, whereas FLIR detector can only detect dominant / high radioactivity radionuclides (Cs-137 and Eu-152).
- At certain distant, FLIR detector identify Ba-133 as a combination of Ba-133 and I-131 due its poor energy resolution characteristic.
- ORTEC detector is able to identify radionuclides immediately whereas FLIR detector need longer period of time (<60 seconds).

DETECTION OF SPECIAL NUCLEAR MATERIAL (SNM)

SOURCE	DISTANCE	FLIR	ORTEC
STANDARD TRIGA FUEL	10 cm	Uranium	U-235, U-238
	50 cm	Uranium	U-235, U-238
	100 cm	Uranium	U-235, U-238
	150 cm	Uranium, Ba-133, Eu-152, Na-22, Th-232, U-235	U-235, HEU, Co-60
	200 cm	Am-241, Ir-192, Eu-152, K-40	U-235
	245 cm	unknown	U-235

SOURCE	DISTANCE	FLIR	ORTEC
STANDARD TRIGA FUEL & Cs-137	10 cm	Cs-137, Uranium	U-235, Cs-137
	50 cm	Cs-137, Uranium	U-235, Cs-137
	100 cm	Cs-137, Uranium, K-40	U-235, Cs-137
	150 cm	-	U-235, Cs-137, Co-60

- ORTEC and FLIR detectors might reporting false results if the count rates is too low.
- FLIR detector is completely unable to identify SNM from TRIGA fresh fuel at distance above 200cm.

DETECTION IN SHIELDING ENVIRONMENT

ORTEC

Plate Material	Am-241	Ba-133	Cs-137	Co-60
1pcs Pb	X	☑	☑	☑
5pcs Al	☑	☑	☑	☑
1pcs Cu	☑	☑	☑	☑
2pcs Cu	X	☑	☑	☑
3pcs Cu	X	☑	☑	☑
10pcs Al	☑	☑	☑	☑

FLIR

Plate Material	Am-241	Eu-152	Ba-133	Cs-137	Co-60
1pcs Pb	X	☑	X	☑	☑
5pcs Al	☑	☑	☑	☑	☑
1pcs Cu	☑	☑	☑	☑	☑
2pcs Cu	X	X	☑	☑	☑
3pcs Cu	X	☑	☑	☑	☑
10pcs Al	X	☑	☑	☑	☑

- The detection capability of radionuclides in shielding environment depends on several factors including of shielding thickness, types of shielding materials and gamma energy.

DETECTION IN HIGH RADIATION BACKGROUND ENVIRONMENT

HIGH BACKGROUND SOURCE	SOURCE AND DISTANCE	FLIR	ORTEC
High radioactivity Cs-137 sealed source located at detector surface	Co-60 (0cm)	X	☑
	Co-60 (10cm)	X	☑
	Co-60 (30cm)	X	☑
	Eu-152 (0cm)	☑	☑
	Eu-152 (5cm)	X	☑
	Eu-152 (10cm)	X	☑
	Eu-152 (30cm)	X	☑

ORTEC detector is able to identify low radioactivity radionuclides in high radiation background environment despite recording high 'dead time' values.

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OPTICAL CONTACT ANGLE MEASUREMENT WITH TOPOGRAPHY: PRINCIPLE AND APPLICATION

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INTRODUCTION

OPTICAL CONTACT ANGLE WITH TOPOGRAPHY

- Combines contact angle analysis with surface topography measurements.
- Quantification of the contact angle which helps in understanding the wetting properties
- Examine surface characteristics impact on contact angle

CONTACT ANGLE MEASUREMENT

Figure 1. Schematic and real contact angle micrographs of hydrophilic, hydrophobic and super hydrophobic surfaces

AIMS

- Explores the utility of optical contact angle measurement with topography and its impact on surface characterization.
- To understand the potential of optical contact angle measurement and insight into wettability evaluation with topography in surface characterization.

THEORY

Young Laplace Theory:

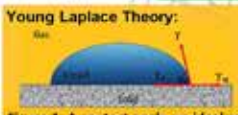


Figure 1. A contact angle on ideal solid surface determined by Young Theory

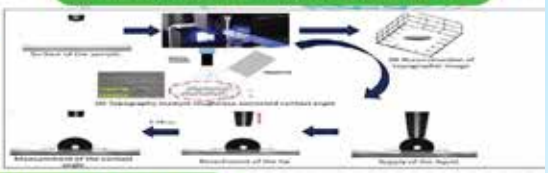
- This equation assuming the surface of the material is flat, chemically homogeneous and smooth (ideal surface).

Wenzel:

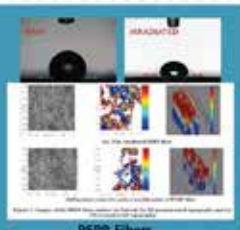
Figure 2. A contact angle on an actual surface material

- The influence of the surface roughness affected the measurement of contact angle which determined by Wenzel in 1936 and further by Cassie and Baxter in 1944

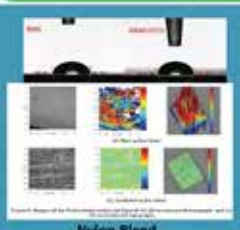
MEASUREMENT PROCEDURE & PRINCIPLE



DATA ANALYSIS BASED ON NATURE APPLICATION



PEPP Fibers



Nylon Blend

The morphology and roughness of PEPP fibers and Nylon blends were measured on a flat fracture surface at the dimension of 1.4 mm x 1.1 mm. Each surface was scanned five times and used as an evaluation index to identify the differences. The optical image, 2D, and 3D topography of fractured surfaces of the samples were reconstructed as shown in Figure 5 an 6. Some data for topography reconstruction was missing due to reflections, and the missing area was displayed as blank.

Table 1. Representative advanced contact angles with topography (Corrected Contact Angle)

Material	Contact Angle (°)	Corrected Contact Angle (°)
PEPP Fiber		
PEPP fiber	128.13	92.75
Radiation induced surface modification of PEPP fiber	116.66	91.44
Nylon Blend		
Nylon blend	89.43	89.98
Irradiated Nylon blend	98.17	97.65

According to Young's theory of 1805, the sample's surface of PEPP fiber is hydrophobic, despite decreasing contact angle. The corrected contact angle analysis measures contact angle based on surface roughness. Consequently, samples with uneven and porous surfaces tend to give lower angles, even though they are not hydrophilic in reality. The actual contact angle is determined by the relationship between surface roughness and wettability. This relationship was defined by Wenzel in 1936, with increased roughness enhancing wettability due to hydrophilic substances' surface composition. The roughness ratio is used to measure actual contact angle values.

CONCLUSION

Optical contact angle measurement and topographical analysis revealed the material affected by surface roughness based on real surfaces providing a comprehensive understanding of surface properties. However, limitations include the need for specialized equipment and potential biases from sample preparation and measurement techniques. Future research should explore the technique's application to different materials and applications. Combining these techniques could enhance surface characterization and contribute to advancements in various fields, including polymer surface modification.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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NUKLEAR MALAYSIA

NTC

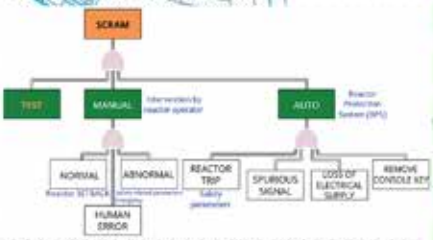
SIGNIFICANT FUNCTIONS OF SCRAM WITH ASSOCIATED ALARMS FOR REACTOR TRIGA PUSPATI (RTP) SAFE OPERATION

NURFARHANA AYUNI JOHA
Mohd Sabri Minhat, Zareen Khan Abdul Jalil Khan,
Mohd Khairulezwan Abdul Manan and Khairul Anwar Bapujee.

INTRODUCTION

The Reactor Protection System (RPS) at RTP is designed to detect any occurrence of abnormalities and protect the reactor from untoward incidents. In case of any abnormality, the protection logic generates a reactor trip signal that releases all control rods to be inserted into the core instantly and trip the reactor. This is called reactor **SCRAM**.
A reactor SCRAM is the rapid insertion or fall of all control rods into the core to instantaneously stop the fission chain reaction.

FUN FACTS!
Safety Control Rod Axe Man
Safety Cut Rope Axe Man
Super Critical Reactor Axe Man
Start Cutting Right Away, Man!



The SETBACK function allows all control rods to descend simultaneously at a maximum speed of 2 mm/s.

START-UP CHECKLIST
⇩
SCRAM TEST
• Manual SCRAM
• Power Power
• Short Period
• Fuel Temperature
• Pool Water level
⇩
CHECKED BY SRO/REACTOR MANAGER
⇩
CORE EXCESS & SHUTDOWN MARGIN CALCULATION
⇩
REACTOR OPERATION
The control rods are withdrawn from reactor core allowing the nuclear reaction to occur

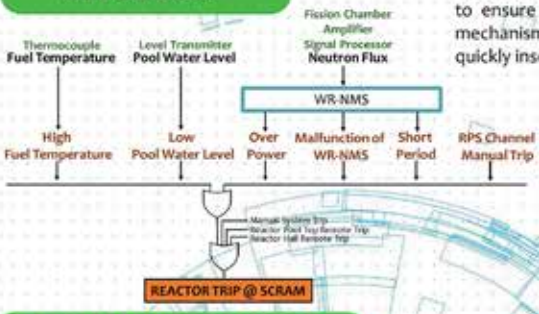
RTP Safety Parameters

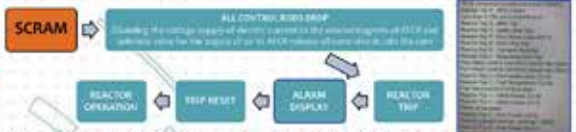
Trip Parameters	Trip Setpoints
Over Power	110% (1.1 MW)
Short Period	3 secs
High Fuel Temperature	500°C
Low Pool Water Level	Below 30 cm
Malfunction of WR-NMS	±5% of nominal operating voltage

The annunciators on the RPS panel are tested by pressing the lamp test switch.
Audible and visible alarms are verified to function during the SCRAM test procedure.
This allows failures to be detected before the reactor is brought into operation.

METHODOLOGY

The control rods are required to move slowly under normal working conditions to ensure the safety of the reactor; in the case of an accident, the driving mechanism can be automatically detached so that the control rods can be quickly inserted into the core by gravity.





The Control Rod Drive Mechanism (CRDM) able to control the startup and shutdown of the reactor, power change and fast reactivity change to protect the reactor.

RESULT AND DISCUSSION

- The SCRAM time measurement is carried out by withdrawing the control rod to the highest level and the time taken for the control rod to fall from fully up to fully down position is measured.
- It was found that all control rods drop for less than 2 seconds.
- It indicates the capability of the control rods to perform properly.

SCRAM Time Measurement

Year	Maintenance	Time taken to SCRAM (secs)			
		SH	SF	RG	TR
2023	Semi-annual	0.599	0.599	0.799	0.603
	Annual	0.599	0.591	0.602	0.601
2022	Semi-annual	0.400	0.600	0.600	0.400
	Annual	0.592	0.798	0.596	0.799
2021	Semi-annual	0.404	0.792	0.782	0.592
	Annual	0.403	0.802	0.791	0.396
2020	Semi-annual	0.604	0.598	0.799	0.601
	Annual	0.600	0.601	0.802	0.599
2019	Semi-annual	0.599	0.802	0.793	0.600
	Annual	0.403	0.599	0.599	0.602

CONCLUSION

Instrumentation and Control (I&C) system at RTP is well designed to initiate automatic and manual SCRAM for the primary purpose of protecting the reactor. The SCRAM test assures that the safety system channels are reliable and operable on a daily basis or prior to an extended run of RTP operation.

REFERENCE

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NUKLEAR MALAYSIA

NTC

KEY ELEMENTS OF THE AGEING MANAGEMENT FOR PUSPATI TRIGA REACTOR

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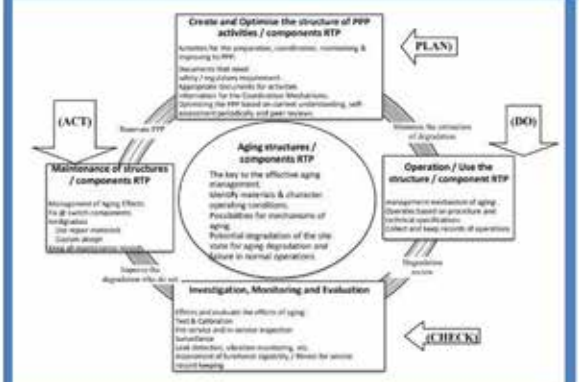
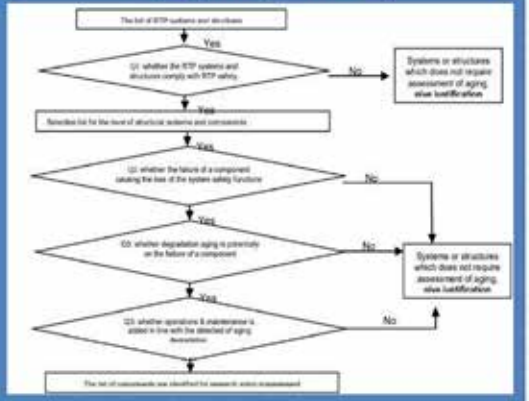
INTRODUCTION

PUSPATI TRIGA Reactor (RTP) operated for 41 years and have intention to keep the reactor in operation as long as technically feasible. The preconditions of the long-term operation are the safety and reactor in good condition. In the paper, the review of ageing management covers the structures, systems and components (SSCs). Key elements of ageing management are identified and described. Proper level of understanding of the ageing phenomena is reached and adequate ageing management programmes. The practice and solution of identified ageing management issues will ensure the safety of long-term operation of RTP.

The elements of the PDCA cycle in order to achieve a systematic Ageing Management Program in RTP



The selection process of the SSCs for the RTP ageing management study



Ageing/Failure Mechanism of Structures, Systems, Components of RTP

CONCLUSION

Significant for safe long-term operation structures, systems and components of RTP are identified. Proper level of understanding of the ageing phenomena is reached and adequate ageing management programs were developed for ensuring the required status and intended function for long-term. Ageing management programs of essential mechanical, electrical and I&C systems and components and building structures cover all important aspects of ageing.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

DESIGNING AND INSTALLATION OF INTERNET OF THINGS (IOT) SYSTEM FOR SMART MUSHROOM HOUSE

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Mohd Dzul Aiman Aslan[1], Nordin Salleh[1], Mohamad Fazreen Abdul Mutalib[1]
Mohd Hafiz Abd Nasir[1], Juhari Yasiran[2], Sani Mohamad[2] and Tan Pong Seng[2]

[1] Agensi Nuklear Malaysia
[2] Sky Aire Resources

INTRODUCTION

- Agrotechnology & Biosciences Division has received development expenditure (DE) allocation to build Smart Mushroom House in 2022.
- This Smart Mushroom House is important to study the potential of mushroom to be commercialized and as a reference center among the mushroom entrepreneurs.
- One of the features in Smart Mushroom House that has been developed was the use of the Internet of Things (IOT) system in parallel with industrial revolution (IR) 4.0.

OBJECTIVE

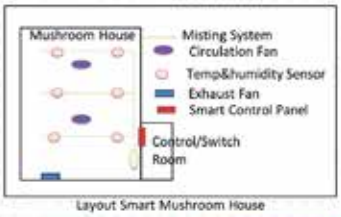
To describe the design process and advantages of IOT system for Smart Mushroom House

METHODOLOGY

RESULT & DISCUSSION

- 2 parameters have been successfully controlled: temperature (25 – 30°C), humidity level (65-80%RH) by installation of misting system, circulation and ventilation fan.
- Design has to follow Kawasan Larangan Dan Tempat Larangan 1959 act which is not allow to use outside cloud server unless approval given by CGSO&MAMPU.
- To resolve the issue, IOT system use local server (raspberry pi), but limited accessibility.

IoT architecture



Layout Smart Mushroom House

Control panel

Display on device

Advantages	Disadvantages
More efficient, increase productivity	Increase unemployment
Money and time saving	Expose to network attacks
Real-time Monitoring and Control	High dependency on internet
Minimize human effort	

Misting system and circulation fan

CONCLUSION

IOT system was successfully installed and has managed to control the temperature and humidity level in Smart Mushroom House. Hence, the R&D on mushroom can be carried out effectively.

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NUKLEAR MALAYSIA

NTC

CONCEPTUAL DESIGN OF STANDARD TANK FOR EVAPORATION RATE MEASUREMENT AT RTP SPENT FUEL POOL FACILITY

Tonny Anak Lanyau, Ahmad Nabil bin Abdul Rahim, Mohd Sabri bin Minhat, Julia binti Abdul Karim, Mohd Fairus bin Abdul Farid, Ridzuan bin Mutalib, Mohd Huzair Hussain, Muhammad Khairul Ariff bin Mustafa, Phongsakorn Prak Tom, Naim Syauqi Hamzah, Alfred Sanggau Anak Ligam, Mohammad Zulhelmi bin Mahadi, Nurfarhana Ayuni Joha, Shahril bin Mohd Shah, Mat Zin bin Mat Husin, Muh Kasim Abdul

INTRODUCTION

Evaporation Standard Tank (EST) has been designed and developed for evaporation rate measurement at RTP Spent Fuel Pool (SFP). The EST is installed to measure the water loss due to evaporation. The evaporation rate of the water inside the EST is used to estimate the evaporation rate of the spent fuel pool. Several factors that may influence the rate of evaporation have been considered such as ambient temperature, humidity, air flow and location inside the SFP building. Important design criteria to be considered are stability, loading, installation, sizing, material and fabrication limitation. This paper discussed the conceptual design of the EST.

METHODOLOGY

RESULT AND DISCUSSION

The proposal on the EST concept is considering the need on determination of evaporation rate at the SFP. The main function of the EST is to provide data on water level reduction at the multiple specified locations at the SFP. These data is used to estimate the average evaporation rate on timely manner. The estimation is important in operational monitoring of the SFP. The concept of EST proposed in this paper is considering the engineering limitations as well as for fabrication and installation. The geometry and proposed location of the EST is illustrated in the Figure 1. The material used is stainless steel plate. The thickness of the plate has to be determined through the static analysis considering the load by the water.

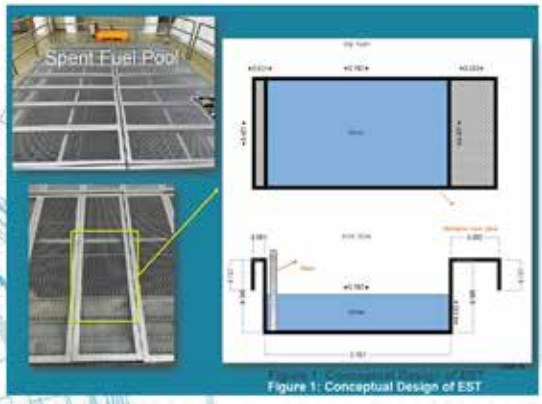

Figure 1: Conceptual Design of EST

CONCLUSION

The design of the EST has been developed to cater the need of the measurement on evaporation rate inside the SFP. The EST was designed to represent the actual size of the SFP. Further enhancement and analysis need to be done before the fabrication and installation of the EST to ensure the functionality and safety.

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NUKLEAR MALAYSIA

PENGUJIAN DAN PENTAULIAHAN PINTU PLUMBUM P2 DSRS

Mohd Zaid Hassan, Muhammad Hannan Bahrin, Mohd Rizal Mamat, Azraf Azman, Anwar Abdul Rahman, Wan Ismail Bin Wan Yusof, Muhamad Nor Bin Atan

Rajah 1. Pintu plumbum P2 DSRS

PENGENALAN

Kertas kerja ini menerangkan tentang proses pengujian dan pentauliahan pintu plumbum yang terdapat dalam rajah 1. Proses ini meliputi penilaian reka bentuk, pemantauan pembinaan, pemasangan sistem automasi dan pengujian kebocoran radiasi. Kajian kali ini memberi fokus kepada kaedah pengukuran lengkung pada permukaan pintu pada pemasangan di bilik perisai radiasi. Melalui kaedah pengukuran yang diperkenalkan dapat menjadi rujukan dalam penilaian terhadap prestasi reka bentuk pembuatan, kaedah pengangkutan dan pengangkatan semasa pemasangan pintu plumbum.

METADOLOGI

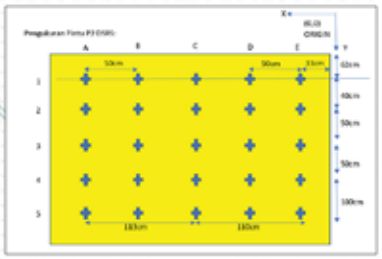
Terdapat dua jenis pengujian dan pentauliahan pada pintu plumbum, iaitu aspek perlindungan sinaran dan mekanikal seperti dalam Jadual 1.

PELINDUNGAN SINARAN	MEKANIKAL
a)Ketebalan bahan perisai	a) Fabrikasi dan pemasangan pintu plumbum mengikut spesifikasi dalam reka bentuk yang telah disahkan oleh ANM.
b)Jarak selisih (*overlap*) di antara pintu dan dinding	b) Integriti struktur melalui model reka bentuk dan simulasi.
c)Jarak jurang (*gap*) antara pintu dan dinding	c) Reka bentuk mempunyai ciri yang memudahkan proses senggara
d)Ujian kebocoran radiasi.	d) Sistem automasi yang teguh dan mempunyai ciri keselamatan saling mengunci (safety *interlock*) dan mudah di selenggara.
	e) Pergerakan yang lancar dan boleh digerakkan secara manual semasa terputus bekalan kuasa.

HASIL DAN PERBINCANGAN

Pentauliahan dan pengujian mekanikal telah dilaksanakan. Namun begitu terdapat lenturan pada permukaan pintu plumbum P2. Pengukuran lenturan secara relatif pada dilaksanakan menggunakan alat pengarasan laser seperti dalam rajah 2 dan rajah 3.Manakala keputusan pengukuran dipaparkan dalam jadual 1 dan ilustrasi lenturan permukaan dalam rajah 4.. Ujian kebocoran telah dijalankan oleh Bahagian Keselamatan Sinaran (BKS), Secara keseluruhannya, kadar dos yang didapati daripada pengukuran adalah lebih rendah berbanding dengan kaedah pengiraan (Raymond Yapp Tze Loong, 2022).

Rajah 2. Pengukuran relatif menggunakan alat pengarasan laser



Rajah 3. Koordinat rujukan bagi pengukuran relatif menggunakan alat pengarasan laser

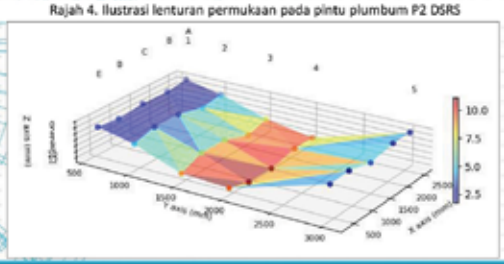
Jadual 1. Keputusan pengukuran relatif menggunakan alat pengarasan laser pada koordinat rujukan

Jarak (mm)	Lajur A	Lajur B	Lajur C	Lajur D	Lajur E	Nilai Purata	Nilai Reka bentuk	Beza (mm)	Beza (%)
Baris 1	30	29	32	33	29	30.60	30.60	0.00	0%
Baris 2	28	27	29	29	27	28.00	31.20	3.20	10%
Baris 3	24	22	25	25	22	23.60	31.95	8.35	26%
Baris 4	22	22	20	20	22	21.20	32.70	11.50	35%
Baris 5	33	33	37	35	33	34.20	34.20	0.00	0%

KESIMPULAN

Lenturan permukaan yang terdapat di kawasan Baris 3 dan Baris 4 menunjukkan bahawa beban tidak diagihkan dengan sempurna terhadap struktur pintu P2. Hal ini menunjukkan bahawa struktur pintu berubah semasa proses penuangan, angkatan dan pemasangan pintu P2.

Rajah 4. Ilustrasi lenturan permukaan pada pintu plumbum P2 DSRS



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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

CABARAN PENGURUSAN TEKNIKAL LAMAN WEB AGENSI NUKLEAR MALAYSIA

Nursuliza binti Samsudin, Norzalina binti Nasirudin, Mohd Dzul Aiman bin Aslan, Mohd Hasnor bin Hasan, Raja Murzaferi bin Raja Moktar, Siti Nurbahyah binti Hamdan, Mohamad Safuan bin Sulaiman, Khairiel Adyani bin Abd. Ghani, Shahrizan bin Saharudin.

PENGENALAN

Laman web agensi merupakan gerbang utama Agensi Nuklear Malaysia dalam menyampaikan maklumat kepada rakyat. Bagi memastikan laman web seiring dengan keperluan inisiatif kerajaan digital, pentadbir laman web perlu sentiasa terlibat aktif dalam mentadbir, menyelenggara dan memantau laman web. Pasukan teknikal perlu berhadapan dengan pelbagai cabaran bagi memastikan ketersediaan laman web dalam jangka masa panjang. Pasukan teknikal perlu membina antara muka laman web, menyediakan infrastruktur seperti pelayan, pangkalan data, storan penyimpanan serta sistem sandaran dan memastikan ketersediaan, kebolehpercayaan dan kestabilan laman web. Cabaran dalam meningkatkan skala dan kapasiti infrastruktur yang telah wujud apabila kandungan laman web mula bertambah dan berlaku kenaikan trafik pengguna.

PENGURUSAN TEKNIKAL LAMAN WEB AGENSI

- Pembangunan dan penyelenggaraan kod sumber
  - Pembangunan berasaskan SDLC
  - Kemahiran bahasa pengatucaraan terkini
  - Penggunaan Content Management System (CMS)
- Pengurusan pangkalan data dan sandaran
  - Penyelenggaraan dan sandaran secara berkala
- Pelayan (*server*) dan sistem rangkaian yang selamat
  - *Virtual server* – Centos 8
  - PDSA
- Keselamatan laman web
  - Ujian penembusan (pentest)
  - Kemaskini kod dan perkakasan

PEMANTAUAN LAMAN WEB

- Sistem Pemantauan Laman Web dan Perkhidmatan Dalam Talian Kerajaan
  - platform pemantauan laman web dan perkhidmatan dalam talian agensi oleh MAMPU
- Uptime Robot
  - membantu untuk memantau kesediaan laman web sekiranya mengalami masalah.

KESIMPULAN

Pengurusan laman web sektor awam menghadapi cabaran teknikal yang memerlukan kepakaran dan perancangan yang teliti. Pentadbir laman web perlu mengatasi cabaran ini dengan melibatkan pakar teknikal, merancang dan melaksanakan langkah-langkah keselamatan yang efektif, serta menjalankan penyelenggaraan berkala dan ujian pemulihan. Dengan usaha yang berterusan dalam menghadapi cabaran ini, laman web agensi dapat berfungsi dengan efisien, selamat, dan berkualiti tinggi, memberikan manfaat kepada orang awam dan masyarakat secara keseluruhan.

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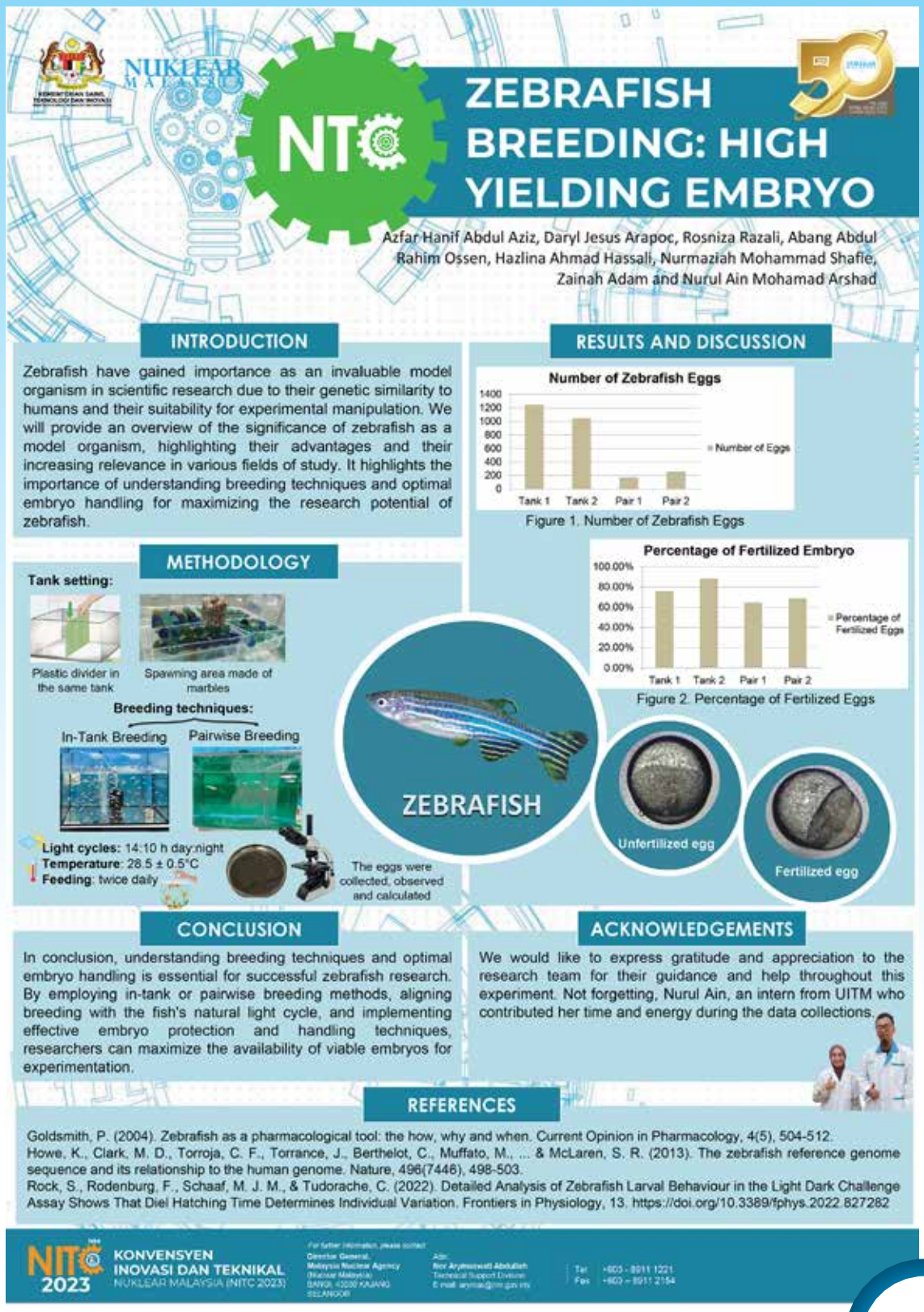
NUKLEAR MALAYSIA
NTC
ZEBRAFISH BREEDING: HIGH YIELDING EMBRYO
Azfar Hanif Abdul Aziz, Daryl Jesus Arapoc, Rosniza Razali, Abang Abdul Rahim Ossen, Hazlina Ahmad Hassali, Nurmaziah Mohammad Shafie, Zainah Adam and Nurul Ain Mohamad Arshad
INTRODUCTION
Zebrafish have gained importance as an invaluable model organism in scientific research due to their genetic similarity to humans and their suitability for experimental manipulation. We will provide an overview of the significance of zebrafish as a model organism, highlighting their advantages and their increasing relevance in various fields of study. It highlights the importance of understanding breeding techniques and optimal embryo handling for maximizing the research potential of zebrafish.
METHODOLOGY
Tank setting:
Plastic divider in the same tank
Spawning area made of marbles
Breeding techniques:
In-Tank Breeding
Pairwise Breeding
Light cycles: 14:10 h day:night
Temperature: 28.5 ± 0.5°C
Feeding: twice daily
ZEBRAFISH
The eggs were collected, observed and calculated
RESULTS AND DISCUSSION
Number of Zebrafish Eggs
1400
1200
1000
800
600
400
200
0
Tank 1
Tank 2
Pair 1
Pair 2
Number of Eggs
Figure 1. Number of Zebrafish Eggs
Percentage of Fertilized Embryo
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
Tank 1
Tank 2
Pair 1
Pair 2
Percentage of Fertilized Eggs
Figure 2. Percentage of Fertilized Eggs
Unfertilized egg
Fertilized egg
CONCLUSION
In conclusion, understanding breeding techniques and optimal embryo handling is essential for successful zebrafish research. By employing in-tank or pairwise breeding methods, aligning breeding with the fish's natural light cycle, and implementing effective embryo protection and handling techniques, researchers can maximize the availability of viable embryos for experimentation.
ACKNOWLEDGEMENTS
We would like to express gratitude and appreciation to the research team for their guidance and help throughout this experiment. Not forgetting, Nurul Ain, an intern from UITM who contributed her time and energy during the data collections.
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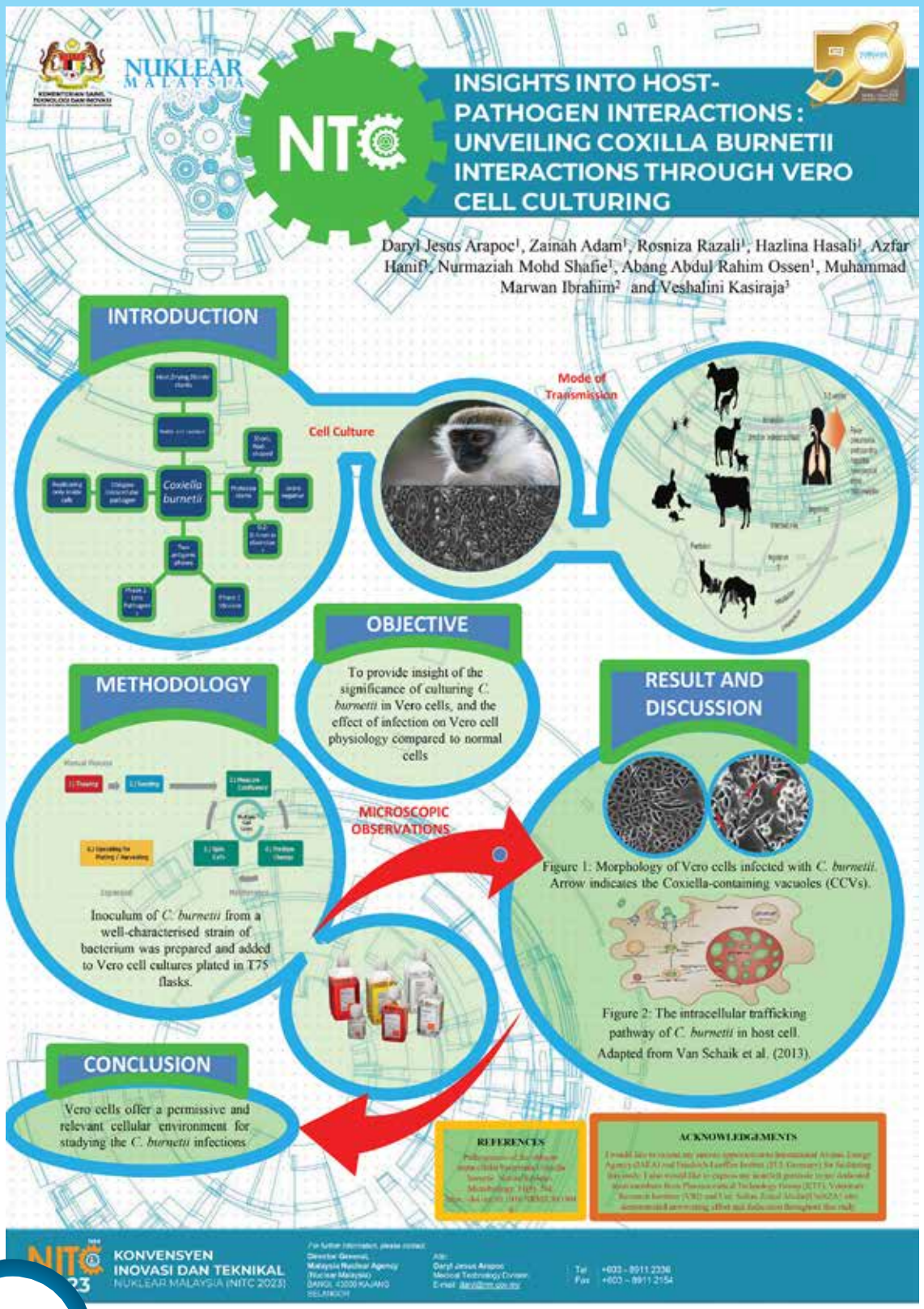
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)


NUKLEAR MALAYSIA
NTC
INSIGHTS INTO HOST-PATHOGEN INTERACTIONS : UNVEILING COXILLA BURNETII INTERACTIONS THROUGH VERO CELL CULTURING
Daryl Jesus Arapoc[1], Zainah Adam[1], Rosniza Razali[1], Hazlina Hasali[1], Azfar Hanif[1], Nurmaziah Mohd Shafie[1], Abang Abdul Rahim Ossen[1], Muhammad Marwan Ibrahim[2] and Veshalini Kasiraja[3]
INTRODUCTION
Coxiella burnetii
Cell Culture
Mode of Transmission
OBJECTIVE
To provide insight of the significance of culturing C. burnetii in Vero cells, and the effect of infection on Vero cell physiology compared to normal cells
METHODOLOGY
Inoculum of C. burnetii from a well-characterised strain of bacterium was prepared and added to Vero cell cultures plated in T75 flasks.
MICROSCOPIC OBSERVATIONS
RESULT AND DISCUSSION
Figure 1: Morphology of Vero cells infected with C. burnetii. Arrow indicates the Coxiella-containing vacuoles (CCVs).
Figure 2: The intracellular trafficking pathway of C. burnetii in host cell. Adapted from Van Schaik et al. (2013).
CONCLUSION
Vero cells offer a permissive and relevant cellular environment for studying the C. burnetii infections
REFERENCES
ACKNOWLEDGEMENTS
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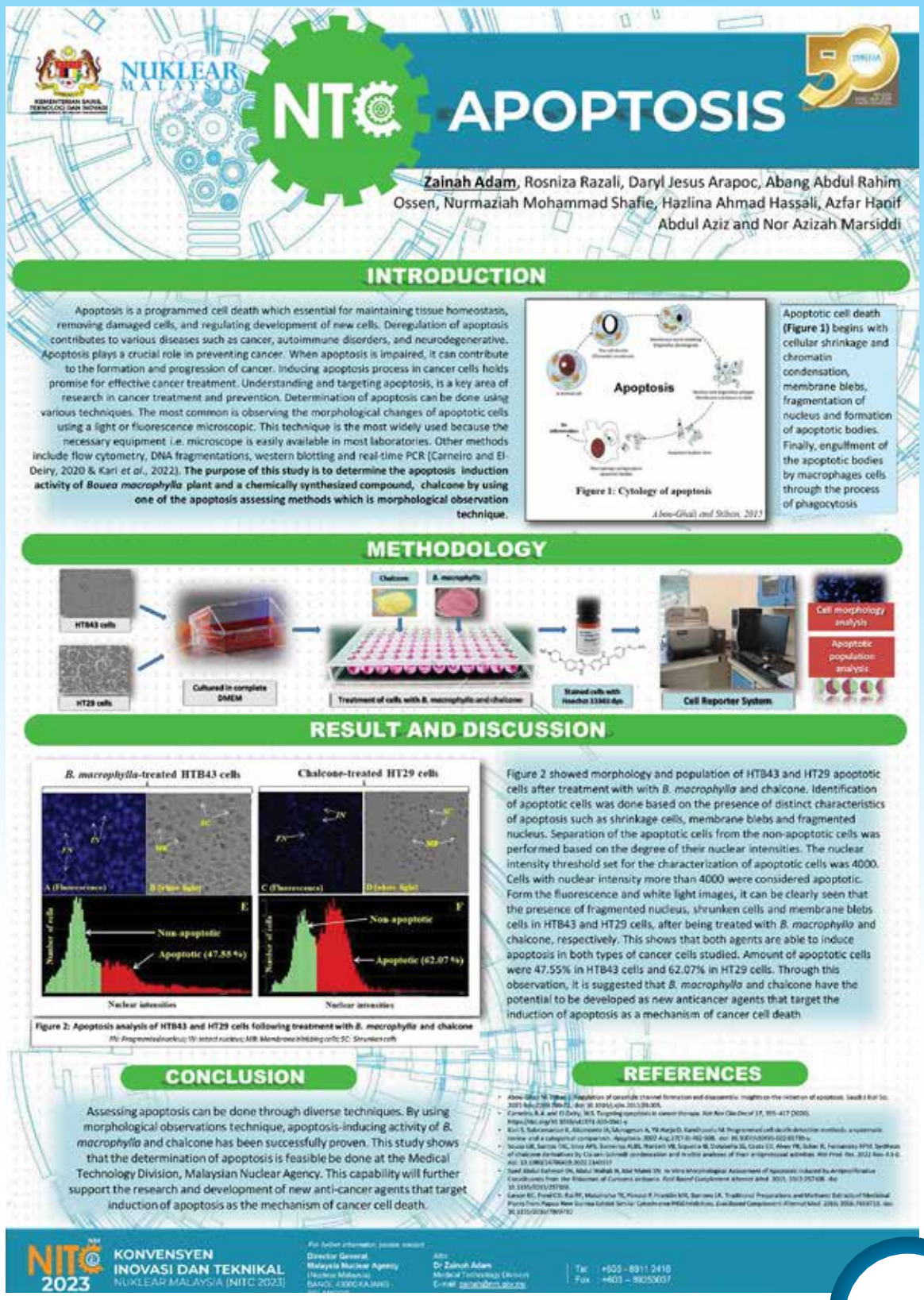
NUKLEAR MALAYSIA
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APOPTOSIS
Zainah Adam, Rosniza Razali, Daryl Jesus Arapoc, Abang Abdul Rahim Ossen, Nurmaziah Mohammad Shafie, Hazlina Ahmad Hassali, Azfar Hanif Abdul Aziz and Nor Azizah Marsiddi
INTRODUCTION
Apoptosis is a programmed cell death which essential for maintaining tissue homeostasis, removing damaged cells, and regulating development of new cells. Deregulation of apoptosis contributes to various diseases such as cancer, autoimmune disorders, and neurodegenerative. Apoptosis plays a crucial role in preventing cancer. When apoptosis is impaired, it can contribute to the formation and progression of cancer. Inducing apoptosis process in cancer cells holds promise for effective cancer treatment. Understanding and targeting apoptosis, is a key area of research in cancer treatment and prevention. Determination of apoptosis can be done using various techniques. The most common is observing the morphological changes of apoptotic cells using a light or fluorescence microscopic. This technique is the most widely used because the necessary equipment i.e. microscope is easily available in most laboratories. Other methods include flow cytometry, DNA fragmentations, western blotting and real-time PCR (Carneiro and El-Deiry, 2020 & Kari et al., 2022). The purpose of this study is to determine the apoptosis induction activity of Bouea macrophylla plant and a chemically synthesized compound, chalcone by using one of the apoptosis assessing methods which is morphological observation technique.
Apoptosis
Figure 1: Cytology of apoptosis
Alwa-Ghali and Stilton, 2015
Apoptotic cell death (Figure 1) begins with cellular shrinkage and chromatin condensation, membrane blebs, fragmentation of nucleus and formation of apoptotic bodies. Finally, engulfment of the apoptotic bodies by macrophages cells through the process of phagocytosis
METHODOLOGY
HT843 cells
HT29 cells
Cultured in complete DMEM
Chalcone
B. macrophylla
Treatment of cells with B. macrophylla and chalcone
Stained cells with Hoechst 33342 dye
Cell Reporter System
Cell morphology analysis
Apoptotic population analysis
RESULT AND DISCUSSION
B. macrophylla-treated HTB43 cells
Chalcone-treated HT29 cells
A (Fluorescence)
B (White light)
C (Fluorescence)
D (White light)
E
F
Non-apoptotic
Apoptotic (47.55 %)
Apoptotic (62.07 %)
Number of cells
Nuclear intensities
Figure 2: Apoptosis analysis of HTB43 and HT29 cells following treatment with B. macrophylla and chalcone
Figure 2 showed morphology and population of HTB43 and HT29 apoptotic cells after treatment with with B. macrophylla and chalcone. Identification of apoptotic cells was done based on the presence of distinct characteristics of apoptosis such as shrinkage cells, membrane blebs and fragmented nucleus. Separation of the apoptotic cells from the non-apoptotic cells was performed based on the degree of their nuclear intensities. The nuclear intensity threshold set for the characterization of apoptotic cells was 4000. Cells with nuclear intensity more than 4000 were considered apoptotic. Form the fluorescence and white light images, it can be clearly seen that the presence of fragmented nucleus, shrunken cells and membrane blebs cells in HTB43 and HT29 cells, after being treated with B. macrophylla and chalcone, respectively. This shows that both agents are able to induce apoptosis in both types of cancer cells studied. Amount of apoptotic cells were 47.55% in HTB43 cells and 62.07% in HT29 cells. Through this observation, it is suggested that B. macrophylla and chalcone have the potential to be developed as new anticancer agents that target the induction of apoptosis as a mechanism of cancer cell death
CONCLUSION
Assessing apoptosis can be done through diverse techniques. By using morphological observations technique, apoptosis-inducing activity of B. macrophylla and chalcone has been successfully proven. This study shows that the determination of apoptosis is feasible be done at the Medical Technology Division, Malaysian Nuclear Agency. This capability will further support the research and development of new anti-cancer agents that target induction of apoptosis as the mechanism of cancer cell death.
REFERENCES
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)
NITC 2023

ISOLATION AND PURIFICATION OF 4-PHENYLCOUMARINS FROM MESUA ASSAMICA BY FAST CENTRIFUGAL PARTITION CHROMATOGRAPHY

Hazlina Ahmad Hassali[1], Rosniza Razali[1], Fazliana Mohd Saaya[1], Daryl Jesus Arapoc[1],Zainah Adam[1] , Nor Azizah Marsiddi[1], Azfar Hanif Abd Aziz[1] , Nurmaziah Mohammad Shafie[1], Abang Abdul Rahim Ossen[1], Veshalini Kasiraja[2], Chan Gomathi[3] and Khalijah Awang[4]

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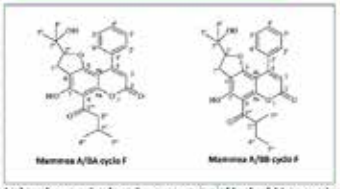
[4] Department of Chemistry, Faculty of Science, University of Malaya, 50100 Kuala Lumpur, MALAYSIA

INTRODUCTION

Natural products are important sources for drug development. Today, it is very crucial to develop effective and selective methods for the isolation and purification of those bioactive natural products. *Mesua assamica* (King & Prain) Kosterm. belongs to the family Calophyllaceae. The preliminary screening findings suggest that non-polar extracts of *M. assamica* bark particularly hexane extract exhibited good cytotoxic activity and could be potentially useful for the development of therapeutic agents against cancer. Fast Centrifugal Partition Chromatography (FCPC), an efficient and easily scalable approach for the isolation and purification of natural products. FCPC method was developed for the separation of 4-phenylcoumarins from *M. assamica hexane* extract.

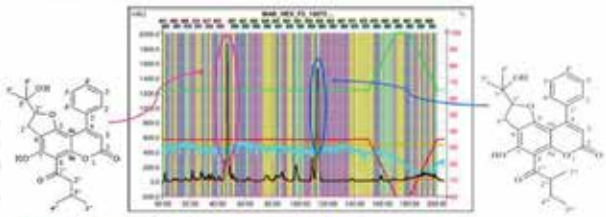
METHODOLOGY



4-phenylcoumarins from hexane extract of bark of *M. assamica*

- Sample : Fraction F3 from hexane crude of *Mesua assamica*
- Instrument : Armen FCPC-250 coupled with Armen Spot Prep II
- Solvent : ACN/H_2O with 0.1% TFA (9:1:9:1)
- Flow Rate : 10mL/min
- Rotor Speed : 1600 rpm
- Mode of elution : Isocratic mode

RESULTS AND DISCUSSION



Two 4-phenylcoumarins compounds were isolated by using FCPC and the structures of these two compounds were identified by 1H NMR, 13C NMR and LC-MS/MS ; Mammea A/BA cyclo F and Mammea A/BB cyclo.

CONCLUSION

FCPC attracted great attention in separation science and have been widely used in the separation of natural products. Two 4-phenylcoumarins namely mammea A/BB cyclo F and mammea A/BA cyclo F were isolated by using FCPC and the structures of these two compounds were identified by 1H NMR, 13C NMR and LC-MS/MS.FCPC is cost-effective and dramatically reduces solvent use resulting in a more environmentally-friendly, green technique.

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NUKLEAR MALAYSIA

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DATA COLLECTION AND ANALYSE FOR ESTABLISHING INITIAL NOISE LEVELS DATABASE IN RTP PLANT ROOM AND BASEMENT

Mohamad Amirudin Mohamad Rosli, Ahmad Nabil Ab Rahim, Ridzuan Abdul Mutalib, Julia Abdul Karim, Muhammad Zulhelmi Mahadi, Khairul Anwar Bapujee

INTRODUCTION

- RTP has been undergoing ageing for about 40 years
- Any component failure must be resolved immediately to deliver customer request for neutron irradiation service
- Administrative procedure for repair usually take sometime and causing delays for RTP operation
- Need a detection system able to predict equipment failure
- Checking and monitoring on motor is an important key to extending its life, to increase its working effectiveness, and to also reduce the maintenance and repair cost[1].
- Therefore, a noise level database would be suitable method to predicts future problem in mechanical components.
- This project will focus at RTP Basement and Plant Room as initiate noise database and familiarize with noise level trends for the selected components.

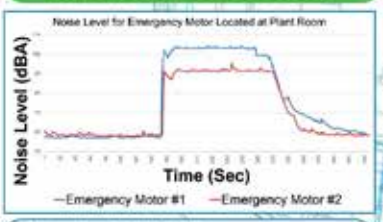
METHODOLOGY

UNI-T (UT353 BT)

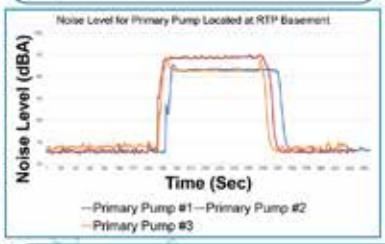
CONCLUSION

1. Slight difference in the noise level in the emergency pump is due to the piping structure causing air resistance
2. Slight difference in the trend of primary pump #2 and #3 need further analysis with more data collection
3. Data recorded will be use as a guide of a current trend of the measured equipment's
4. More data need to be measured to compare the noise trend and the noise level consistencies though out their lifetime.

RESULT AND DISCUSSION



- Noise trend at RTP plant room for emergency pump #1 and #2 measure at before start up, during operating and shutting down
- Similar noise level trend during start-up
- Amplitude difference due piping design causing more air resistance
- Shutting down noise trend for motor #1 has 2 slopes



- During peak load, primary pump #1 show normal pump graph trend, while primary pump #2 and #3 show slight difference in graph trend.
- primary pump #2 peak load recorded noise level average at 94 dBA and show no in-rush current involve.
- Every motor should have in-rush current supply during starting of the equipment.
- In-rush current is the high amount of electrical current that flows into an electric motor when it is first turned on or starts operating.
- This surge of current occurs during the initial moments when the motor is accelerating from a standstill to its normal operating speed.
- Primary pump #3 show normal graph trend until at the end of peak load.
- Before primary pump #3 shutting off the recorded noise level spike a little and continued to reduce until shutdown.

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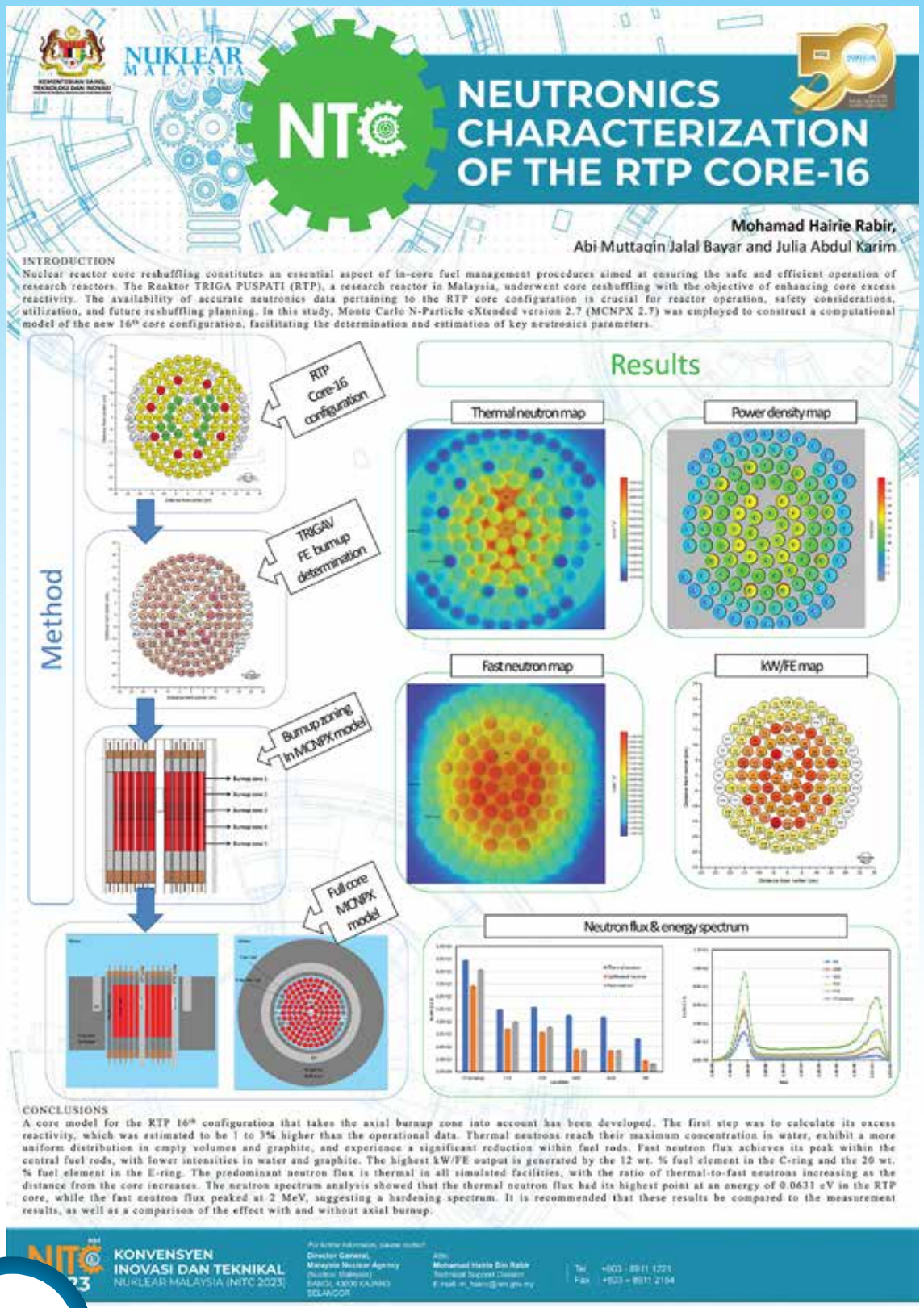
NUKLEAR MALAYSIA
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NEUTRONICS CHARACTERIZATION OF THE RTP CORE-16
Mohamad Hairie Rabir,
Abi Muttaqin Jalal Bayar and Julia Abdul Karim
INTRODUCTION
Nuclear reactor core reshuffling constitutes an essential aspect of in-core fuel management procedures aimed at ensuring the safe and efficient operation of research reactors. The Reaktor TRIGA PUSPATI (RTP), a research reactor in Malaysia, underwent core reshuffling with the objective of enhancing core excess reactivity. The availability of accurate neutronics data pertaining to the RTP core configuration is crucial for reactor operation, safety considerations, utilization, and future reshuffling planning. In this study, Monte Carlo N-Particle eXtended version 2.7 (MCNPX 2.7) was employed to construct a computational model of the new 16th core configuration, facilitating the determination and estimation of key neutronics parameters.
Method
RTP Core-16 configuration
TRIGAV FE burnup determination
Burnup zoning in MCNPX model
Full core MCNPX model
Results
Thermal neutron map
Power density map
Fast neutron map
kW/FE map
Neutron flux & energy spectrum
CONCLUSIONS
A core model for the RTP 16th configuration that takes the axial burnup zone into account has been developed. The first step was to calculate its excess reactivity, which was estimated to be 1 to 3% higher than the operational data. Thermal neutrons reach their maximum concentration in water, exhibit a more uniform distribution in empty volumes and graphite, and experience a significant reduction within fuel rods. Fast neutron flux achieves its peak within the central fuel rods, with lower intensities in water and graphite. The highest kW/FE output is generated by the 12 wt. % fuel element in the C-ring and the 20 wt. % fuel element in the E-ring. The predominant neutron flux is thermal in all simulated facilities, with the ratio of thermal-to-fast neutrons increasing as the distance from the core increases. The neutron spectrum analysis showed that the thermal neutron flux had its highest point at an energy of 0.0631 eV in the RTP core, while the fast neutron flux peaked at 2 MeV, suggesting a hardening spectrum. It is recommended that these results be compared to the measurement results, as well as a comparison of the effect with and without axial burnup.
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

LEXSYG SMART- TL OSL READER AT NUCLEAR DATING LABORATORY, MALAYSIA NUCLEAR AGENCY

Mohd Zuhair Mohd Sanusi , Nooradilah Abdullah , Norfaizal Mohamed , Muhammad Izzat Muammar Ramli, Muhammad Noh Sawon and Mohd Tarmizi Ishak

INTRODUCTION

Nuclear Dating Laboratory located at Malaysian Nuclear Agency aim to conduct a study on dating mineral based material. This laboratory is located at Block 19 under the supervision of Radiochemistry Environment Group (RAS), Waste Technology and Environment Division (BAS).

LEXSYG SMART

The advance LEXSYG SMART reader is the combination TL and OSL for luminescence measurement. This combination can provide advantages in the application of dating minerals. This reader system is very sensitive to changes, up to several millimeter scale through depth-luminescence profile (Ageby, L et al., 2022). Thus, the reader can provide dating age from 100 years up to 200,000 years or even older with precision range 5-10% (James Feather, 2008). In addition, this reader only requires small aliquot sample in preservation of archeology material (Brill & Tamura, 2020). Therefore, the advantages this reader can be fully utilize to perform luminescence measurement in the nuclear dating laboratory.

RADIATION SOURCES

Technical Aspect	Specification
Type of radiation	Beta
Radioisotope	Strontium-90 (Sr-90)
Activity	1.85 GBq
Form	Sealed (302 capsule)
Factory	Eckert & Ziegler Nuclitc GmbH

Table: Technical aspect on irradiation sources

OPTICAL STIMULATION

Colour	Wavelength (nm)	Type
Blue	445/458	Laser diode/LED
Green	525	LED
Yellow	590	LED
Infrared	850	Laser diode/LED
Violet	405	Laser diode

Table: Optical stimulation on LEXSYG SMART

THERMAL STIMULATION

The heating ceramic plate on the reader can reach a temperature operational up to 700 °C. The advantages of this heating plate is to allow the sample to gain thermal stimulation homogenously, repeatably and definitively. The ability of heating plat can achieve of rate 0.1-20.0 K/s

CONCLUSION

The LEXSYG Smart reader system is an advance tool for luminescence measurement. This is due to numerous advantages in technical aspect. Thus, existence of this advance TL OSL reader is adequate to develop dating technique at Malaysia Nuclear Agency for sample such as ceramic, rock and sediments.

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Figure: LEXSYG SMART reader

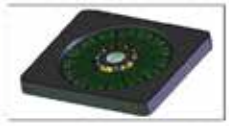

Figure: Optical stimulation

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NUKLEAR MALAYSIA

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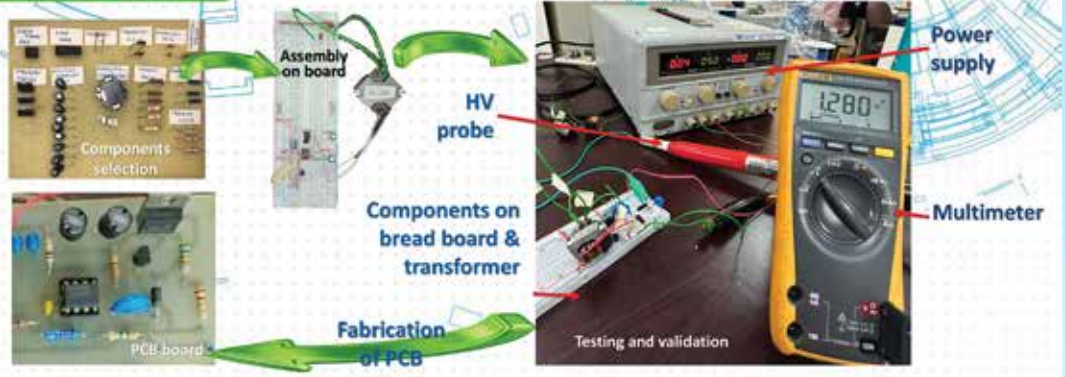
PROVE OF CONCEPT FOR HIGH VOLTAGE CIRCUITS FOR RADIATION DETECTION DEVICE

Nor Arymaswati Abdullah, Maslina Mohd Ibrahim, Noor Farhana Husna A. Aziz, Nabilah Ramli, Muhd. Izzuan Mohd. Ghazali and Khairunnisa Nadrah Md. Zahir

INTRODUCTION

Many ionizing radiation detectors rely on the application of high voltage to initiate their operational state. There are different types of detectors used in ionizing radiation detection such as ionizing chambers, proportional counters, GM counters, and luminescence detectors. Each of these detectors requires a different high voltage value when operating. Therefore, this project is to develop in-house of wide range high voltage (HV) modules. Not only to support for small detector such as GM tube but these modules will be able to support detectors such as HPGE or ion chamber as well.

METHODOLOGY



RESULTS AND DISCUSSION

This paper shares two types of circuits. A circuit that uses a transformer integrated with a multiplier to increase the voltage up to 3000V and the other one is a circuit assembled with inductors to generate 450V and 500V. All of these voltages are identified based on GM tube specifications and the expected output based on HV in the detector used in NM. However, these circuits require more exploration due unstable output and relatively high power consumption including noise that interferes with signal flow.

Transformer turn	Resistance (Ohm)	HV value (V)
15:3100	1.7:128k	1531
25:3100	**2.2:285**	**2911**
20:2600	2.0:243	2130
50:3100	4.2:280	1220
30:1000	2.2:112.9	1119
25:1500	2.3:112.9	1870
50:1500	3.3:121.3	1280
150:1700	9.4:138.3	234

Transformer turn	Resistance (Ohm)	HV value (V)
NIL (replaced with inductor)	19.95k	241
	17.66k	255
	11.04k	305
	6.29k	355
	2.77k	405
	3.8	455

APPLICATIONS

NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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MELT FLOW INDEX OF IRRADIATED GROUND TIRE RUBBER (GTR) COMPOUND

Norshafarina Ismail, Muhamad Nur Falah Karoji & Nur Amisha Mahizan

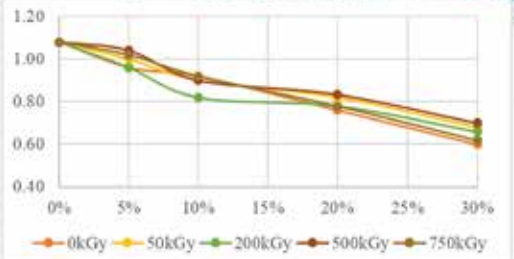
INTRODUCTION

- A melt flow indexer measures the mass (weight) of melt polymer extruded through a specified die under constant temperature and constant pressure during a fixed time.
- It is an **indirect measure of molecular weight**, with a high melt flow rate corresponding to low molecular weight thus is **inversely proportional to the viscosity** of the melt at the condition of the measurement.
- Chain scissoring of the polymer during polymer degradation by an **electron beam breaks down the three-dimensional crosslinked rubber network** into **lower molecular weight fragments**, producing a physical recovery of rubber waste fragments for non-reinforcing filler.
- Polymer blends based on recycled rubbers and thermoplastic resins lead to **thermoplastic elastomer (TPE) production**, exhibiting flexibility from the rubber phase and processability from the thermoplastic resin

METHODOLOGY

GTR with particles size ranging from 500 to 700µm was subjected to electron beam irradiation to undergo chain scissoring. The irradiation doses were 50, 200, 500, and 750kGy with 50kGy/pass, utilizing a 2 MeV electron beam accelerator. The irradiated GTR later were compounded with high-density polyethylene (HDPE) polymer according to the defined GTR weight ratio using melt mixer HAAKE for 10 minutes at 60 rpm rotor speed

RESULT AND DISCUSSION



1. MFI measurements of HDPE show a **declining trend** with the incorporation of higher **unirradiated GTR.** Lower MFI measurement shows higher viscosity that suggests crosslinked GTR does not flow and agglomerates in the matrix.
2. The more filler content incorporated into the resin, the more viscous it becomes and shows lower MFI measurements.
3. However, MFI measurements of HDPE show a slight **incline trend** with the incorporation of higher **irradiated GTR.** It indirectly shows an indication of the fluidity of an irradiated GTR/HDPE compound.
4. This suggests **chain scissoring** may have taken place and lowered the molecular weightthat directly influences MFI measurement.

CONCLUSION

A **high dose of irradiation** by electron beam can break down the rubber crosslinked network and **change the melt flow index** as compared to a non-irradiated rubber, simultaneously **affecting the compound fluidity,** and giving **direction** to subsequent polymer processing.

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NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

IMPROVING MEASUREMENT OF POLONIUM-210 IN BIOTA SAMPLES AT RADIOCHEMISTRY AND ENVIRONMENTAL GROUP, MALAYSIAN NUCLEAR AGENCY

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INTRODUCTION

Polonium-210 (^{210}Po) is one of the most radiotoxic radionuclides found in nature, and it can accumulate in high concentrations in various marine species (Fisher et al., 2013). 80% of the yearly background dosage due to seafood consumption is associated with ^{210}Po (Alonso-Hernandez et al., 2002). Due to its radiotoxicity, determining ^{210}Po is, therefore, very crucial. This study utilized certified reference material (CRM) IAEA-414 (Mixed Fish) to discuss the primary factors that influence the ^{210}Po measurement process and will assist in making decisions when analyzing biota samples in the Radiochemistry and Environmental Group (RAS), Malaysian Nuclear Agency.

METHODOLOGY

Figure 1: The process for determining ^{210}Po in biota samples, as well as the parameters changed in this study (highlighted in red)

RESULT AND DISCUSSION

^{210}Po certified value: 1.79 ± 0.29 Bq/kg

The reference date for decay correction being 1 January 2019. The ^{210}Po has been corrected from the decay of ^{226}Ra from the measurement date and has assumed in secular equilibrium with ^{210}Pb at the measurement date

Table 1: Evaluation of the laboratory value, compared to the certified value when varied the parameters

Parameters				
Sample amount (g)	Counting time (hours)	Acid	Reducing agent	Evaluation
0.5	24	HNO_3	HAC	NOT ACCEPTED
2.0	24	HNO_3	HAC	NOT ACCEPTED
2.0	72	HF	HAC	ACCEPTED
2.0	72	HNO_3	HAC	ACCEPTED
2.0	72	HNO_3	AA	NOT ACCEPTED

Table 2: Observation of recovery when varied the post-plating technique

Post-plating technique	Recovery (%)
Air dry	30-50
Rinsed with ethanol	60-95

CONCLUSION

According to this study, when determining ^{210}Po in biota samples, 2 g of sample is recommended, and sample digestion with HNO_3 acid is sufficient. When the silver disc is cleaned with ethanol, the recovery of ^{210}Po is considerably improved, while air drying may allow the presence of a watermark, which may prevent heavy alpha particle penetration. 72 hours of counting time should be used to achieve enough ^{210}Po peak counts.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to the Malaysian Nuclear Agency (Nuklear Malaysia) and other project team members who assisted in the success of this project.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

THERMOGRAVIMETRIC ANALYSIS OF IRRADIATED FILM: EFFECT OF INSTRUMENTAL FACTORS

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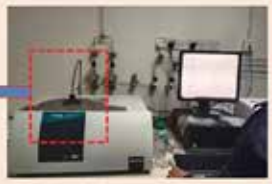
INTRODUCTION

Thermogravimetric analysis (TGA) is a technique for investigating the thermal decomposition of polymers. Changes in the mass of the sample are recorded in a thermogravimetric curve as a function of temperature or time due to decomposition, oxidation or evaporation of the sample. Among the characteristics that can be measured are composition, decomposition temperatures, thermal stability and absorbed moisture. One of the factors that affects the thermogravimetric curve is the heating rate. It can affect polymer decomposition by altering the relative rates at which decomposition reactions occur. The heating rate can be defined as the rate at which the temperature increases in degrees per minute.

OBJETIVE

To evaluate the effect of the heating rate and irradiation on the thermal decomposition of polyethylene (PE) sheets.

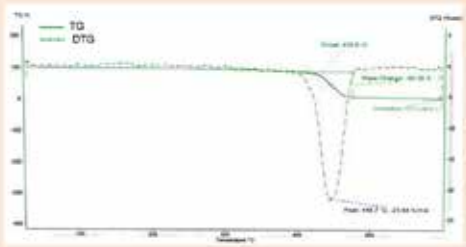
METHODOLOGY



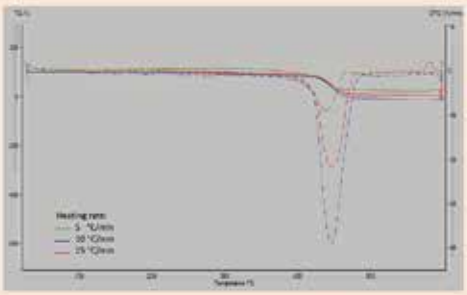
Netzsch thermogravimetric instrument (209) Tarsus

Sample : PE sheet (0, 25, 50 & 75 kGy)
Mass : 0.1 – 0.5 mg
Temp. : 30 - 600 °C
Flow rate : 20 mL/min (N_2)
Heating rate : 5, 10 & 15 °C/min

RESULTS & DISCUSSION



TGA thermogram of PE sheet



Dose, kGy	T_{onset}, °C	T_{max}, °C
0	387	448
25	389	450
50	389	453
75	433	469

Table 1: onset of decomposition temperature, (T onset) and the maximum decomposition temperature (T max) of unirradiated and irradiated PE plastic sheet at 25, 50 and 75 kGy.

Single-step decomposition.
The sharpness of the curves changed with the heating rate.
The thermal stability of PE plastic sheet increased upon irradiation.

CONCLUSION

In the present work, TGA is carried out to understand the thermal stability of PE sheets irradiated at different doses using electron-beam radiation. The irradiation had a positive effect on the thermal stability of the PE sheets.
The heating rate has a significant effect on the shape or sharpness of thermal curves.

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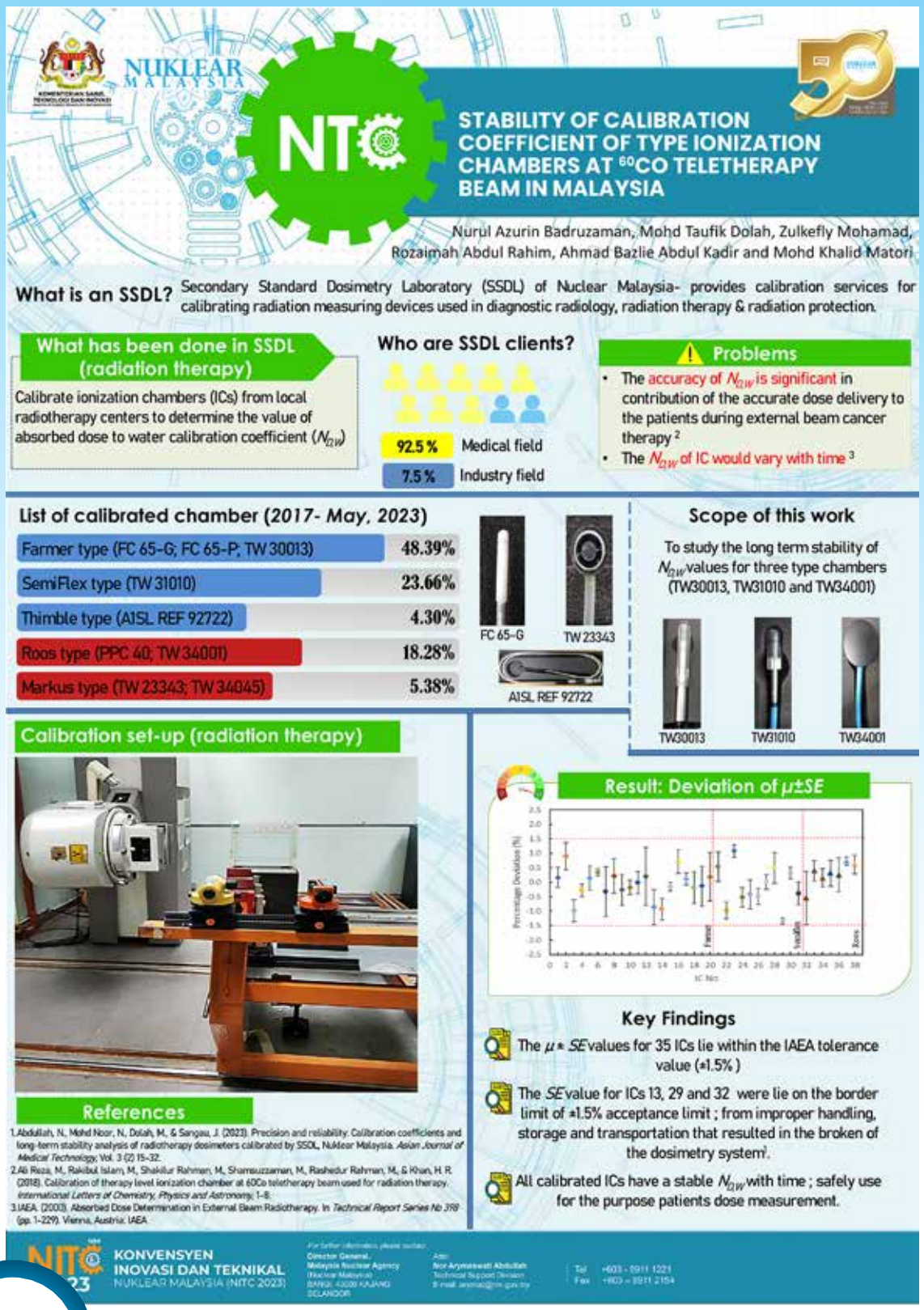
NUKLEAR MALAYSIA
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STABILITY OF CALIBRATION COEFFICIENT OF TYPE IONIZATION CHAMBERS AT ⁶⁰CO TELETHERAPY BEAM IN MALAYSIA
Nurul Azurin Badruzaman, Mohd Taufik Dolah, Zulkefly Mohamad, Rozaimah Abdul Rahim, Ahmad Bazlie Abdul Kadir and Mohd Khalid Matori
What is an SSDL? Secondary Standard Dosimetry Laboratory (SSDL) of Nuclear Malaysia- provides calibration services for calibrating radiation measuring devices used in diagnostic radiology, radiation therapy & radiation protection.
What has been done in SSDL (radiation therapy)
Calibrate ionization chambers (ICs) from local radiotherapy centers to determine the value of absorbed dose to water calibration coefficient ($N_{D,W}$)
Who are SSDL clients?
92.5 % Medical field
7.5 % Industry field
Problems
The accuracy of $N_{D,W}$ is significant in contribution of the accurate dose delivery to the patients during external beam cancer therapy [2]
The $N_{D,W}$ of IC would vary with time [3]
List of calibrated chamber (2017- May, 2023)
Farmer type (FC 65-G; FC 65-P; TW 30013) 48.39%
SemiFlex type (TW 31010) 23.66%
Thimble type (A1SL REF 92722) 4.30%
Roos type (PPC 40; TW 34001) 18.28%
Markus type (TW 23343; TW 34045) 5.38%
FC 65-G
TW 23343
A1SL REF 92722
Scope of this work
To study the long term stability of $N_{D,W}$ values for three type chambers (TW30013, TW31010 and TW34001)
TW30013
TW31010
TW34001
Calibration set-up (radiation therapy)
Result: Deviation of μ±SE
Key Findings
The μ ± SE values for 35 ICs lie within the IAEA tolerance value (±1.5%)
The SE value for ICs 13, 29 and 32 were lie on the border limit of ±1.5% acceptance limit ; from improper handling, storage and transportation that resulted in the broken of the dosimetry system[3].
All calibrated ICs have a stable $N_{D,W}$ with time ; safely use for the purpose patients dose measurement.
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NUKLEAR MALAYSIA

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KHIDMAT UJIAN KAWALAN MUTU RADAS X-RAY PELANGGAN LUAR NEGARA (BRUNEI) AGENSI NUKLEAR MALAYSIA: PENGALAMAN DAN CABARAN

Shahrul Azlan Azizan, Mohd Khalid Matori, Dr. Azuhar Ripin, Nadiah Ayob, Ts. Dr. Husaini Salleh dan Wan Hazlinda Ismail

PENGENALAN

Ujian kawalan mutu bagi radas x-ray adalah amalan penting dalam program jaminan mutu dalam radiologi diagnostik perubatan. Organisasi Kesihatan Sedunia (WHO) menyifatkan jaminan mutu dalam perubatan diagnostic x-ray sebagai satu usaha yang dijalankan oleh pekerja bagi memeriksa peralatan untuk memastikan imej diagnostik yang dihasilkan adalah berkualiti tinggi, memberikan maklumat yang cukup pada kos yang terendah melalui pendedahan sinaran paling minimum kepada pesakit. Makmal Fizik Perubatan (MPL), Bahagian Keselamatan dan Kesihatan Sinaran, Agensi Nuklear Malaysia telah ditubuhkan pada 1997. Antara perkhidmatan yang ditawarkan ialah khidmat kawalan mutu radas x-ray perubatan dan khidmat tentukuran peralatan ujian Radiologi Diagnostik untuk pihak luar. Agensi Nuklear Malaysia sebagai pemegang lesen kelas H daripada Kementerian Kesihatan Malaysia (KKM) yang menyediakan perkhidmatan kawalan mutu (QC) untuk semua jenis radas x-ray diagnostik kepada klinik dan hospital swasta di seluruh negara. MPL menyediakan perkhidmatan ini bagi hospital dan klinik di seluruh negara semenjak tahun 2000 apabila KKM mula membuat penguatkuasaan terhadap keperluan QC ini. Perkhidmatan ini juga telah mula mendapat permintaan dari negara luar seperti Brunei semenjak daripada tahun 2005 lagi. Perkhidmatan ujian ini merupakan perkhidmatan yang dibayar oleh pihak Brunei kepada Agensi Nuklear Malaysia berdasarkan kepakaran (Lesen kelas H, KKM) yang ada pada agensi tersebut. Khidmat ini juga merupakan satu pengiktirafan negara luar atas kepakaran yang ada di Agensi Nuklear Malaysia. Ianya juga dapat menaikkan nama Agensi Nuklear Malaysia dan negara kerana ujian kawalan mutu mesin x-ray yang diperkenalkan oleh Makmal Fizik Perubatan (MPL), Agensi Nuklear Malaysia mendapat permintaan dari negara luar. Ini akan memberi impak yang besar kepada imej negara serta dapat meningkatkan lagi pendapatan Agensi Nuklear Malaysia khususnya dan negara secara amnya. Perkhidmatan ke negara Brunei ini akan menambah jaringan kerjasama organisasi (networking) kerajaan dengan pelanggan-pelanggan dan pihak-pihak berkaitan (Kementerian Kesihatan dan badan penguatkuasaan perlindungan sinaran) di sana.

METODOLOGI

Secara umumnya ujian kawalan mutu bagi kemudahan bagi radas x-ray merangkumi tiga aspek utama iaitu pemeriksaan keselamatan dari segi pepasangan mekanikal dan elektrikal, pemeriksaan keselamatan perlindungan sinaran dan pengukuran tahap prestasi radas. Pemeriksaan keselamatan dari segi mekanikal boleh mengenalpasti sebarang tanda ketidakstabilan atau kerosakan terhadap pepasangan mekanikal pada radas x-ray. Pemeriksaan elektrikal pula dilakukan antaranya terhadap kabel-kabel, lampu penunjuk dan paparan, lampu penunjuk tiub dan penguncian tiub, prestasi dan piawaian keselamatan tiub. Ujian telah dijalankan mengikut prosedur dan had toleran yang ditetapkan oleh pihak KKM dengan menggunakan peralatan pengukur yang dikalibrasi dengan sijil kalibrasi yang sah. Jadual 1 menunjukkan peralatan yang digunakan untuk melaksanakan ujian kawalan mutu radas x-ray di Panaga Health Centre (Brunei Shell Petroleum).

Jadual 1. Peralatan ujian kawalan mutu radas x-ray

Equip. Required	Specification details
Dose meter	Range: 0.1 µGy to 0.2 Gy, 0.01 µGy/s to 0.2 Gy/s Energy range: 20 to 150 keV, Uncertainty: < ± 10%
Meter kVp	kVp range: 30 to 150 kVp, accuracy: < 3% Capacity: 4Gy of air equivalence
Exposure timer	Electronic timer, accuracy: < 1% or ± 0.3 ms
Densitometer	Range: 0 to 3.3 OD Repeatability: ± 0.01 OD, Accuracy: ± 0.02 OD
Survey meter	Ionization chamber, dose and dose/rate modes Sensitivity, color of unit, fast response time
Aluminium filters	Purity: at least 99.0 % Thickness: 0.5 and 1 mm, total of 2.0 mm
Collimator and beam alignment test tools	- Sheet wires, bent to form 90° angle to mark corners of the light field. - Hollow cylindrical Perspex, 150 cm with small steel ball centred at each end.
Focal spot test tool	Star test pattern/resolution test tool/square
Water phantom	30 x 30 cm², thickness: 5, 15, 25 cm, 30 to 35 cm

KEPUTUSAN DAN PERBINCANGAN

Sepanjang pengalaman Makmal Fizik Perubatan menjalankan perkhidmatan jaminan mutu x-ray di Brunei didapati tiada masalah besar terhadap terhadap keseluruhan ujian. Semua radas x-ray telah dipasang dengan baik dan memuaskan kecuali beberapa kes terpinggir di bawah di mana;

- Ujian Light beam illumination mendapat nilai yang lebih rendah dari toleran. Walaubagaimanapun ianya boleh diterima kerana light beam yang terhasil masih jelas kelihatan.
- Pengaturan kabel didapati tidak kemas dan mengganggu pergerakan tiub.

Dari pengalaman, Panaga Health Centre (Brunei Shell Petroleum) setiap tahun akan mendapatkan khidmat Agensi Nuklear Malaysia sehingga ke hari ini kerana perkhidmatan yang ditawarkan berkualiti dan pelanggan sangat berpuas hati. Dalam menambah kualiti perkhidmatan yang diberikan, Makmal Fizik Perubatan sentiasa bersiap sedia dengan perkembangan terkini berkaitan perkhidmatan kawalan mutu radas sinar-X perubatan. Perolehan terhadap peralatan-peralatan ujian kawalan mutu yang terkini sentiasa dilakukan bagi meningkatkan kesiapsiagaan kumpulan Fizik Perubatan terhadap perkhidmatan kawalan mutu di era moden ini. Sikap bekerja dalam satu pasukan yang ditunjukan oleh Makmal Fizik Perubatan dapat membantu dalam memberikan perkhidmatan jaminan mutu yang terbaik ke seluruh negara dan juga luar negara seperti Brunei. Jadual 2 menunjukkan radas x-ray yang dilaksanakan ujian kawalan mutu di Brunei.

Jadual 2. Radas x-ray yang dilaksanakan ujian kawalan mutu di Brunei.

Radas x-ray	Jenama/model
General x-ray	Shidmadzu UD 150L-40
Dental x-ray Orthopantomogram (OPG)	Vatech PCH 2500
Dental x-ray (Intra-oral)	Heliodent MD 70
Dental x-ray (Intra-oral)	Heliodent MD 70
Dental x-ray (Intra-oral)	Sirona Heliodent Vario
Dental x-ray (Intra-oral)	Sirona Heliodent Vario

Cabaran :

- Kerenah birokrasi
- Prosedur Kastam yang ketat
- Logistik
- SOP yang ketat di tempat bertugas
- Masa yang terhad

KESIMPULAN

Makmal Fizik Perubatan, Kumpulan Metrologi Sinaran, BKS mampu mengekalkan prestasinya dalam menyediakan khidmat Ujian kawalan mutu radas x-ray kepada pelanggan luar setiap tahun. Selain merupakan salah satu keperluan dan syarat yang ditetapkan oleh KKM, ujian ini perlu dilaksanakan supaya objektif perlindungan sinaran kepada pesakit, pekerja dan orang awam mengikut Peraturan-peraturan Pelesenan Tenaga Atom (Perlindungan Sinaran Keselamatan Asas) 2010 dipatuhi selain dapat menjana pendapatan Agensi Nuklear Malaysia khususnya dan negara secara amnya.

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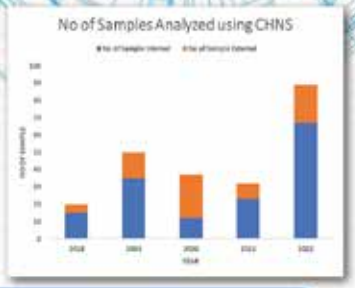
ELEMENTAL ANALYZER FOR ANALYSIS OF CHNS

Siti Aminah Omar*, Muhammad Farhan Ridzuan, Zalina Laili, Md Suhaimi Elias, Nazaratul Ashifa Abdullah Salim, Azian Hashim, Shakirah Shukor, Muhammad Azfar Azman and Munirah Abdul Zali

INTRODUCTION

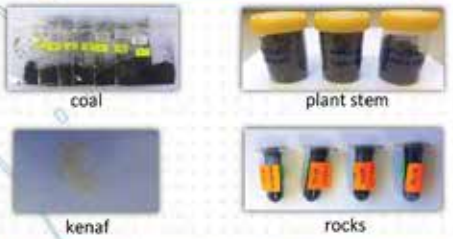
Elemental Analyzer is used to measure the percentage of Carbon (C), Hydrogen (H), Nitrogen (N) and Sulphur (S) in a sample. It is a straightforward and a reliable analysis to assess purity and chemical composition of a compound. Elemental analyzer is also known as CHNS analysis. It works based on Dumas technique which involves complete combustion and oxidation of the sample which produces CO_2, H_2O, NO_2 and SO_2.



ANALYSIS PROCEDURE

1) Sample is placed inside tin capsules
2) Weighing of sample using microbalance
3) Placement of weighed tin capsules inside CHNS carousel
4) Analysis report printed out

EXAMPLE TYPES OF SAMPLES



CONCLUSION

Elemental Analyzer or CHNS analysis is deemed as a simple and straightforward analysis capable of providing result for determination of mass fraction of carbon, hydrogen, nitrogen and sulphur (CHNS).

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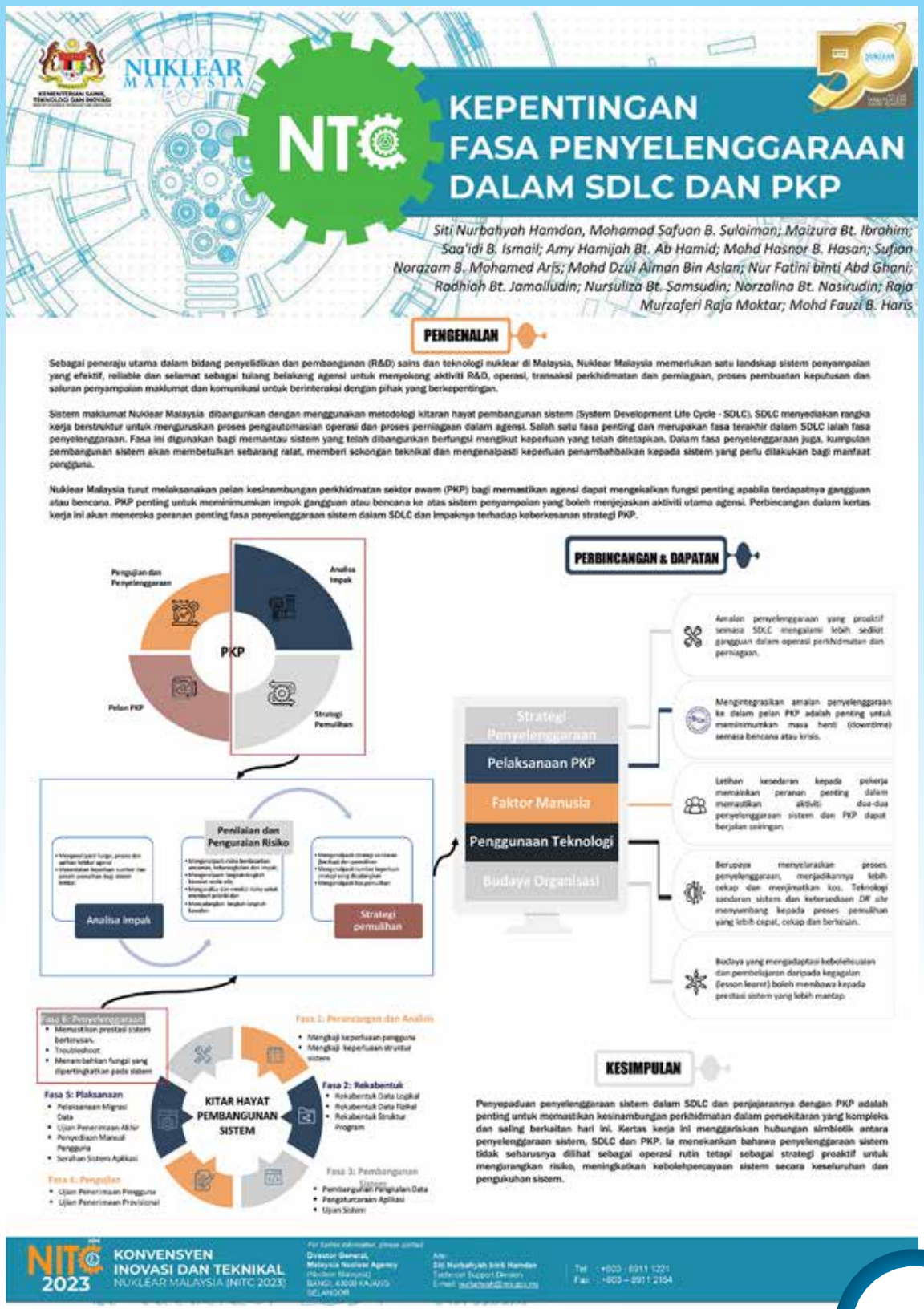
NUKLEAR MALAYSIA
NTC
KEPENTINGAN FASA PENYELENGGARAAN DALAM SDLC DAN PKP
Siti Nurbahyah Hamdan, Mohamad Safuan B. Sulaiman; Maizura Bt. Ibrahim; Saa'idi B. Ismail; Amy Hamijah Bt. Ab Hamid; Mohd Hasnor B. Hasan; Sufian Norazam B. Mohamed Aris; Mohd Dzul Aiman Bin Aslan; Nur Fatini binti Abd Ghani; Radhiah Bt. Jamalludin; Nursuliza Bt. Samsudin; Norzalina Bt. Nasirudin; Raja Murzaferi Raja Moktar; Mohd Fauzi B. Haris
PENGENALAN
Sebagai peneraju utama dalam bidang penyelidikan dan pembangunan (R&D) sains dan teknologi nuklear di Malaysia, Nuklear Malaysia memerlukan satu landskap sistem penyampaian yang efektif, reliable dan selamat sebagai tulang belakang agensi untuk menyokong aktiviti R&D, operasi, transaksi perkhidmatan dan perniagaan, proses pembuatan keputusan dan saluran penyampaian maklumat dan komunikasi untuk berinteraksi dengan pihak yang berkepentingan.
Sistem maklumat Nuklear Malaysia dibangunkan dengan menggunakan metodologi kitaran hayat pembangunan sistem (System Development Life Cycle - SDLC). SDLC menyediakan rangka kerja berstruktur untuk menguruskan proses pengautomasian operasi dan proses perniagaan dalam agensi. Salah satu fasa penting dan merupakan fasa terakhir dalam SDLC ialah fasa penyelenggaraan. Fasa ini digunakan bagi memantau sistem yang telah dibangunkan berfungsi mengikut keperluan yang telah ditetapkan. Dalam fasa penyelenggaraan juga, kumpulan pembangunan sistem akan membetulkan sebarang ralat, memberi sokongan teknikal dan mengenalpasti keperluan penambahbaikan kepada sistem yang perlu dilakukan bagi manfaat pengguna.
Nuklear Malaysia turut melaksanakan pelan kesinambungan perkhidmatan sektor awam (PKP) bagi memastikan agensi dapat mengekalkan fungsi penting apabila terdapatnya gangguan atau bencana. PKP penting untuk meminimumkan impak gangguan atau bencana ke atas sistem penyampaian yang boleh menjejaskan aktiviti utama agensi. Perbincangan dalam kertas kerja ini akan meneroka peranan penting fasa penyelenggaraan sistem dalam SDLC dan impaknya terhadap keberkesanan strategi PKP.
PERBINCANGAN & DAPATAN
Pengujian dan Penyelenggaraan
Analisa Impak
PKP
Pelan PKP
Strategi Pemulihan
Penilaian dan Penguraian Risiko
Analisa Impak
Strategi pemulihan
Strategi Penyelenggaraan
Pelaksanaan PKP
Faktor Manusia
Penggunaan Teknologi
Budaya Organisasi
Amalan penyelenggaraan yang proaktif semasa SDLC mengalami lebih sedikit gangguan dalam operasi perkhidmatan dan perniagaan.
Mengintegrasikan amalan penyelenggaraan ke dalam pelan PKP adalah penting untuk meminimumkan masa henti (downtime) semasa bencana atau krisis.
Latihan kesedaran kepada pekerja memainkan peranan penting dalam memastikan aktiviti dua-dua penyelenggaraan sistem dan PKP dapat berjalan seiringan.
Berupaya menyelaraskan proses penyelenggaraan, menjadikannya lebih cekap dan menjimatkan kos. Teknologi sandaran sistem dan ketersediaan DR site menyumbang kepada proses pemulihan yang lebih cepat, cekap dan berkesan.
Budaya yang mengadaptasi kebolehcucian dan pembelajaran daripada kegagalan (lesson learnt) boleh membawa kepada prestasi sistem yang lebih mantap.
Fasa 4: Penyelenggaraan
Memastikan prestasi sistem berterusan.
Troubleshoot
Menambahkan fungsi yang dipertingkatkan pada sistem
Fasa 1: Perancangan dan Analisis
Mengkaji keperluan pengguna
Mengkaji keperluan struktur sistem
Fasa 2: Rekabentuk
Rekabentuk Data Logikal
Rekabentuk Data Fizikal
Rekabentuk Struktur Program
Fasa 3: Pembangunan Sistem
Pembangunan Pangkalan Data
Pengaturcaraan Aplikasi
Ujian Sistem
Fasa 5: Pelaksanaan
Pelaksanaan Migrasi Data
Ujian Penerimaan Akhir
Penyediaan Manual Pengguna
Serahan Sistem Aplikasi
Fasa 6: Pengujian
Ujian Penerimaan Pengguna
Ujian Penerimaan Provisional
KITAR HAYAT PEMBANGUNAN SISTEM
KESIMPULAN
Penyepaduan penyelenggaraan sistem dalam SDLC dan penjajarannya dengan PKP adalah penting untuk memastikan kesinambungan perkhidmatan dalam persekitaran yang kompleks dan saling berkaitan hari ini. Kertas kerja ini menggariskan hubungan simbiotik antara penyelenggaraan sistem, SDLC dan PKP. Ia menekankan bahawa penyelenggaraan sistem tidak seharusnya dilihat sebagai operasi rutin tetapi sebagai strategi proaktif untuk mengurangkan risiko, meningkatkan kebolehpercayaan sistem secara keseluruhan dan pengukuhan sistem.
NITC 2023
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

PROSES PEMASANGAN PUNCA TERKEDAP IRIDIUM-192 UNTUK INDUSTRI RADIOGRAFI DI MAKMAL PENGELUARAN IRIDIUM-192, BAHAGIAN TEKNOLOGI PERUBATAN

Siti Selina Abdul Hamid, **Wan Mohd Ferdaus Wan Ishak***, Mohd Hafiz Ishak, Azahari Kasbollah

PENGENALAN

Proses pemasangan punca terkedap Ir-192 di dalam sel aktif adalah berdasarkan hasil pemindahan teknologi yang diperolehi daripada Korean Atomic Energy Agency Research Institute (KAERI) /Ho Jin Industry Ltd. kepada Agensi Nuklear Malaysia khususnya Bahagian Tekonologi Perubatan (BTP). Jabatan Tenaga Atom telah memberi kebenaran/kelulusan penggunaan fasiliti pengeluaran di BTP bagi proses pemasangan dan pengeluaran punca terkedap Ir-192. Kertas kerja ini akan menerangkan langkah-langkah pemasangan Ir-192 ke dalam pengecas punca yang akan digunakan bagi industri radiografi.

BAHAN DAN KAEDAH

Penyusunan *pigtail* mengikut no siri serta padanan *pigtail* dan kapsul

Ujian Go or NoGo untuk memeriksa panjang dan diameter memenuhi spesifikasi

Pemeriksaan kualiti melalui pemerhatian pada monitor dan gambar diambil sebagai bukti

- Penerimaan punca terkedap Ir-192 dalam bentuk *double encapsulated disc*
- Pemindahan *transport container* ke dalam sel aktif
- Pemeriksaan no siri serta padanan pigtail dan kapsul
- Meletakkan Ir-192 ke dalam kapsul assembler
- Pemasangan pigtail dan kapsul secara jenis skru
- Ujian *Go or NoGo*
- Proses mengapit *(Clamping)*
- Pemeriksaan kualiti
- Ir-192 dimasukkan ke dalam pengecas punca
- Selesai proses pemasangan dan sedia untuk dihantar ke lokasi

Memindahkan *pigtail* Ir-192 ke dalam corong pengecas punca

Bekas pengangkutan yang mengandungi 4 lubang untuk menempatkan *pigtail* Ir-192

Bekas pengangkutan diletakkan ke dalam kenderaan dan ditutupi lagi dengan lapisan penebat

KEPUTUSAN DAN KESIMPULAN

Proses pemasangan punca terkedap Ir-192 dilakukan di dalam sel aktif. Terdapat beberapa proses dimana gambar diambil bagi tujuan rekod dan keselamatan serta sebagai verifikasi pemasangan Ir-192 mengikuti spesifikasi yang telah ditetapkan. Selain dari itu, personel yang terlibat dalam proses pemasangan Ir-192 juga perlu mahir dan cekap dalam setiap langkah bagi memastikan dedahan terhadap radioaktif adalah singkat. Maka dengan itu, pekerja telah dilatih dalam pengendalian penggunaan pengapit. Kesimpulannya, proses pemasangan punca terkedap Ir-192 memerlukan kemahiran bagi memastikan tiada kebocoran berlaku kepada punca terkedap Ir-192.

Bulan	Jan	Feb	Mac	April	Mei	Jun	Julai	Ogos	Sept	Okt	Nov	Dis
Bilangan	0	0	22	22	22	24	0	22	22	-	-	-

Bilangan pengeluaran Ir-192 bagi tahun 2023

RUJUKAN

1. Production techniques and quality control of sealed radioactive sources of palladium-103, iodine-125, iridium-192 and ytterbium-169. IAEA-TECHDOC-1512

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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NUKLEAR MALAYSIA

NTC

KHIDMAT PENGELUARAN PUNCA TERKEDAP IRIDIUM-192 KEPADA INDUSTRI RADIOGRAFI 2008 – 2023

Siti Selina Abdul Hamid, **Mohd Hafiz Ishak***, Wan Mohd Ferdaus Wan Ishak, Azahari Kasbollah

PENGENALAN

Pusat Khidmat Bekalan Radioisotop (BRI), Bahagian Teknologi Perubatan mempunyai kepakaran dalam pemasangan punca terkedap Iridium-192 (Ir-192). Ir-92 adalah sejenis bahan radioaktif berjangka hayat 73.83 hari dan menyusut kepada zarah beta dan sinar gama.

Pada tahun 2008, sel aktif di BTP telah diubah suai khusus untuk pengeluaran Ir-192 berdasarkan teknologi yang diperolehi daripada Korea. Manakala, punca Ir-192 diimport dari Korea dalam bentuk *double encapsulated disc*. Ir-192 yang dikeluarkan di BTP digunapakai dalam bidang radiografi industri iaitu bagi ujian tanpa musnah untuk mengenalpasti keretakan paip dalam industri minyak dan gas.

Pada tahun 2009, BTP telah mula aktif mengeluarkan Ir-192. Anggaran keluaran Ir-192 adalah sebanyak 20 – 25 kapsul/batch dan radioaktiviti bagi satu kapsul adalah 50 – 60 Ci. Oleh itu, objektif kertas kerja ini adalah untuk melaporkan pengeluaran Ir-192 yang telah dilaksanakan di BTP semenjak dari tahun 2008 hingga 2023.

BAHAN DAN KAEDAH

Proses pengeluaran dan pemasangan Ir-192 didalam sel aktif

1. Pemeriksaan no siri kapsul Ir-192
2. Meletakkan kapsul Ir-192 ke dalam kapsul *assembler*
3. Masukkan *pigtails*
4. Ujian Go or NoGo
5. Periksa panjang dan diameter
6. Proses mengapit
7. Ujian kawalan mutu
8. Masukkan dalam *source changer*

KEPUTUSAN DAN KESIMPULAN

BTP berjaya mengeluarkan Ir-192 yang digunapakai dalam bidang radiografi industri. Butiran pengeluaran serta penerangan yang berkaitan adalah seperti berikut:

2009 – 2012	Pengeluaran Ir-192 adalah dalam 100 - 150 kapsul setahun.
2013 – 2014	Tiada pengeluaran disebabkan terdapat masalah teknikal dari segi dokumen kerjasama dengan syarikat.
2015	Fasa permulaan pengeluaran dan merupakan pengeluaran paling sedikit iaitu 95 kapsul sahaja
2016 - 2021	Selama 6 tahun pengeluaran Ir-192 adalah lebih daripada 200 biji kapsul setahun (230 – 330 biji kapsul) .
2019	Pengeluaran Ir-192 mencapai tahap maksimum iaitu sebanyak 330 kapsul dikeluarkan.
2022	Hanya 107 kapsul dikeluarkan disebabkan krisis Rusia/Ukraine. Kesukaran mendapat punca terkedap Ir-192.
2023	112 kapsul

Semasa krisis Rusia/Ukrainie, syarikat industri NDT di Malaysia terpaksa mengimport Ir-192 yang telah siap dipasang. Kos harga yang dipasang dari luar negara adalah lebih mahal berbanding dengan dipasang di NM. Dijangka penggunaan punca terkedap Ir-192 semakin bertambah seiring dengan pertambahan industri NDT di Malaysia. Kesimpulannya, Pusat Khidmat BRI berjaya mengekalkan prestasinya dalam pemasangan dan pengeluaran punca terkedap Ir-192 dalam industri radiografi.

Bilangan pengeluaran Ir-192 bagi tahun 2009 hingga tahun 2023.

RUJUKAN

1. Production techniques and quality control of sealed radioactive sources of palladium-103, iodine-125, indium-192 and ytterbium-169. IAEA-TECHDOC-1512

NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

PENYENGGARAAN DAN PENJAGAAN SISTEM TOMOGRAFI BERKOMPUTER SINAR-X

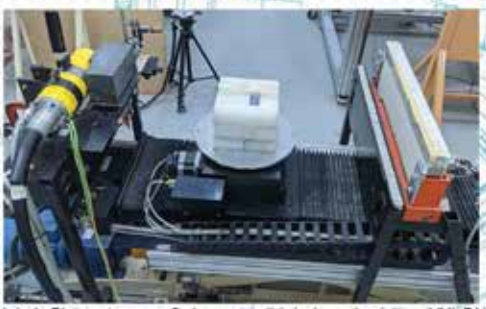
*Susan Sipaun, Mohamad Rabaie Bin Shari, *Izuhan Bin Ismail, *Ramzah Bin Mohamed, Hearie Bin Hassan, Airwan Affandi Bin Mahmood dan Nurliyana Binti Abdullah*

PENGENALAN

Suatu program penyenggaraan dan penjagaan telah ditetapkan bagi menguji fungsian kesemua komponen sistem tomografi sinar-x bagi mencapai prestasi optima sistem (Jadual 1). Rajah 1-3 menerangkan kerja penyenggaraan yang telah dijalankan di makmal tomografi sinar-x.

Jadual 1. Senarai semak penyenggaraan dan penjagaan

KOMPONEN	SEMAKAN	KEKERAPAN
Mesin sinar-x / Operasi mesin	Senggara Cegahan / Pemanasan tiub (kV)	1 kali setahun / Setiap 3-14hari
Pengesan LAD	Piksel & corak graf	Harian
Meja CT	Kedudukan & putaran 360°	Harian



Rajah 1. Sistem tomografi sinar-x terdiri dari mesin sinar-x YXLON MG 165/4.5 (kiri), meja berputar boleh laras 6K4 Time & Precision (tengah) dan pengesan tatasusunan linear LAD Xscan f3 series (kanan)

KAEDAH

- Penyenggaraan mesin sinar-x: penentusahan kefungsian, pembersihan dan ujian mekanikal dan elektrikal.
- Penentukuran pengesan: setiap baris dan lajur piksel diperiksa nilai minima, maksimum, hingar dan purata.
- Pemeriksaan mekanikal: alihan linear sehingga 1 meter (motor 1), gerakan menegak sehingga 30mm (motor 2) dan putaran 360 darjah (motor 3).

HASIL KAJIAN DAN PERBINCANGAN

Rajah 2. Penentukuran pengesan: Setiap baris dan lajur piksel diperiksa menggunakan perisian XView 4.2

(a) Penjana voltan tinggi (b) Kepala kabel / Ruang antara muka (c) Kabel ke tiub sinar-x

Rajah 3. Kabel voltan tinggi menghantar keluaran voltan tinggi dari (a) penjana voltan tinggi ke (c) tiub sinar-x dan menghantar voltan pemanasan ke filamen tiub. Kepala kabel dan ruang antara muka (b) perlu diperiksa, dibersihkan dan disenggara dengan rapi.

KESIMPULAN

Melalui proses penyenggaraan cegahan, pengguna sistem tomografi sinar-x dapat menjangkakan dimana kemungkinan berlakunya isu teknikal pada masa akan datang serta bahagian sistem atau komponen yang mungkin akan rosak sebelum ianya berlaku.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

INDUSTRIAL COMPUTED TOMOGRAPHY IMAGING ROOM

Susan Sipaun, Nur Adlin Syahira Mohd Faizal (UiTM), Mohamad Rabaie Shari, Airwan Affandi Mahmood and Nurliyana Abdullah

INTRODUCTION

Radiation leakage can cause an over-exposure of personnel to radiation and can cause harm to their health. This paper describes the radiation exposure levels while the x-ray CT was operated continuously at 160kV. The selected areas for investigation were the X-ray CT lab and the surrounding areas (Figs. 1 & 2). Two radiation survey meters were used in this experiment; multipurpose survey meter (RDS-110) and general-purpose survey meter (Ludlum Model 3) paired with Ludlum Model 44-9 pancake detector.

AREAS OF INVESTIGATION

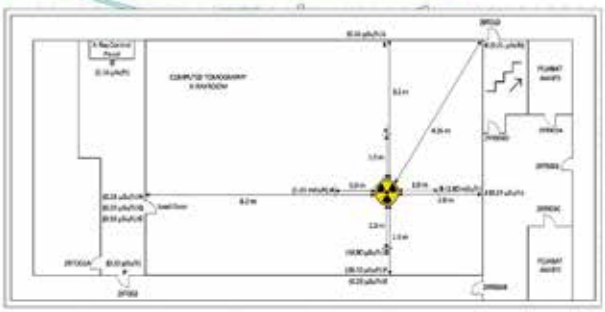

Figure 1. Schematic diagram of X-ray CT room and its surrounding area (ground floor)

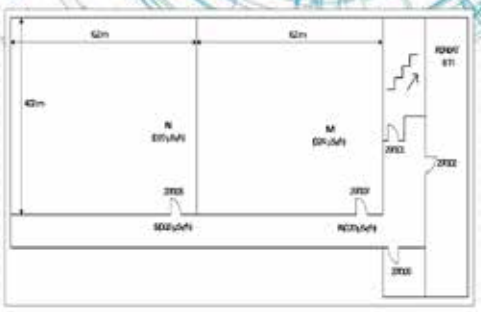

Figure 2. Schematic diagram of offices (first floor)

RESULTS

Table 1. Dose rate measurement outside the X-ray CT room.

Position	G	H	I	J	K	L	M	N	O	P	Q	R	S
Distance from source (m)	6.2	6.2	1.8	2.8	4.4	3.2	2.4	2.4	4.0	2.0	6.2	2.4	2.4
Background dose rate (μSv/h)	0.20	0.21	0.20	0.19	0.19	0.16	0.22	0.22	0.20	0.19	0.21	0.20	0.21
Dose rate (μSv/h)	0.18	0.18	0.24	0.25	0.2	0.16	0.25	0.2	0.17	0.2	0.2	0.21	0.18
	0.18	0.18	0.22	0.23	0.2	0.16	0.25	0.2	0.16	0.2	0.2	0.19	0.18
	0.17	0.18	0.22	0.23	0.22	0.17	0.22	0.18	0.16	0.2	0.2	0.19	0.18
Average dose rate (μSv/h)	0.18	0.18	0.23	0.24	0.21	0.16	0.24	0.19	0.16	0.20	0.20	0.20	0.18
Standard deviation	0.01	3.40E-17	0.01	0.01	0.01	0.01	0.02	0.01	0.01	3.40E-17	3.40E-17	0.01	3.40E-17
Dose rate (μSv/h)	0.18±0.01	0.18±3.40E-17	0.23±0.01	0.24±0.01	0.21±0.01	0.16±0.01	0.24±0.02	0.19±0.01	0.16±0.01	0.20±3.40E-17	0.20±3.40E-17	0.20±0.01	0.18±3.40E-17

CONCLUSION

The results in Table 1 show that this CT imaging room is adequately constructed for x-ray CT works whereby radiation dose outside the room in the surrounding area is between **0.16±0.01 μSv/h and 0.24±0.02 μSv/h**. Limit for occupational exposure is 20mSv per year or 2.28 μSv/h.

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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

PROPAGATION AND TITRATION OF NEWCASTLE DISEASE VIRUS IN EMBRYONIC CHICKEN EGGS

Abang Abdul Rahim Ossen[1]*, Nurmaziah Mohammad Shafie[1], Zainah Adam[1], Rosniza Razali[1], Daryl Jesus Arapoc[1], Hazlina Ahmad Hassali[1], Azfar Hanif Abd Aziz[1], Pheik-Sheen Cheow[2], Suet Lin Chia[2,3,4]

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INTRODUCTION

Newcastle Disease virus (NDV) is a non-segmented, single-stranded, negative-sense RNA virus that belongs to the family paramyxoviridae (Al-Ziaydi et al., 2020). NDV mainly affects avian can be propagated by using embryonic chicken eggs, which is an old but a reliable method that is still far superior to produce high titre of NDV culture (McGinnes et al., 2006). The titre of the virus can be quantified by using Hemagglutination Assay (HA) test, which is a fast and inexpensive technique that utilized serial dilution and the clumping activity of the red blood cells caused by the virus (Ryu, 2017). This poster explains the procedure from viral propagation to titration, which the culture can be utilized in the application of vaccine development.

ANATOMY OF EMBRYONIC EGG

METHODOLOGY

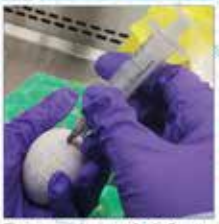
1 EGG SANITATION & STORAGE

The eggs are sanitized by fumigation using 5 g of potassium permanganate mixed with 17.5 ml of formalin for 15 minutes. The eggs are aerated before being incubated at 38°C.

2 CANDLING

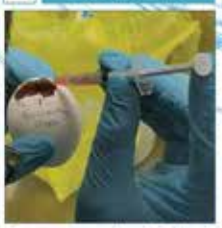
The eggs are candled everyday until 2 days post-inoculation to check for their viability.

3 VIRUS INOCULATION



The eggs are marked 2 mm above the allantoic cavity at the air sac with the embryo's head facing away. It is poked with a thumb tack and injected with 0.1 ml (20 HA) of stock virus into the allantoic cavity and sealed with a glue. The eggs are incubated for 2 days.

4 VIRUS HARVESTING

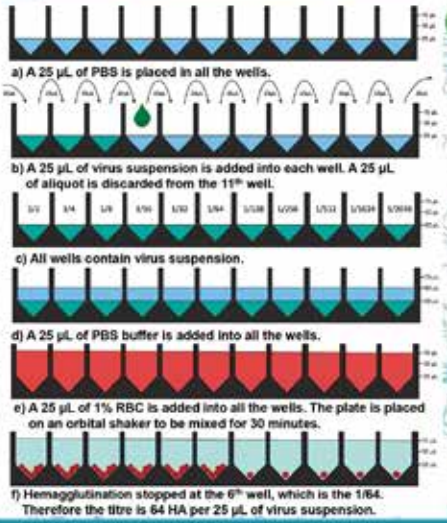


The eggs are placed inside a refrigerator at 4°C overnight before harvest. The shell on the air sac is knocked with a spatula and fragments are removed using forceps. The allantoic fluid containing a virus culture is carefully extracted.

5 PREPARATION OF RED BLOOD CELLS (RBC)

A 25 ml of chicken blood is mixed with 1 ml of 0.12 M Na_2-EDTA. The mixture is washed using PBS buffer with an equal volume and centrifuged at 15k RPM for 5 minutes, repeated for 3 times. A stock of RBC with a concentration of 10% v/v in PBS buffer is obtained.

6 HEMAGGLUTINATION ASSAY (HA) TEST



a) A 25 µL of PBS is placed in all the wells.

b) A 25 µL of virus suspension is added into each well. A 25 µL of aliquot is discarded from the 11th well.

c) All wells contain virus suspension.

d) A 25 µL of PBS buffer is added into all the wells.

e) A 25 µL of 1% RBC is added into all the wells. The plate is placed on an orbital shaker to be mixed for 30 minutes.

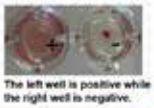
f) Hemagglutination stopped at the 6th well, which is the 1/64. Therefore the titre is 64 HA per 25 µL of virus suspension.

RESULTS AND DISCUSSION

A propagated virus suspension in an allantoic fluid has the same colour and opacity of an egg white at room temperature. A fail propagation will result in a cloudy appearance due to bacterial contamination. The presence of blood or egg yolk in the harvested fluid is also considered as contamination.

The titration of the virus culture is determined on the last number of well with a positive result in the HA test. If the last positive result is shown on the sixth well, which the dilution is $\frac{1}{2^6}$ or $\frac{1}{64}$, the value is reciprocal to the dilution number, which is 2^6 or 64. Therefore, the viral titre is 2^6 HA units or 64 HA units.

The presence of blood indicates the culture is contaminated.



The left well is positive while the right well is negative.

CONCLUSION

Using embryonic chicken eggs and hemagglutination assay are still the reliable techniques to propagate and titrate NDV or any other influenza viruses.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

UTILISATION OF GAMMA COUNTER IN BIODISTRIBUTION STUDY BY CUT & COUNT APPROACH

Anee Suryani Sued, Nurul Fazliana Amira Mohd Jamil, Wan Hamirul Bahrin Wan Kamal, Saifullizan Mohamad, Ng Yen, Siti Aminah Mohamad , Manisah Saedon, Muhammad Ridzuan Rosdi, and Muhammad Fathurrahman Faizul Akhmal

ABSTRACT

Biodistnbution (BQC) of ^{99m}Tc-DTPA in Sprague Dawley rats was evaluated in six (6) different time points within the range of 5 min to 24 h. Through cut & count approach, three (3) rats were used for each time point. The gamma radiation emitted from ^{99m}Tc isotope in 13 organs/samples was counted using Gamma Counter (Wizard^2 Perkin Elmer, USA). Prior to use, the Gamma Counter shall undergo normalization, background measurement and Instrument Performance Assessment Measurement. Correction to the Gamma Counter efficiency was performed by applying radioisotope (^{99m}Tc) standard data to BQC data. This correction needs to be performed for every isotope used in BQC cut and count study.

METHODOLOGY

1 Performance Qualification
- Normalisation with ^{129}I
- Background measurement
- Instrument Assessment Performance

2 Biodistribution Study
- Animal experiment & sample disecting
- ^{99m}Tc activity / % ID determination

RESULT AND DISCUSSION

Performance Qualification

- Normalisation - PASS
- Background Measurement – PASS
- IPA Measurement - PASS

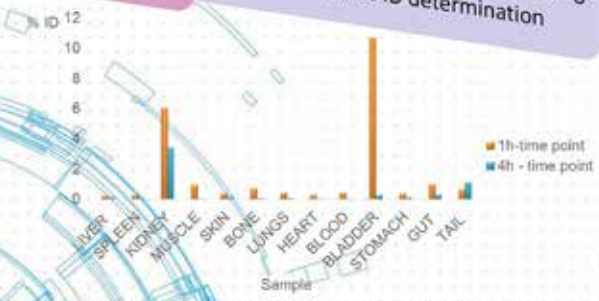

Figure 3.1: Biodistribution study of ^{99m}Tc-DTPA in *Sprague Dawley* rats at 1h and 4h time point

CONCLUSION

Gamma counter (WIZARD^2 Perkin Elmer, USA) is suitable to be used for the detection and measurement of gamma radiation in samples during biodistribution study in the research and development of radiopharmaceutical kits.

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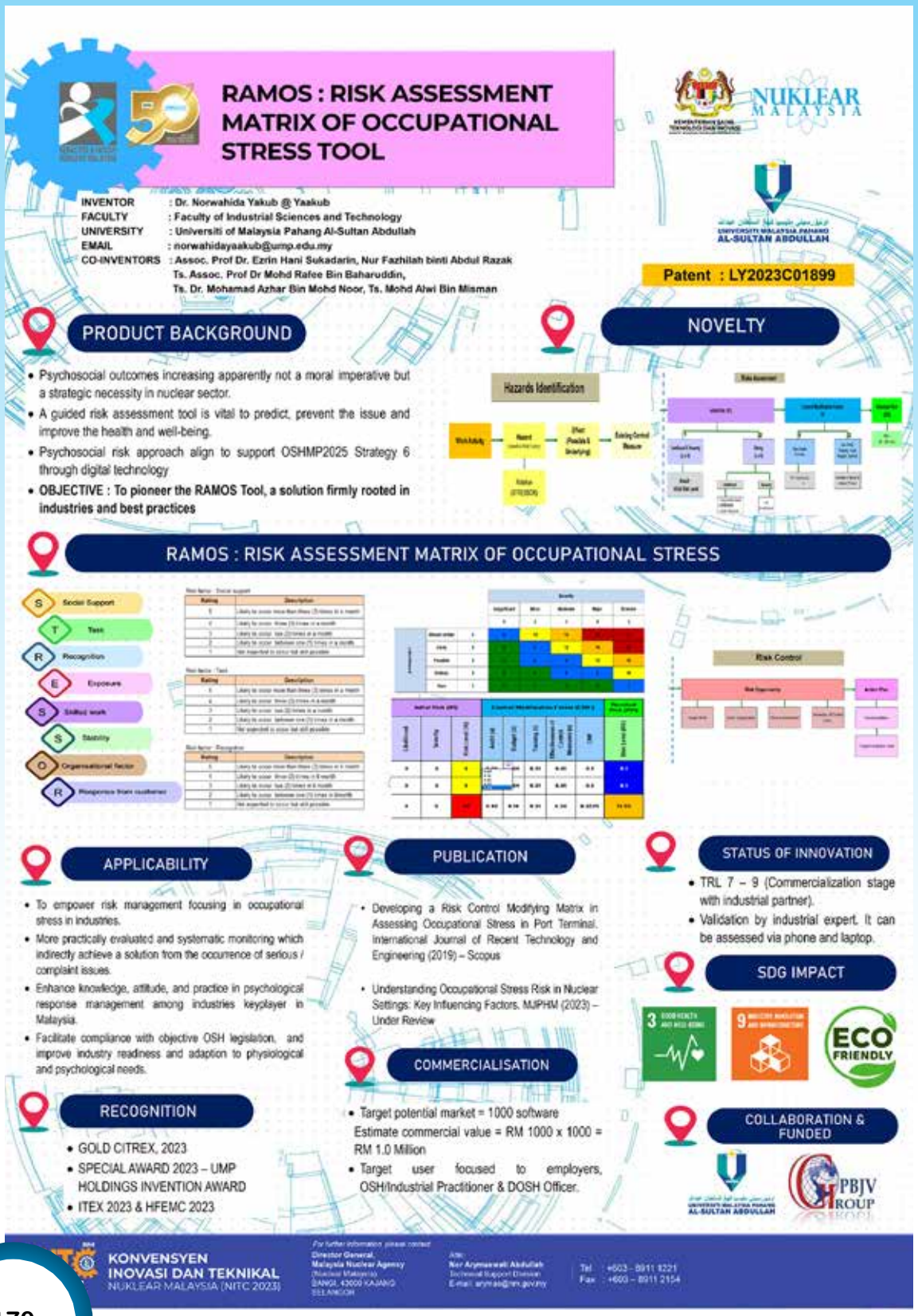
RAMOS : RISK ASSESSMENT MATRIX OF OCCUPATIONAL STRESS TOOL
INVENTOR : Dr. Norwahida Yakub @ Yaakub
FACULTY : Faculty of Industrial Sciences and Technology
UNIVERSITY : Universiti of Malaysia Pahang Al-Sultan Abdullah
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CO-INVENTORS : Assoc. Prof Dr. Ezrin Hani Sukadarin, Nur Fazhilah binti Abdul Razak
Ts. Assoc. Prof Dr Mohd Rafee Bin Baharuddin,
Ts. Dr. Mohamad Azhar Bin Mohd Noor, Ts. Mohd Alwi Bin Misman
NUKLEAR MALAYSIA
Patent : LY2023C01899
PRODUCT BACKGROUND
Psychosocial outcomes increasing apparently not a moral imperative but a strategic necessity in nuclear sector.
A guided risk assessment tool is vital to predict, prevent the issue and improve the health and well-being.
Psychosocial risk approach align to support OSHMP2025 Strategy 6 through digital technology
OBJECTIVE : To pioneer the RAMOS Tool, a solution firmly rooted in industries and best practices
NOVELTY
Hazards Identification
RAMOS : RISK ASSESSMENT MATRIX OF OCCUPATIONAL STRESS
Risk Control
APPLICABILITY
To empower risk management focusing in occupational stress in industries.
More practically evaluated and systematic monitoring which indirectly achieve a solution from the occurrence of serious / complaint issues.
Enhance knowledge, attitude, and practice in psychological response management among industries keyplayer in Malaysia.
Facilitate compliance with objective OSH legislation, and improve industry readiness and adaption to physiological and psychological needs.
PUBLICATION
Developing a Risk Control Modifying Matrix in Assessing Occupational Stress in Port Terminal. International Journal of Recent Technology and Engineering (2019) – Scopus
Understanding Occupational Stress Risk in Nuclear Settings: Key Influencing Factors. MJPHM (2023) – Under Review
STATUS OF INNOVATION
TRL 7 – 9 (Commercialization stage with industrial partner).
Validation by industrial expert. It can be assessed via phone and laptop.
SDG IMPACT
ECO FRIENDLY
COMMERCIALISATION
Target potential market = 1000 software
Estimate commercial value = RM 1000 x 1000 = RM 1.0 Million
Target user focused to employers, OSH/Industrial Practitioner & DOSH Officer.
RECOGNITION
GOLD CITREX, 2023
SPECIAL AWARD 2023 – UMP HOLDINGS INVENTION AWARD
ITEX 2023 & IFEMC 2023
COLLABORATION & FUNDED
PBJV GROUP
KONVENSYEN INOVASI DAN TEKNIKAL
NUKLEAR MALAYSIA (NITC 2023)

Penyediaan SOP bagi Memperbaiki Mutu Perbincangan Teknikal di dalam Mesyuarat JPICT Agensi Nuklear Malaysia

Mohamad Safuan Bin Sulaiman[1], Shukri Bin Mohd[2], Siti Nurbahyah Binti Hamdan[1], Maizura Binti Ibrahim[3], Saa'idi Bin Ismail[3], Mohd Fauzi Bin Haris[1], Amy Hamijah Binti Ab Hamid[1], Sufian Norazam Bin Mohamed Aris[1], Mohd Hasnor Bin Hasan[1], Mohd Dzul Aiman Bin Aslan[1], Norzalina Binti Nasirudin[1], Raja Murzaferi Bin Raja Moktar[1], Nur Fatini Binti Abdul Ghani[1], Muhammad Rawi Bin Mohamed Zin[3], Rosli Bin Darmawan[4]

[1]Pusat Teknologi Maklumat, BST, Nuklear Malaysia affiliation, [2]Bahagian Sokongan Teknikal, Nuklear Malaysia, [3]Program Teknikal, Nuklear Malaysia, [4]Program Penyelidikan dan Pembangunan Teknologi, Nuklear Malaysia. **Correspondence author: safuan@nm.gov.my**

PENGENALAN

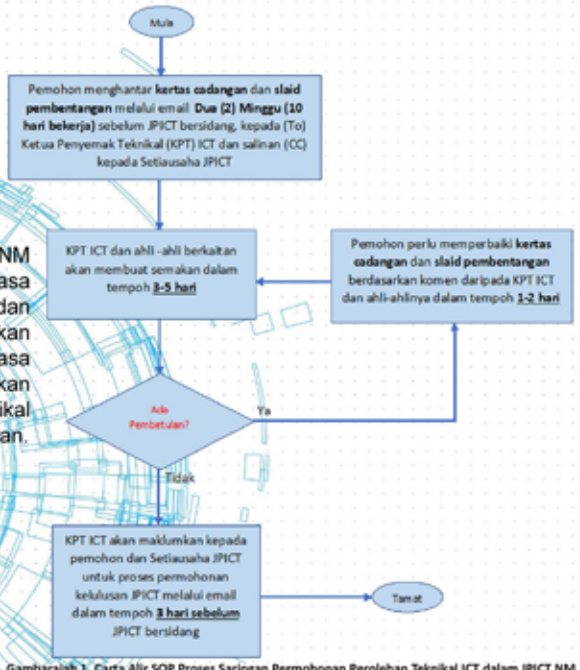
Dalam melaksanakan fungsi JPICT NM, perbincangan teknikal secara mendalam tidak dapat dielakkan. Justeru, masa yang panjang perlu diperuntukkan dalam membincangkan sesuatu isu penting samada yang melibatkan polisi mahupun teknikal. Seringkali kedua-dua isu tersebut saling bertaut silang sehingga masa perbincangan berlanjutan dan menyebabkan mesyuarat lewat ditangguhkan serta pernah dilaksanakan pada siri kedua dalam bilangan yang sama. Bagi mengatasi masalah ini, pada mesyuarat JPICT Bil 2/2023 [5], ahli mesyuarat sebulat suara bersetuju agar satu SOP diwujudkan untuk mengasingkan perbincangan teknikal secara mendalam berkaitan projek dan usul dari setiap bahagian dalam Nuklear Malaysia. Hanya hasilan perbincangan teknikal tersebut sahaja yang akan diangkat ke mesyuarat JPICT NM.

KAEDAH

Pembangunan SOP ini menggunakan kaedah kualitatif yang melibatkan beberapa siri perbincangan, temuduga, carian dan penelitian dokumen, aduan, komen serta pemerhatian dari pengalaman dalam melaksanakan perjalanan mesyuarat JPICT NM. Deraf SOP yang dibangunkan telah dibentangkan dalam JPICT NM Bil 3/2023 dan telah dipersetujui untuk dilaksanakan. Perlaksanaan dan pengujian SOP ini juga telah dilaksanakan dalam JPICT NM Bil 2/2023 pada 28 Mei 2023 dan Bil 3/2023 pada 8 Ogos 2023. Tuan Timbalan Ketua Pengarah Program Teknikal merangkap Ketua Pegawai Digital (CDO) Nuklear Malaysia (YBrs. Dr. Muhammad Rawi Bin Mohamed Zin) dan Tuan Pengarah BST (YBrs. Dr. Shukri Bin Mohd) telah mengesahkan SOP tersebut.

HASIL & PERBINCANGAN

Gambarajah 1, menunjukkan hasil pembangunan SOP tersebut. Penerangan terperinci carta alir SOP boleh merujuk kepada kertas abstrak lanjutan (Extended Abstract). Boleh email kepada : safuan@nm.gov.my untuk mendapatkan abstrak lanjutan tersebut.



Gambarajah 1. Carta Alir SOP Proses Saringan Permohonan Perolehan Teknikal ICT dalam JPICT NM

KESIMPULAN

SOP ini telah diterima baik ahli mesyuarat JPICT NM dan telah berjaya mengurangkan penggunaan masa perbincangan teknikal. lanya didapati berkesan dan dicadangkan untuk diteruskan pada mesyuarat akan datang. Penggunaan SOP ini dapat mengurus masa perbincangan dengan lebih baik tanpa mengabaikan perbincangan yang memperincikan aspek teknikal dalam membuat keputusan yang tepat dan meyakinkan.

RUJUKAN

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2. Garis Panduan Mengenai Tatacara Memohon Kelulusan Teknikal Projek ICT Agensi Kerajaan Jabatan Perdana Menteri Malaysia, Surat Pekeliling Am Bilangan 1 Tahun 2009 30 April 2009.
3. Garis Panduan Mengenai Tatacara Memohon Kelulusan Teknikal Projek ICT Agensi Kerajaan Jabatan Perdana Menteri Malaysia, Surat Pekeliling Am Bilangan 1 Tahun 2008, 18 Februari 2008
4. Garis Panduan Mengenai Tatacara Memohon Kelulusan Teknikal Projek ICT Agensi Kerajaan (Tambahan Pertama Kepada Spa Bil. 2 Tahun 2000), Surat Pekeliling Am Bilangan 4 Tahun 2004, 20 Ogos 2004
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NUKLEAR MALAYSIA
NTC
DEVELOPMENT OF WEB-BASED DATABASE MANAGEMENT SYSTEM (DBMS) FOR FIELDWORK SITE SERVICE: ELECTRICAL RESISTIVITY SURVEY
Mohd Faizun Khalid, Dr. Rahman Yaccup, Dr. Lakam Mejus, Nor Dalila Desa, Mohd Muzamil Mohd Hashim, Dr. Nurul Fairuz Diyana Bahrudin, Muhamad Syahiran Mustaffa, Engku Mohd Fahmi Engku Chik, Rozilawati Mohd Japar, Kamaruzaman Mohamad @ Mamat, Mohamad Wafiy Abdul Wahab.
INTRODUCTION
Electrical Resistivity Survey is one of two fieldwork site services that carried out by E-Tag Group. Terrameter LS 2 is the latest ABEM device used by the team to perform resistivity fieldwork. After team completed resistivity fieldwork, researcher has to retrieve result from device for technical report preparation. The number of resistivity reports are increasingly prepared to be published, so development of web-based database management system (DBMS) is purposed to manage and organize a large number of resistivity reports with more efficiently. This web-based DBMS is also organize and store details of clients that request for resistivity fieldwork. This part assists researcher to manage details of new resistivity fieldwork for the particular client's company on request.
METHODOLOGY
1
CLIENT
Select Client for Add New Resistivity Fieldwork
2
Researcher manages Details of New Resistivity Fieldwork
3
Manager approves of New Resistivity Fieldwork
4
APPROVED
Researcher notified of Approved Resistivity Fieldwork
5
Team perform Resistivity Fieldwork at site
6
Researcher prepares report of Resistivity Fieldwork
WEB-BASED DBMS
User Login with Different Roles
Name and Role are displayed on the screen
Form to adding details of New Resistivity Fieldwork
List of Resistivity Fieldworks
CONCLUSION
Nowadays, web-based database management system is widely developed for variety of industries especially in R&D Industry. This DBMS is currently developed to be a full system that can be used by E-Tag Group. In the future, this DBMS will be proposed with second fieldwork site that carried out by E-Tag Group known as Seismic.
KONVENSYEN INOVASI DAN TEKNIKAL
NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

ISOLATION AND PURIFICATION OF 4-PHENYLCOUMARINS FROM MESUA ASSAMICA BY FAST CENTRIFUGAL PARTITION CHROMATOGRAPHY

Hazlina Ahmad Hassali [1], Rosniza Razali[1], Fazliana Mohd Saaya[1], Daryl Jesus Arapoc[1], Zainah Adam[1], Nor Azizah Marsiddi[1], Azfar Hanif Abd Aziz[1], Nurmaziah Mohammad Shafie[1], Abang Abdul Rahim Ossen[1], Veshalini Kasiraja[2], Chan Gomathi[3] and Khalijah Awang[4]

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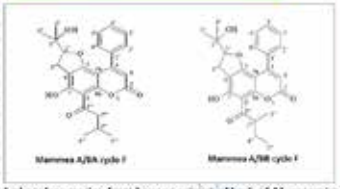
[3]Gilson Inc.3000 Parmenter Street, PO Box 620027, Middleton, WI 53562-0027, USA
[4]Department of Chemistry, Faculty of Science, University of Malaya, 50100 Kuala Lumpur, MALAYSIA

INTRODUCTION

Natural products are important sources for drug development. Today, it is very crucial to develop effective and selective methods for the isolation and purification of those bioactive natural products. *Mesua assamica* (King & Prain) Kosterm. belongs to the family Calophyllaceae. The preliminary screening findings suggest that non-polar extracts of *M. assamica* bark particularly hexane extract exhibited good cytotoxic activity and could be potentially useful for the development of therapeutic agents against cancer. Fast Centrifugal Partition Chromatography (FCPC), an efficient and easily scalable approach for the isolation and purification of natural products. FCPC method was developed for the separation of 4-phenylcoumarins from *M. assamica hexane* extract.

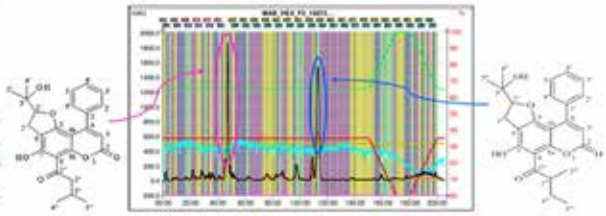
METHODOLOGY



4-phenylcoumarins from hexane extract of bark of *M. assamica*

- Sample : Fraction F3 from hexane crude of *Mesua assamica*
- Instrument : Armen FCPC-250 coupled with Armen Spot Prep II
- Solvent : ACN/H_2O with 0.1% TFA (9:1:9:1)
- Flow Rate : 10mL/min
- Rotor Speed : 1600 rpm
- Mode of elution : Isocratic mode

RESULTS AND DISCUSSION



Two 4-phenylcoumarins compounds were isolated by using FCPC and the structures of these two compounds were identified by 1H NMR, 13C NMR and LC-MS/MS ; Mammea A/BA cyclo F and Mammea A/BB cyclo.

CONCLUSION

FCPC attracted great attention in separation science and have been widely used in the separation of natural products. Two 4-phenylcoumarins namely mammea A/BB cyclo F and mammea A/BA cyclo F were isolated by using FCPC and the structures of these two compounds were identified by 1H NMR, 13C NMR and LC-MS/MS.FCPC is cost-effective and dramatically reduces solvent use resulting in a more environmentally-friendly, green technique.

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Puppala, E. R., Yalamarthi, S. S., Aocherlar, S. L., Prasad, N., Syamprasad, N. P., Singh, M., Nanjappan, S. K., Ravichandiran, V., Tripathi, D. M., Gangasani, J. K., & Naidu, V. G. M. (2023). Mesua assamica (King&Prain) kosterm. Bark ethanolic extract attenuates chronic restraint stress aggravated DSS-induced ulcerative colitis in mice via inhibition of NF- κß/STAT3 and activation of HO-1/Nrf2/SIRT1 signaling pathways. *Journal of ethnopharmacology, 301*, 115765.

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NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

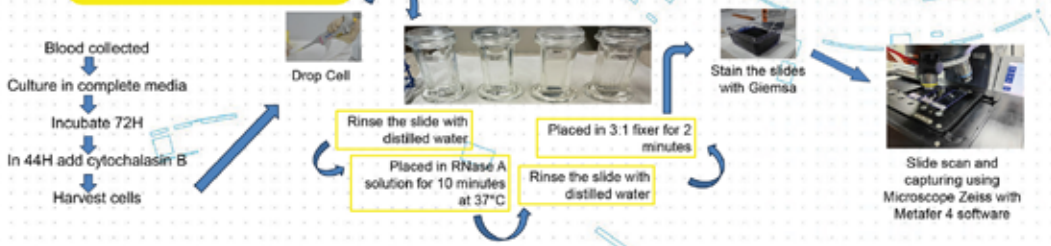
PRE-TREATMENT WITH RNASE A IN CYTOKINESIS BLOCK MICRONUCLEUS ASSAY FOR ANALYSIS USING AUTOMATED SYSTEM

Juliana Mahamad Napiah, Rahimah Abdul Rahim, Nurul Nazeerah Juarimi and Noraisyah Mohd Yusof

INTRODUCTION

The cytokinesis-block micronucleus (CBMN) assay is a comprehensive technique for measuring DNA damage, including lymphocytes. CBMN assay is a simple and an alternative way for indicator of chromosome damage. It is because only need to measure visible micronuclei (MN) in binucleated cells, micronuclei analysis is much easier than metaphase chromosome aberration analysis and very useful in a large radiation accident case because of its simplified technique and much easier to analysis. Treatment with RNase A is a pretreatment step in the protocol to remove any residual RNA present. Objective of this study to prove RNase A is a treatment that very useful for analyze binucleated cell using automated analysis system. Automated system is more sensitive to analyze image compared to manual microscope.

METHODOLOGY



RESULT AND DISCUSSION

Figure 1 show microscopic view of binucleated cells with and without treatment of RNase A. background for image (a) is darker than image (b). RNase A was reducing the background so that the image much easier to analyze.

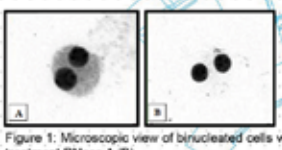


Figure 1: Microscopic view of binucleated cells without RNase A treatment (A) and with treatment RNase A (B).

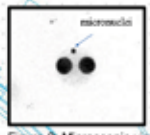


Figure 2: Microscopic view of binucleated cells with 1 MN (slide treated with RNase A)

Binucleated cells with micronuclei shown in Figure 2. Image clearly shows a micronuclei, micronuclei size is small than the binucleated cell and same color with binucleated cell. Without treatment, the background was darker, and micronuclei look-a-like image will be confusing to analyze.

CONCLUSION

RNase A treatment is useful for analyzing Giemsa stained CBMN microscopic images quickly and automatically. Automated system is more sensitive compared to manual microscope. Clear background of cell is more helpful to analyze the cell.

REFERENCES

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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UTILIZING ONTOLOGY FOR MODELLING THE EXISTING PERSONNEL TRUSTWORTHINESSEVALUATION PROCESS

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INTRODUCTION

Personnel trustworthiness evaluation is an important task to mitigate insider threats in the nuclear sector. Most organizations implemented a background-checking process for personnel trustworthiness evaluation. The process is done manually, by screening a personnel's background data, by a security personnel in the Security Department. The process raised issues as there is human intervention in the process. The screening result could be biased based on the human perception or the relationship of the evaluator to the personnel that is being evaluated. Therefore, there is a need to overcome the problem. An artificial intelligence (AI) system could autonomously evaluate the personnel's trustworthiness, thus eliminating human bias. One of the techniques in developing an AI system is by utilizing the knowledge-based technique. In the knowledge-based technique, the use of ontologies is necessary to provide useful features such as providing a vocabulary for referring to the terms and a subject area, and a taxonomy of hierarchical categorization or classification of entities within the domain. Therefore, this paper proposed ontology, namely, the **Personnel Trustworthiness Evaluation Ontology (PTEO)** to model the existing personnel trustworthiness evaluation process.

Trustworthiness

- *A noun that could be projected to a person with the definition of the personal state or quality of being trustworthy or reliable.*
- *Ability to be relied on as honest & truthful.*
- *A moral value is considered to be a virtue.*
- *A trustworthy person is someone in whom you can place your trust and rest assured that the trust shall not be betrayed.*

(Oxford Dictionary, 2021)

METHODOLOGY

A method proposed by Noy, et al (2019) is followed because it adopted a simple knowledge-engineering methodology. Apart from that, the IAEA guidelines, Nuclear Security Series (NSS) No. 8-G (Rev.1) is used as the core domain reference. Furthermore, for the personnel trustworthiness, the personnel and reliability checklist published by the Institute of Nuclear Security (INS) is also used.

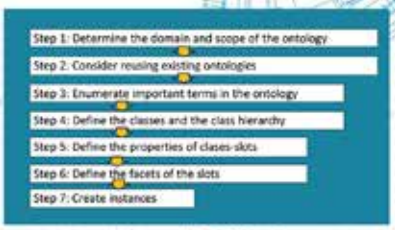


Figure 1: Steps used for PTEO development

THE PTEO VERSION 1.1

PTEO models the insiders based on three insider attributes:
(1) Access
(2) Authority
(3) Knowledge

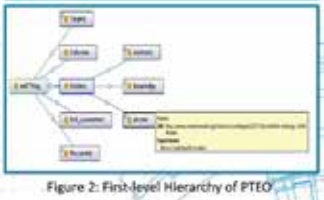


Figure 2: First-level Hierarchy of PTEO

Figure 3: Second-level Hierarchy of PTEO v1.1

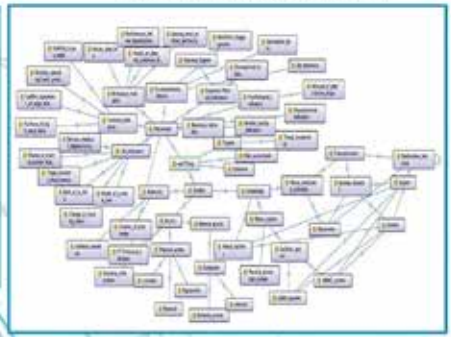


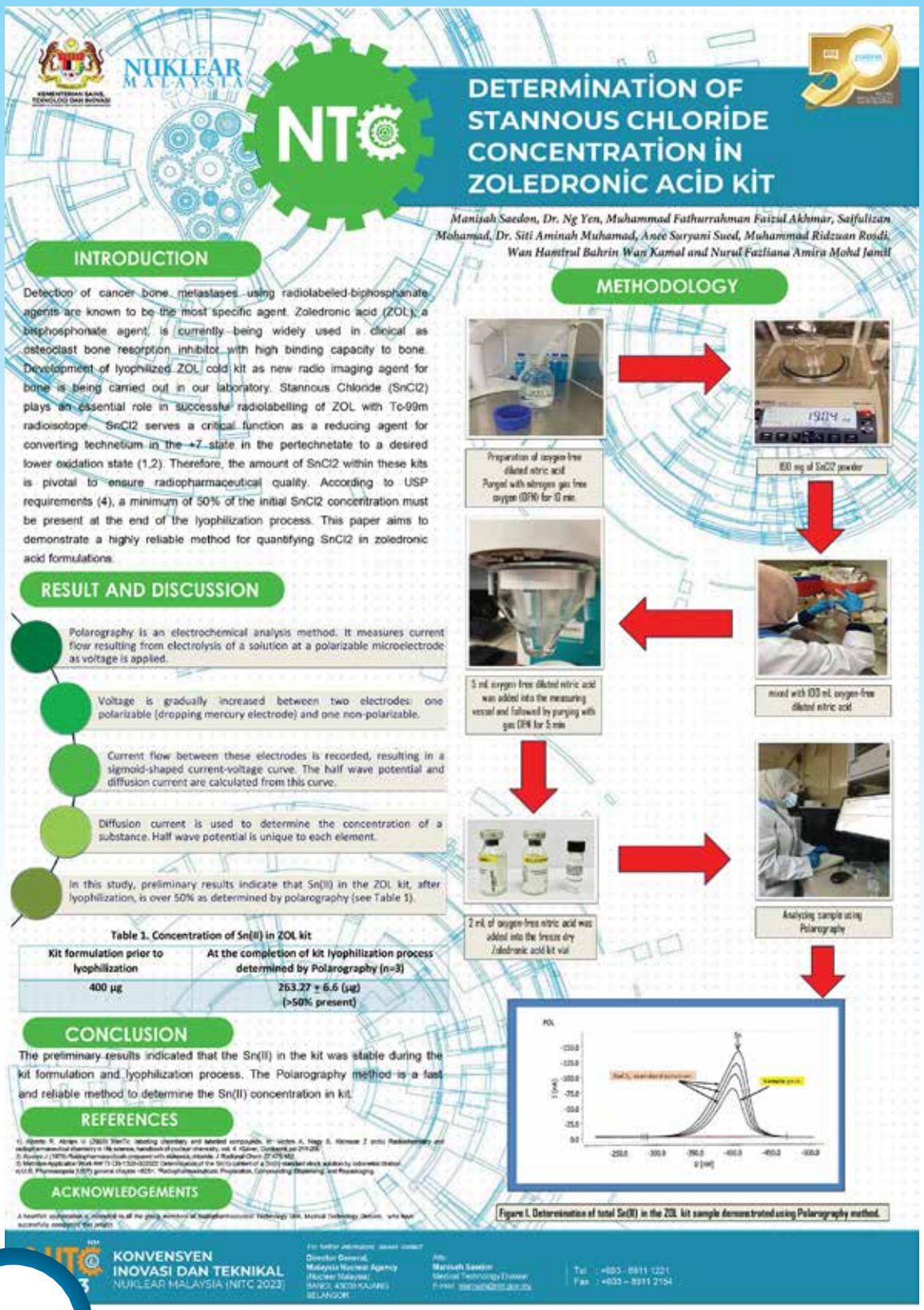
Figure 4: Radial Diagram of PTEO v1.1

CONCLUSION & FUTURE WORKS

In this paper, we have presented an ontology to model the process of evaluating personnel trustworthiness and identify potential insiders based on existing international best practices. The ontology is named based on the function it serves, which is the Personnel Trustworthiness Evaluation Ontology (PTEO) version 1.1. We also presented a methodology used during the ontology development and gives justification for why the method was adopted. The potential applications of ontology are that, it can be used in AI systems to autonomously assess the personnel trustworthiness periodically and create situational awareness so that early steps can be taken to mitigate the risk or insider threat to protect the nuclear/radioactive material, associated facilities, and associated activities.

ACKNOWLEDGEMENTS

This study was supported by the International Atomic Energy Agency (IAEA) research grant under the IAEA Coordinated Research Project CRP J02011: Improving the Security of Radioactive Material throughout its Lifecycle, Associated Facilities, and Associated Activities (Contract No. 22165).


NUKLEAR MALAYSIA
NTC
DETERMINATION OF STANNOUS CHLORIDE CONCENTRATION IN ZOLEDRONIC ACID KIT
Manisah Saedon, Dr. Ng Yen, Muhammad Fathurrahman Faizal Akhmar, Saifulizan Mohamad, Dr. Siti Aminah Muhamad, Anee Suryani Sued, Muhammad Ridzwan Rosidi, Wan Hamirul Bahrin Wan Kamal and Nurul Fazliana Amira Mohd Jamil
INTRODUCTION
Detection of cancer bone metastases using radiolabeled biphosphanate agents are known to be the most specific agent. Zoledronic acid (ZOL), a bisphosphonate agent, is currently being widely used in clinical as osteoclast bone resorption inhibitor with high binding capacity to bone. Development of lyophilized ZOL cold kit as new radio imaging agent for bone is being carried out in our laboratory. Stannous Chloride (SnCl2) plays an essential role in successful radiolabelling of ZOL with Tc-99m radioisotope. SnCl2 serves a critical function as a reducing agent for converting technetium in the +7 state in the pertechnetate to a desired lower oxidation state (1,2). Therefore, the amount of SnCl2 within these kits is pivotal to ensure radiopharmaceutical quality. According to USP requirements (4), a minimum of 50% of the initial SnCl2 concentration must be present at the end of the lyophilization process. This paper aims to demonstrate a highly reliable method for quantifying SnCl2 in zoledronic acid formulations.
RESULT AND DISCUSSION
Polarography is an electrochemical analysis method. It measures current flow resulting from electrolysis of a solution at a polarizable microelectrode as voltage is applied.
Voltage is gradually increased between two electrodes: one polarizable (dropping mercury electrode) and one non-polarizable.
Current flow between these electrodes is recorded, resulting in a sigmoid-shaped current-voltage curve. The half wave potential and diffusion current are calculated from this curve.
Diffusion current is used to determine the concentration of a substance. Half wave potential is unique to each element.
In this study, preliminary results indicate that Sn(II) in the ZOL kit, after lyophilization, is over 50% as determined by polarography (see Table 1).
Table 1. Concentration of Sn(II) in ZOL kit
Kit formulation prior to lyophilization: 400 µg
At the completion of kit lyophilization process determined by Polarography (n=3): 263.27 ± 6.6 (µg) (>50% present)
CONCLUSION
The preliminary results indicated that the Sn(II) in the kit was stable during the kit formulation and lyophilization process. The Polarography method is a fast and reliable method to determine the Sn(II) concentration in kit.
REFERENCES
ACKNOWLEDGEMENTS
METHODOLOGY
Preparation of oxygen free diluted nitric acid Purged with nitrogen gas free oxygen (OFN) for 10 min
100 mg of SnCl2 powder
mixed with 100 mL oxygen-free diluted nitric acid
5 mL oxygen free diluted nitric acid was added into the measuring vessel and followed by purging with gas OFN for 5 min
2 mL of oxygen-free nitric acid was added into the freeze dry Zoledronic acid kit vial
Analyzing sample using Polarography
Figure 1. Determination of total Sn(II) in the ZOL kit sample demonstrated using Polarography method.
KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

SISTEM PEMBUMIAN UNTUK PERALATAN NUKLEAR

Mohamad Firdaus bin Yusop, Nur Hamizah Binti Mohd Zaini

PENDAHULUAN

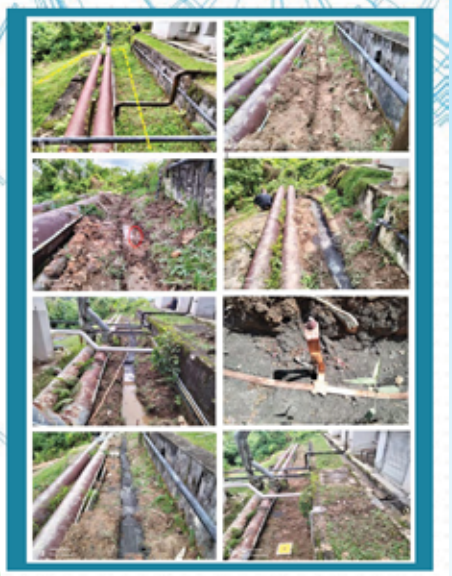
Pembumian ialah proses penyambungan peralatan nuklear ke garisan bumi atau tanah fizikal untuk mengalirkan arus yang tidak diingini serta melindungi pengguna dan peralatan daripada bahaya elektrik. Jika litar pintas atau kebocoran arus berlaku, elektrik mungkin mengalir melalui badan manusia dan menyebabkan kecederaan serius dan merosakkan peralatan nuklear. Sistem pembumian peralatan nuclear yang direka perlu mematuhi piawaian keselamatan yang ditetapkan oleh agensi kawal selia seperti Suruhanjaya Elektroteknikal Antarabangsa (IEC) dan Suruhanjaya Kawal Selia Nuklear (NRC).

KEPENTINGAN SISTEM PEMBUMIAN BAGI ALATAN NUKLEAR

- Dalam konteks peralatan nuklear, sistem pembumian berfungsi untuk melindungi peralatan daripada lonjakan kuasa atau potensi arus bocor yang boleh merosakkan komponen sensitif dan mengganggu operasi peralatan.
- Kilat yang menyebabkan lonjakan arus tinggi dan gangguan elektrik seperti peningkatan voltan atau bekalan elektrik yang tidak stabil boleh menyebabkan kerosakan peralatan nuklear dan meningkatkan risiko kebakaran

FAKTOR – FAKTOR PEMASANGAN SISTEM PEMBUMIAN

1. Kerintangan tanah
2. Elektrod Pembumian
3. Ciri – ciri sistem peralatan nuklear
4. Keadaan persekitaran
5. Peraturan dan piawaian keselamatan
6. Keperluan penyelenggaraan



Proses pemasangan sistm pembumian

CABARAN & PENYELESAIAN SISTEM PEMBUMIAN

Cabaran: Infrastruktur bangunan lama menyebabkan , tahap kebolehpercayaan sistem pembumian merosot disebabkan oleh hakisan, penyelenggaraan yang tidak mencukupi atau reka bentuk yang ketinggalan zaman

Penyelesaian:

- Pemeriksaan dan penyelenggaraan yang kerap. Ini termasuk menjalankan ujian berkala untuk memastikan sistem pembumian berfungsi dalam parameter yang boleh diterima
- Pengubahsuaian pada infrastruktur bangunan. Ini boleh melibatkan pemasangan elektrod pembumian tambahan atau menaik taraf konduktor pembumian sedia ada untuk mengurangkan rintangan kepada pembumian

KONKLUSI

Pembumian yang baik boleh melindungi pengguna dan peralatan daripada lonjakan kuasa dan memastikan operasi yang selamat. Pengalir yang baik, reka bentuk yang betul dan penyelenggaraan berkala adalah faktor yang paling penting dalam mencapai pembumian yang berkesan.

NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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NUKLEAR MALAYSIA

NTC

The Collaboration Between Malaysian Nuclear Agency and Japan Atomic Energy Agency For Follow-up Training Course on Nuclear and Radiological Emergency Preparedness

Noor Fadilla Ismail, Muhamad Zahidee Taat, Azimawati Ahmad, Mohd Fazlie Bin Abdul Rashid, Syed Asraf Fahlawi Wafa S.M Ghazi, Asmaliza Hashim, Raymond Yapp Tze Loong, Shahrul Azlan Azizan, Hairul Nizam Idris, Mohamed Zaffar Ali Mohamed Amiro, Manisah Saedon.

INTRODUCTION

Since year 2010, the Malaysian Nuclear Agency (Nuclear Malaysia) has established a strong partnership with the Japan Atomic Energy Agency (JAEA) to consistently host the Follow-up Training Course on Nuclear and Radiological Emergency Preparedness (FTC NREP).

OBJECTIVE

1. To learn about radiological/nuclear emergency preparedness.
2. To introduce the instruments and software utilized during radiological/nuclear emergency situations.
3. To learn the technique of radiation monitoring and contamination.
4. To learn the sampling technique for the environment during a radiological/nuclear emergency
5. To obtain the knowledge of radiological/nuclear emergency simulation.

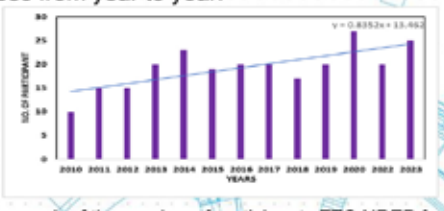
PARTICIPATION

1. Malaysian Nuclear Agency
2. Department of Atomic Energy Malaysia
3. Royal Malaysia Police
4. Royal Malaysia Customs Department
5. Department of Civil Defense Malaysia
6. Malaysian Fire and Rescue Department.

Pict 1: The official picture for FTC NREP (years 2023) with the JAEA coordinator, lecturers and participants

RESULT AND DISCUSSION

1. The number of participants in this FTC NREP course increases from year to year.



Pict 2: The graph of the number of participants FTC NREP from the years 2010 to 2023.

2. This FTC NREP course provides benefits in terms of enhancing knowledge and expertise in radiological/nuclear emergencies.
3. This FTC NREP course is the best platform for sharing experienced related to radiological/nuclear emergency response.

CONCLUSION

This course has successfully enhanced the expertise and understanding related to radiological emergencies among the course participants. Additionally, it has also fostered international relationships and cooperation with JAEA in promoting radiological and nuclear emergency preparedness.

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KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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NUKLEAR MALAYSIA

NTC

KAJIAN KEPUASAN BEKERJA STAF MAKMAL RADIOKIMIA DAN ALAM SEKITAR

Norfaizal Mohamed, Nooradilah Abdullah, Mohd Zuhair Mohd Sanusi, Muhammad Izzat Muammar Rami, Mohamad Noh Sawon dan Mohd Tarmizi Ishak

PENGENALAN

Makmal Radiokimia dan Alam Sekitar (RAS) merupakan makmal yang menjalankan khidmat analisis pengukuran keradioaktifan di dalam sampel makanan, alam sekitar dan industri. Makmal RAS telah memperolehi akreditasi ISO/IEC 17025 dalam bidang pengujian keradioaktifan pada 8 Disember 2005 dan berjaya mengekalkan akreditasi tersebut sehingga kini. Selain dari mengukur kepuasan pelanggan terhadap mutu perkhidmatan yang ditawarkan, Makmal RAS juga ada menjalankan kajian kepuasan bekerja staf untuk menilai tahap kepuasan bekerja staf dan bagi mematuhi klausa 8.9.2 (i), standard MS ISO/IEC 17025:2017. Takrifan kepuasan bekerja menurut Gordon (1991) adalah sikap dan tanggapan seseorang pekerja terhadap pengalaman bekerja. Kepuasan bekerja staf mempunyai pengaruh terhadap prestasi kerja dari segi produktiviti dan kualiti perkhidmatan.

METODOLOGI

Makmal RAS mengambil pendekatan menggunakan borang soal-selidik sebagai salah satu kaedah bagi mendapatkan maklum balas daripada semua staf. Soal-selidik yang dijalankan terbahagi kepada enam (6) bahagian iaitu maklumat asas; bidang tugas/tanggungjawab; kepimpinan penyelia/ketua; ganjaran/pengiktirafan dan hubungan di tempat kerja; kemudahan di tempat kerja; dan pandangan/cadangan. Skala Likert digunakan sebagai skala penilaian di mana staf akan memberikan maklum balas terhadap penyataan yang dikemukakan. Borang soal-selidik diedarkan kepada semua staf setiap tahun bermula tahun 2020 dan kertas kerja ini akan membincangkan hasil kajian untuk 3 tahun (2020 hingga 2022).

KEPUTUSAN DAN PERBINCANGAN

A

Penyataan	Rendah	Sederhana	Tinggi
Berjaya melaksanakan tanggungjawab	0	67.4	92.6
Peluang melakukan kerja berbeza	4.5	20.5	75.5
Agihan kerja bersesuaian	0	12.2	87.8
Peluang melakukan tugas mengikut kebolehan	0	12.7	87.3
Kebebasan menggunakan pertimbangan	0	11.0	89.0
Kesesuaian tugas dengan jawatan	0	10.3	89.7
Mengikuti latihan yang sesuai	0	24.5	75.5
Minat dengan tugas	0	08.5	91.5
Maklum dengan fail tuju jabatan	0	10.8	89.2
Berintegriti dan menjaga kerahsiaan	0	03.9	96.1

B

Penyataan	Rendah	Sederhana	Tinggi
Penyelia memberi arahan yang jelas	8.8	17.4	77.3
Penyelia memberi maklum balas mengenai tugas	3.8	10.7	76.4
Penyelia memberi sokongan Pembangunan kerjaya	3.3	14.1	81.9
Penyelia berkebolehan membuat keputusan	3.8	10.4	79.7
Penyelia berkomunikasi tentang hala tuju jabatan	3.9	17.9	78.6
Penyelia berusaha menerima cadangan/pendapat	3.9	16.1	80.0
Penyelia membuat agihan tugasan yang adil	3.9	30.5	65.6
Hubungan baik penyelia	3.9	12.6	83.5
Menerima kritikan bersifat positif	3.8	07.2	89.0
Pengurusan pihatin dengan kebajikan	3.9	21.6	74.4

C

Penyataan	Rendah	Sederhana	Tinggi
Berpeluang mendapat penghargaan	8.8	18.8	73.7
Peluang untuk terus maju dalam kerjaya	3.9	20.4	75.7
Peluang menghadiri latihan di luar	5.4	16.1	78.5
Pemberian insentif atau pengiktirafan	3.8	28.3	69.9
Hubungan baik dengan rakan sekerja	0	06.9	94.1
Rakan sekerja sentiasa memberi bantuan	0	16.1	83.9
Saling hormat-menghormati antara staf	0	37.5	62.5
Semangat kekitaan antara staf	1.9	44.0	54.1

D

Penyataan	Rendah	Sederhana	Tinggi
Kemudahan pejabat di lokasi yang bersesuaian	8.8	21.3	71.4
Persekitaran pejabat yang kondusif	3.7	24.1	72.2

Jadual 1: Purata tahap kepuasan staf (A) bidang tugas/tanggungjawab; (B) kepimpinan penyelia/ketua; (C) ganjaran/pengiktirafan dan hubungan di tempat kerja; dan (D) kemudahan di tempat kerja

Dalam jadual 1 menunjukkan purata tahap kepuasan staf Makmal RAS yang telah dikategorikan mengikut tahap kepuasan rendah, sederhana dan tinggi. Secara keseluruhan, ke semua penyataan telah menunjukkan purata tahap kepuasan di peringkat tinggi.

Hasil kajian ini menunjukkan staf Makmal RAS mempunyai kepuasan yang tertinggi untuk pernyataan berintegriti dan menjaga kerahsiaan, manakala penyataan yang perlu diberi perhatian (purata rendah melebihi 5%) adalah peluang mendapat penghargaan, kemudahan pejabat di lokasi yang bersesuaian, penyelia memberi arahan yang jelas serta peluang menghadiri latihan di luar.

KESIMPULAN

Secara umumnya dapatan kajian menunjukkan staf Makmal RAS mempunyai kepuasan yang tinggi dalam bidang tugas/tanggungjawab; kepimpinan penyelia/ketua; ganjaran/pengiktirafan dan hubungan di tempat kerja; dan kemudahan di tempat kerja. Kepuasan bekerja merupakan antara indikator penting dalam menyatupadukan staf bagi memastikan semua staf berasa seronok untuk bekerja di Makmal RAS dan sekaligus dapat meningkatkan produktiviti perkhidmatan yang ditawarkan.

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NTC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

SEDEKAD PELAKSANAAN KAJIAN KEPUASAN PELANGGAN MAKMAL RADIOKIMIA DAN ALAM SEKITAR (RAS)

Norfaizal Mohamed, Nooradilah Abdullah, Siti Noor Hayani Mohd Noor, Narizan Sanusi dan Maziah Mahmud

PENGENALAN

Makmal Radiokimia dan Alam Sekitar (RAS) merupakan makmal yang menjalankan khidmat analisis pengukuran keradioaktifan di dalam sampel makanan, alam sekitar dan industri. Makmal RAS telah memperolehi akreditasi ISO/IEC 17025 dalam bidang pengujian keradioaktifan pada 8 Disember 2005 dan berjaya mengekalkan akreditasi tersebut sehingga kini. Kepuasan pelanggan merupakan pengukuran sesuatu kualiti perkhidmatan yang ditawarkan dan ianya perlu dilaksanakan bagi mematuhi keperluan klausa 8.6.2, standard MS ISO/IEC 17025:2017. Makmal RAS telah menetapkan sasaran sekurang-kurangnya 75% indeks kepuasan pelanggan (bermula tahun 2016) dan kertas kerja ini akan membincangkan analisis kepuasan pelanggan Makmal RAS yang telah dijalankan selama sedekad iaitu dari tahun 2013 sehingga 2022.

METODOLOGI

Makmal RAS mengambil pendekatan menggunakan borang soal-selidik sebagai salah satu kaedah bagi mendapatkan maklum balas daripada pelanggan yang menerima perkhidmatan. Soal-selidik yang dijalankan menjurus kepada maklumat am dan teknikal seperti perkhidmatan kaunter, mengemaskini maklumat pelanggan, harga, tempoh masa yang diambil, kualiti sijil atau laporan analisis yang dikeluarkan, aduan pelanggan dan sebagainya. Skala Likert digunakan sebagai skala penilaian di mana pelanggan akan memberikan maklum balas terhadap penyataan yang dikemukakan. Beberapa maklumat seperti skor kepentingan, skor kepuasan, analisis jurang dan indeks kepuasan pelanggan akan dianalisis berdasarkan maklum balas yang diterima.

KEPUTUSAN DAN PERBINCANGAN

Skor kepentingan dan skor kepuasan yang menunjukkan purata tertinggi adalah bagi penyataan kualiti sijil atau laporan analisis yang dikeluarkan, manakala analisis jurang iaitu perbezaan antara kepuasan dan kepentingan menunjukkan bacaan yang mempunyai perbezaan tertinggi adalah bagi penyataan tempoh masa yang diambil untuk sesuatu perkhidmatan.

Rajah 1: Indeks Kepuasan Pelanggan bagi Makmal RAS

Berdasarkan kepada analisis yang dijalankan, beberapa tindakan penambahbaikan telah dilaksanakan bagi meningkatkan mutu perkhidmatan di Makmal RAS, antaranya menambahbaik prosedur kerja bagi memastikan kualiti dan tempoh masa sesuatu sijil atau laporan analisis dapat dikeluarkan mengikut piagam pelanggan.

KESIMPULAN

Hasil dari kajian kepuasan pelanggan ini telah dibincangkan dalam Mesyuarat Ulasan Pengurusan (MRM) dan semua staf RAS turut dimaklumkan semasa sesi latihan dalaman. Walaupun indeks kepuasan pelanggan untuk setiap tahun melebihi dari objektif kualiti makmal yang ditetapkan, usaha berterusan untuk memantapkan lagi perkhidmatan perlu dilaksanakan bagi memastikan perkhidmatan yang ditawarkan sentiasa dapat memenuhi permintaan dan kepuasan pelanggan.

RUJUKAN

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2. Thomas J. Cartin (1999). Practices of Organizational Performance Excellence: Principles and American Society for Quality, ISBN 0873894286, 9780873894289.

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NUKLEAR MALAYSIA

NTC

KAJIAN SEMAKAN PEMERIKSAAN DAN PERAKUAN PELUPUSAN ASET ALIH BAGI TAHUN 2021-2022

Nur Hamizah Mohd Zaini, Noor Hafizah Omar, Syirrazie Shaari

PENDAHULUAN

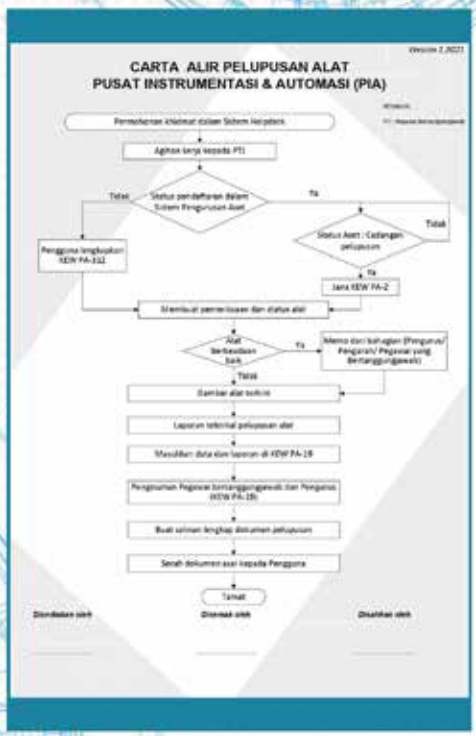
Pelupusan aset merupakan satu proses melupuskan sesuatu aset alih kerajaan dimana secara fizikalnya masih ada dalam simpanan tetapi tidak digunakan atau diperlukan dan perlu dikeluarkan dari simpanan dan rekod. Proses pelupusan aset alih haruslah dilaksanakan mengikut Pekeliling Perbendaharaan Malaysia (AM2.7) "Tatacara Pengurusan Aser Alih Kerajaan: Pelupusan". Pelupusan aset alih kerajaan bertujuan untuk memastikan agensi kerajaan tidak menyimpan aset alih yang tidak boleh digunakan atau tidak diperlukan disamping menjimatkan ruang simpanan atau pejabat. Selain itu, pelupusan aset juga boleh menjana hasil kepada kerajaan dan juga kaedah pelupusan ini dipilih bersifat mesra alam dan lestari.

JUSTIFIKASI PEMERIKSAAN FIZIKAL ASET

1. Tidak ekonomi dibaiki
2. Usang
3. Rosak dan tidak boleh digunakan
4. Luput tempoh penggunaan
5. Keupayaan aset alih tidak lagi diperingkat optimum
6. Tiada alatganti di pasaran
7. Pembekal tidak lagi memberi khidmat sokongan
8. Tidak lagi diperlukan oleh jabatan
9. Perubahan teknologi
10. Melebihi keperluan

ISU PELUPUSAN ASET DI ANM

1. Pengguna membuat aduan "Pelupusan" didalam sistem helpdesk PIA bagi alat bernilai bawah RM5k.
2. Pengguna membuat aduan "Pelupusan" sedangkan alat masih berfungsi
3. Pelupusan tidak selesai didalam sistem MyAsset sedangkan alat telah diambil oleh pihak stor
4. Alat tidak mempunyai no siri MyAsset
5. Pelupusan maya



Tatacara pelupusan asset di ANM

KONKLUSI

Setiap pegawai kerajaan haruslah mengambil tahu mengenai tatacara pengurusan pelupusan aset. Hal ini bertujuan untuk memastikan objektif pelupusan aset alih kerajaan tercapai

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NUKLEAR MALAYSIA

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MEASUREMENT OF ION BEAM IN MALAYSIAN NUCLEAR AGENCY PLASMA FOCUS

Rokiah Mohd Sabri, Abd Halim Baijan, Mohd Faiz Mohd Zin, Puteri Nuraliah Husna Mohd Tajuddin, Leo Kwee Wah, Mukhlis Mokhtar, Mohd Azhar Ahmad, Mohammad Karimi Manawir, Mohd Noor Shafeek Jaafar

INTRODUCTION

The discharge current waveform getting from MNA-PF operation can be considered a significant indicator of realistic simulation and analyze all the gross properties of a plasma focus. Using the Lee Model code, the important information (axial and radial phase dynamics and radiations) of a device can be traced quickly from the current flow through the plasma sheath. However, when the computed discharge current waveform is fitted with the measured one, the computed outputs of the code provide the following realistic data: the dynamics and energy in each phase, the geometry of pinch column, densities and temperatures, radiations, neutron yields, and ion beam. Therefore, to simulate a specific DPF device by this code, the measured discharge current waveform of the device is to be picked out from current discharged from a laboratory experiment. So, the extended 6-phase Lee Model code was used to study the ion beam generated in the MNA-PF device using the fitting procedures mentioned above for 12.5 kV voltage supply.

METHODOLOGY

Figure 1 Malaysian Nuclear Agency Plasma Focus device

Figure 2 Lee Model code parameters to compute current trace

$$Flux\ (ions\ m^{-2}\ s^{-1}) = 2.75 \times 10^{25} \left(\frac{f_e}{\sqrt{MZ_{eff}}}\right)\left(\frac{ln[b/r_p]}{r_p^2}\right)\frac{I_{pinch}^2}{\sqrt{U}} \quad (1)$$

$$Fluence\ (ions\ m^{-2}) = 2.75 \times 10^{9} \left(\frac{f_e}{\sqrt{MZ_{eff}}}\right)\left(\frac{ln[b/r_p]}{r_p^2}\right) \quad (2)$$

Ion beam energy (E)

$$E(J) = Z_{eff}U \times Number\ of\ ion\ in\ beam \quad (3)$$

RESULTS

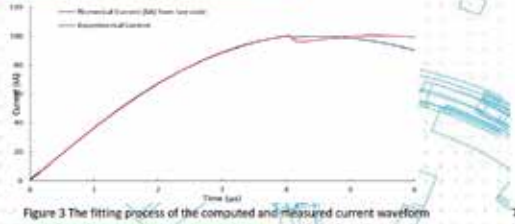


Figure 3 The fitting process of the computed and measured current waveform

Voltage	12.5 kV
Speed Factor	83.7
U (keV)	22.3
U*Zeff (keV)	201.0
Ion Flux ($m^{-2}s^{-1}$)	1.8E+27
Ion Fluence (m^{-2})	3.4E+19
Damage Factors ($Wm^{-2}s^{0.5}$)	7.9E+9
FPS Energy %fc0	2.6
FPS Speed (cm/us)	16.0
Number of Ions	9.1E+13
Current Density (A/m^2)	2.6E+8
Ion Speed 1 Charge (cm/us)	32.6
Ion Speed Zeff (cm/us)	98.0
Ion Current (kA)	7.0
r_p pinch (10^{-2} m)	8.2
Pinch Duration (ns)	19.0
Ions/s	4.8E+21
T Pinch ($\times 10^6$ K)	0.9
Ion Beam Energy, E (J)	2.9

Table 1 Ion beam properties with pressure Argon gas, 12.5 kV voltage supply in MNA-PF

DISCUSSION

The operating pressure of Argon gas and the corresponding flux, fluence, and energy of outgoing ion beam from pinch plasma in terms of I_{peak}, I_{pinch}, Z_{eff}, r_p, and U are obtained using the Eqs (1), (2), and (3) through the Lee Model code. Table 1 shown the ion beam characteristics in MNA-PF. From the computed results, ion beam flux = 1.8E+27 $m^{-2}s^{-1}$, ion beam fluence = 3.4E+19 (m^{-2}) and ion beam energy = 2.9 J.

CONCLUSION

Measurements of the ion beam flux, ion beam fluence and ion beam energy are calculated on the low energy MNA-PF device with Argon gas around the operational pressure 1.5 mbar during the experiment. The Lee model is adapted to the version of 6-phase code for studying the formed plasma, as well as the produced ion beams. The fitting procedures between the measured and computed current waveforms are applied for each shot. Then, numerical experiments are carried out using the Lee Model code.

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

NUKLEAR MALAYSIA

NTC

CHARACTERISTICS OF IRRADIATED CHITOSAN USE IN AQUAPONICS

Sarada Idris, Maznah Mahmud, Khomsaton Abu Bakar, Norhashidah Talip, Nurul Aizam Idayu Mat Sani, Norafifah Ahmad Fabillah and Mohamad Nalrazmi Mohamad Shukri

INTRODUCTION

The inclusion of irradiated chitosan in aquaponics systems functions as a nutritional supplement for fish and facilitates the enhancement of plant development. Oligochitosan in the form of aqueous solution obtained from irradiation of chitosan at 25 kGy was characterized using suitable methods and equipment. The parameters such as molecular weight, chemical structural, nutrient analysis, protein digestion test, microbial and toxicity test were evaluated in this study.

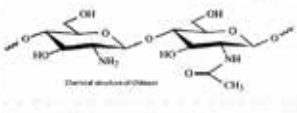
METHODOLOGY

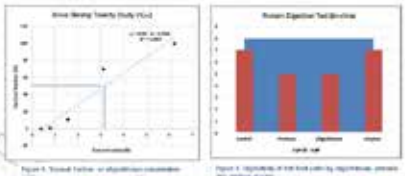
Characterization of irradiated chitosan used in aquaponics

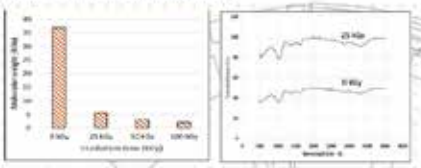
-Molecular weight
-Chemical structural
-Nutrient analysis
-Anti Microbial test
-Brine shrimp toxicity study
-Protein digestion test

RESULT AND DISCUSSION

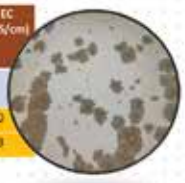
Irradiation of chitosan at 25 kGy reduced its molecular weight from 37 kDa to 5 kDa (figure 1).The FTIR spectrum (figure 2) showed slight decrease in the band between 865 and 1124 cm -1 is probably due to decay of C-O-C groups indicated chitosan degradation caused by splitting of 1-4 glycosidic bonds. Irradiated chitosan has antimicrobial activity against *e.Coli* bacteria (figure 3), which is indicated as a good supplement to protect fish against this bacteria. Brine shrimp toxicity study (figure 4) proposed that oligochitosan is safe to use at 3.14 percent of its original concentration. It is important to mention that protein digestion test (figure 5) of fish feed pallet revealed the performance of oligochitosan is as good as protease enzyme in digesting protein molecule to amino acid, hence promoting growth rate and improving feed conversion ratio of tilapia. Dietary of oligochitosan present at low concentrations increases nitrogen consumption and amino acid digestibility. Nitrogen, phosphorus and potassium which are important macro-nutrients for plant growth and crop productivity, supply by irradiated chitosan as well as fish feces and food waste (figure 6).







	N (ppm)	P (ppm)	K (ppm)	EC (mS/cm)
Irradiated chitosan	418	598	1295	
Hydroponic	142	260	479	1.80
Aquaponic	224	329	502	2.23



CONCLUSION

Irradiation of chitosan causes the chain to scission into smaller fragments and improving its molecular mobility due to its shorter chain and size, suitable for use in production of oligochitosan for aquaponics. Irradiated chitosan, or oligochitosan, has valuable characteristic such as great nutritional resources for plants and improved protein digestion and absorbtion in fish gut. It is concluded that irradiated chitosan is a biocompatible material having potential use as food supplement for tilapia and plant growth promoter in aquaponics systems.

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NITC 2023 KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

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SPECIFICATION AND POTENTIAL APPLICATION OF SPLIT TUBE FURNACE

Umi Zulaikha Mohd Azmi, Nur Faatihah Ahmad Redzuan, Norizam Saad, Muhammad Haziq Sayuti, Khairol Nizam Mohamed, Mohamad Azman Che Mat Isa, Ishak Mansor, Shukri Mohd

INTRODUCTION

Thermocouple **Type K**

Heating element **Kanthal Coil**

Properties of tube **Quartz**

Brand & Model **VT Tube Furnace STF-1200-450-100**

Max temperature **1200°C**

Max operating temperature **1100°C**

Tube dimension: **100 OD x 92 ID x 1000 L mm**

METHODOLOGY

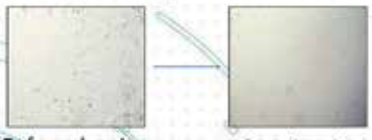
Cleaning Si wafer (Kern, 2018; Dalila et al., 2020)

Thermal oxidation using split tube furnace

Surface analysis

RESULT AND DISCUSSION

Cleanliness of wafer prior to thermal oxidation



Before cleaning | After cleaning

Surface analysis

Oxidation time (mins)	0	30	60	90
Thickness (nm)	Not available	125	150	150
Roughness (nm)	0.0845	0.068	0.057	0.047

CONCLUSION

As a conclusion, split tube furnace successfully grows the oxide layer on silicon wafer by using thermal oxidation method. It was performed at various oxidation time with constant temperature which affecting the surface of wafer in terms of thickness and roughness.

REFERENCES

Dalila, N. R., Arshad, M. K. M., Gopinath, S. C. B., Nuzaihan, M. N. M., & Fathil, M. F. M. (2020). Molybdenum disulfide—gold nanoparticle nanocomposite in field-effect transistor back-gate for enhanced C-reactive protein detection. *Microchimica Acta, 187*, 588. https://doi.org/10.1007/s00604-020-04562-7

Kern, W. (2018). Overview and Evolution of Silicon Wafer Cleaning Technology. In *Handbook of Silicon Wafer Cleaning Technology* (pp. 3–85). Elsevier Inc. https://doi.org/10.1016/B978-0-323-51084-4.00001-0

KONVENSYEN INOVASI DAN TEKNIKAL NUKLEAR MALAYSIA (NITC 2023)

PENGALAMAN PENERIMAAN BARANGAN DARIPADA IAEA MENERUSI PROJEK KERJASAMA TC

Oleh: [1]Yii Mei-Wo, [2]Hazmimi Kasim, [1]Mohamad Syahiran Mustaffa,[3]Mohd Noor Hidayat Adenan, [1]Nooradilah Abdullah

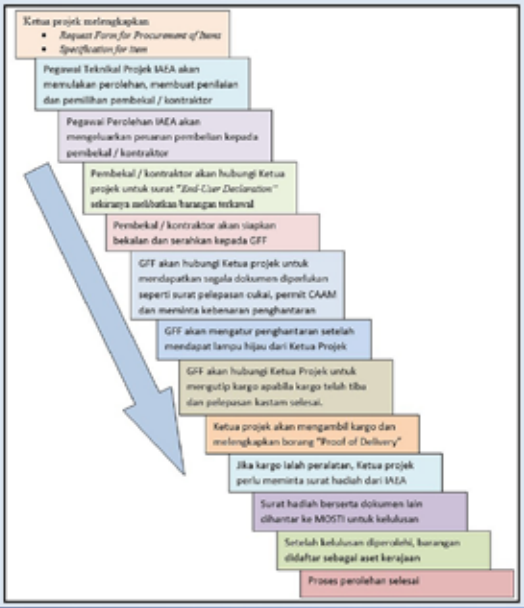
ABSTRAK

Projek TC IAEA merupakan mekanisma utama IAEA memindahkan teknologi nuklear kepada negara-negara anggota. Di bawah program tersebut, negara anggota akan dibantu dalam pelbagai aspek seperti pembangunan sumber manusia dan keperluan barangan penyelidikan. Artikel ini menerangkan pengalaman penulis menguruskan penerimaan barangan sumbangan daripada IAEA dan diharap ianya boleh dijadikan panduan kepada kakitangan Nuklear Malaysia pada masa hadapan sekiranya berdepan situasi yang sama.

PENGENALAN

Projek TC IAEA merupakan program kerjasama teknikal pemindahan teknologi nuklear antara Agensi Tenaga Atom Antarabangsa (IAEA) dengan negara anggota untuk membantu menangani masalah keutamaan pembangunan dalam negara seperti masalah kesihatan, pertanian, air dan alam sekitar, aplikasi industri, pengurusan pengetahuan nuklear dan lain-lain (IAEA 2021a). Di bawah program tersebut, negara anggota boleh memohon pelbagai keperluan dan latihan seperti memohon peralatan saintifik dan barang pakai habis, memohon latihan, lawatan saintifik, misi pakar, program fellowship, sangkutan dan lain-lain. Kertas kerja ini menerangkan aliran proses serta pengalaman penulis dalam pengurusan penerimaan barangan sumbangan daripada IAEA dan diharap dapat dijadikan panduan kepada kakitangan Nuklear Malaysia di masa hadapan.

ALIRAN PROSES



CONTOH DOKUMEN


Pesanan Pembelian IAEA


Borang Draf K1 Kastam


Surat Pelepasan Cukai


Slip Pas Harian KLIA


Surat Sumbangan IAEA


Borang Pendaftaran Aset

KESIMPULAN

Projek TC IAEA merupakan mekanisma yang sangat baik untuk membantu membina kapasiti di Agensi Nuklear Malaysia. Namun begitu, kerjasama erat dari pelbagai pihak yang terlibat seperti IAEA – UNDP – Scan Global (logistik, GFF) dan dalaman Nuklear Malaysia diperlukan untuk membolehkan proses tersebut berjalan dengan lancar. Pengalaman yang dikongsikan ini diharap dapat membantu rakan-rakan lain apabila berdepan situasi serupa di masa hadapan samada melalui projek TC atau projek-projek kerjasama IAEA yang lain.

PENGHARGAAN

1. Staf Kumpulan Radiokimia dan Alam Sekitar.
2. Semua pihak yang terlibat secara langsung dan tidak langsung.

RUJUKAN

- Bolloré Logistics Malaysia Sdn. Bhd., (2022), komunikasi dengan staf Bolloré Malaysia.
- Scan Global Logistics Sdn. Bhd., (2023), komunikasi dengan staf Scan Global Malaysia.
- IAEA, (2021a), About the TC programme, akses dalam talian di https://www.iaea.org/services/technical-cooperation-programme/about pada 26hb Mac 2021.

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TECHNOLOGY PREVIEW SHOWCASE (TPS)

04 Okt 2023
(Kuantan)

27 Okt 2023
(Melaka)

NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL APLIKASI KIMIA ANALISIS (ACA)

Seiring dengan Pelan Strategik BAS 2017-2030, iaitu "**Menyediakan Perkhidmatan Analisis Kimia yang Cemerlang, Cekap, serta Berkualiti kepada Pelanggan Dalam dan Luar Agensi Nuklear Malaysia**", makmal ACA dilengkapi dengan kemudahan instrumentasi analisis dan berkeupayaan dalam menyediakan perkhidmatan analisis unsur untuk pelbagai jenis sampel (alam sekitar, produk, makanan dll) kepada sektor awam dan swasta. Makmal ACA juga turut menyediakan kemudahan latihan dan panduan kepada pelajar universiti dalam mengendalikan peralatan analisis. Makmal ini mengaplikasikan kawalan kualiti dan amalan jaminan kualiti yang baik bagi memberikan output berkualiti tinggi dan ianya memenuhi piawaian antarabangsa.

Perkhidmatan analisis sampel yang ditawarkan oleh makmal ACA adalah seperti berikut:

1. **ANALISIS PENGAKTIFAN NEUTRON (APN)**
   Merupakan analisis teknik nuklear dan dikategorikan sebagai ujian tanpa musnah, APN mampu mengesan dan mengukur lebih 30 unsur termasuk logam nadir bumi.

Gambar menunjukan sebahagian proses penyiaran serta pembilangan sampel bagi kaedah APN.

2. **ANALISIS SPEKTROMETRI JISIM PLASMA GANDINGAN ARUHAN (ICP-MS)**
   Teknik ICP-MS boleh mengesan dan mengukur pelbagai unsur logam berat dan unsur surih dalam pelbagai jenis sampel pelanggan dalam kepekatan yang rendah (ppb).


Gambar menunjukan sebahagian proses analisis unsur menggunakan ICP-MS

3. **ANALISIS SPEKTROMETRI PENYERAPAN ATOM (AAS)**
   Teknik AAS boleh mengesan dan mengukur pelbagai unsur logam berat seperti Al, Ca, Cu, Fe, Mg, Na, Pb dan Zn dalam kepekatan yang tinggi (ppm).


Gambar menunjukan sebahagian proses analisis unsur menggunakan AAS

4. **ANALISIS PENGUKUR UNSUR CHNS**
   CHNS mampu menentukan unsur karbon, hidrogen, nitrogen dan sulfur daripada pelbagai jenis sampel seperti tanah, tumbuh-tumbuhan, arang batu dan minyak.


Gambar menunjukan sebahagian proses analisis menggunakan Pengukur CHNS

5. **ANALISIS ION KROMATOGRAFI (IC)**
   Teknik IC membolehkan penentuan spesies ion (anion dan kation) bukan organik dan organik, dalam kepekatan sekitar 0.50 ppm.


Gambar menunjukan sebahagian penyediaan analisis menggunakan Ion Kromatografi

N.U.R

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Gambar menunjukkan sebahagian proses penyinaran serta pembilangan sampel bagi kaedah APN

2. **ANALISIS SPEKTROMETRI JISIM PLASMA GANDINGAN ARUHAN (ICP-MS)**
   Teknik ICP-MS boleh mengesan dan mengukur pelbagai unsur logam berat dan unsur surih dalam pelbagai jenis sampel pelanggan dalam kepekatan yang rendah (ppb).


Gambar menunjukkan sebahagian proses analisis unsur menggunakan ICP-MS

3. **ANALISIS SPEKTROMETRI PENYERAPAN ATOM (AAS)**
   Teknik AAS boleh mengesan dan mengukur pelbagai unsur logam berat seperti Al, Ca, Cu, Fe, Mg, Na, Pb dan Zn dalam kepekatan yang tinggi (ppm).


Gambar menunjukkan sebahagian proses analisis unsur menggunakan AAS

4. **ANALISIS PENGUKUR UNSUR CHNS**
   CHNS mampu menentukan unsur karbon, hidrogen, nitrogen dan sulfur daripada pelbagai jenis sampel seperti tanah, tumbuh-tumbuhan, arang batu dan minyak.


Gambar menunjukkan sebahagian proses analisis menggunakan Pengukur CHNS

5. **ANALISIS ION KROMATOGRAFI (IC)**
   Teknik IC membolehkan penentuan spesies ion (anion dan kation) bukan organik dan organik, dalam kepekatan sekitar 0.50 ppm.


Gambar menunjukkan sebahagian penyediaan analisis menggunakan ion kromatografi

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NUKLEAR MALAYSIA
TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023
LOJI ALURTRON
ALURTRON menawarkan khidmat penyinaran alur elektron (EB) ke atas produk untuk tujuan taut silang, pengubahsuaian polimer, rawatan permukaan, rawatan air, litografi, pendopan elekron dan lain-lain tujuan untuk menyokong pertumbuhan sektor industri/komersil dan aktiviti penyelidikan dan pembangunan (R&D). Proses penyinaran menghasilkan keseragaman dos yang baik, output yang tinggi dalam masa yang pantas dengan kos operasi yang rendah dan mesra alam. ALURTRON juga menyediakan perkhidmatan ujian makmal dan diperakui dengan pensijilan Sistem Pengurusan Kualiti (QMS) ISO 9001.
Senarai khidmat ALURTRON
Perkhidmatan Penyinaran Alur Elektron:
1. Wayar/kabel dan tiub
2. Semikonduktor Silikon wafer
3. Filem dan lembaran
4. Produk hidrogel
5. Pembangunan produk baru (R&D)
Ujian Makmal dan Kawalan Kualiti:
1. Ujian Hot Set
2. Ujian Gel Content
3. Ujian Dosimetri
Perkhidmatan penyinaran wayar & kabel
Penyinaran produk
Ujian Hot Set
N.U.R
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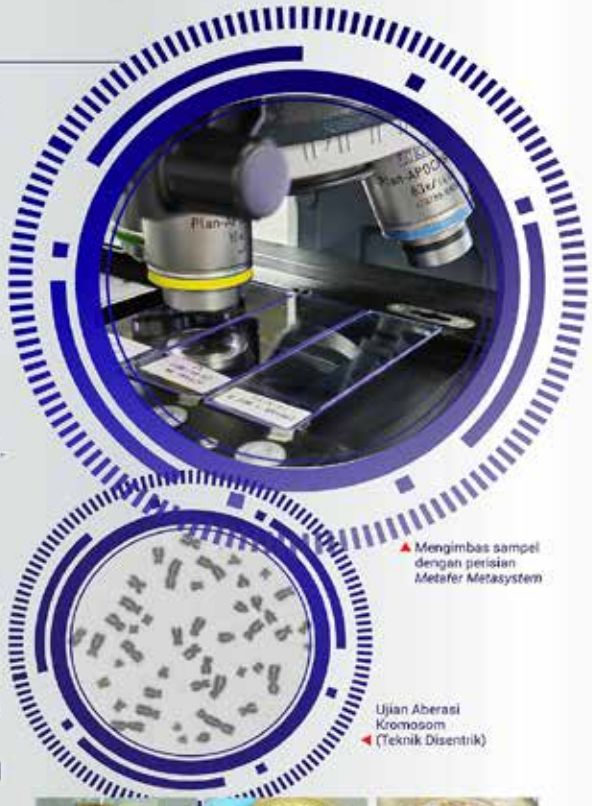
NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL UJIAN BIOLOGI (BIOTEST/ BIODOS)

Makmal Kawalan Mutu Mikrobiologi **(BIOTEST)** menawarkan khidmat ujian bagi memenuhi keperluan pengesahan kualiti ke atas produk untuk kegunaan perubatan seperti produk radiofarmaseutikal dan peranti perubatan.

Makmal Biodosimetri **(BIODOS)** menawarkan khidmat ujian aberasi kromosom untuk menganalisa dos dedahan pekerja sinaran di Malaysia.



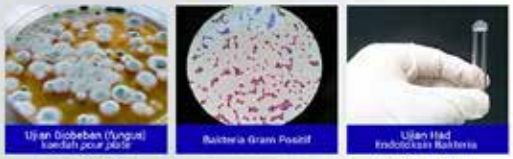
▲ Mengimbas sampel dengan perisian Metafer Metasystem

Ujian Aberasi Kromosom
◀ (Teknik Disentrik)

SENARAI KHIDMAT BIOTEST:

1. Ujian Kesterilan
2. Ujian Biobeban (bakteria atau fungus)
3. Ujian Had Endotoksin Bakteria (Kaedah Pembekuan Gel : Sensitiviti 0.125 IU)
4. Ujian Penggalakan Pertumbuhan
5. Pengeraman dan Pemantauan Sampel Plat Mikrobiologi
6. Pengeraman dan Pemantauan Sampel *Media Fill* dan Kesterilan
7. Validasi Ujian Kesterilan Menggunakan Mikroorganisma
8. Validasi Ujian Had Endotoksin Bakteria (Kaedah Pembekuan Gel : Sensitiviti 0.125 IU)

Ujian Kesterilan | Ujian Penggalakan Pertumbuhan | Ujian Biobeban (bakteria) kaedah membrane filtration



Ujian Biobeban (fungus) kaedah pour plate | Bakteria Gram Positif | Ujian Had Endotoksin Bakteria

SENARAI KHIDMAT BIODOS:

1. Ujian Aberasi Kromosom (Teknik Disentrik)
2. Penggunaan Alat Sistem Biodosimetri

N.U.R

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NUKLEAR MALAYSIA
TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023
PUSAT KHIDMAT BEKALAN RADIOISOTOP (BRI)
Pusat Khidmat Bekalan Radioisotop (BRI) menawarkan 2 jenis kemudahan perkhidmatan:
Makmal Pengeluaran Radioisotop:
1. Menawarkan servis pemprosesan dan pemasangan radioisotop Iridium-192 (Ir-192) menggunakan sel aktif.
2. Ir-192 digunakan bagi mengenalpasti kecacatan paip dalam sektor industri minyak dan gas.
Makmal Khidmat Analisis Farmaseutikal:
1. Analisis LCMS/MS Triple ToF
2. Penyaringan Fitokimia
3. Ujian Radikal Bebas
4. Ujian Toksisiti Embrio Ikan (FETT)
5. Ujian Toksisiti Anak Udang (BSLA)
6. Analisis UHPLC
7. Assai Apoptosis
8. Ujian Perembesan Insulin
9. Assai Toksisiti Sel (MTT)
10. Assai Jumlah Fenolik
Pemasangan pigtail radioisotop Iridium-192
Meletakkan kapsul Ir-192 ke dalam alat pemasangan kapsul
Sistem Zebrafish
Sistem UHPLC
Sistem LCMS/MS Triple ToF
Sistem Cell Reporter
Untuk keterangan lanjut, sila hubungi:
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NUR

TECHNOLOGY PREVIEW SHOWCASE (TPS)

NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL PENGELUARAN RADIOISOTOP (BTP)

Makmal Pengeluaran Radioisotop, Bahagian Teknologi Perubatan (BTP) yang dilengkapi dengan kemudahan pengeluaran radioisotop bertanggungjawab bagi pengeluaran radioisotop untuk tujuan penyelidikan dan pembangunan (R&D) dan perkhidmatan bagi kegunaan sektor perubatan nuklear dan industri.

Radioisotop yang dihasilkan bagi tujuan penyelidikan dan pembangunan (R&D) untuk tujuan perubatan nuklear

1. Radioisotop Samarium-153 membantu melegakan sakit dan bisa-bisa pada tulang pesakit kanser.
2. Radioisotop Lutetium-177 bagi kegunaan rawatan theragnostik untuk penyakit kanser.
3. Radioisotop Holmium-166 bagi tujuan diagnosis dan rawatan kanser terutamanya kanser hati.
4. Radioisotop Cromium-51 digunakan bagi menentukan kadar penapisan glomerular (buah pinggang).
5. Radioisotop Iodin-131 digunakan dalam rawatan kelenjar tiroid dan kanser.
6. Radioisotop Technetium-99m digabungkan dengan agen pembawa khusus bagi pengimejan fungsi organ dan penyakit.

Perkhidmatan untuk sektor industri

1. Menawarkan khidmat kepakaran dalam pemasangan punca terkedap Iridium-192 (Ir-192) yang digunapakai dalam sektor industri bagi ujian tanpa musnah.

Untuk keterangan lanjut, sila hubungi:

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TECHNOLOGY PREVIEW SHOWCASE (TPS)

NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

PUSAT KECEMERLANGAN NUKLEAR (CoNE)

Pusat Kecemerlangan Nuklear (CoNE) merupakan sebuah pusat latihan awam kerajaan di bawah Nuklear Malaysia yang bertanggungjawab untuk melaksanakan program latihan dalam bidang teknologi nuklear dan teknologi berkaitan kepada kumpulan profesional, warga industri awam-swasta, belia dan masyarakat. Tujuan meningkatkan kemahiran yang diperlukan, menggalakkan kesedaran keselamatan dan mewujudkan tenaga kerja yang cekap dalam memainkan peranan yang lebih besar dalam agenda pembangunan negara. Program latihan ditawarkan melalui tujuh (7) Sektor Latihan iaitu Keselamatan Sinaran dan Kesihatan, Sinaran Perubatan, Ujian Tanpa Musnah, Keselamatan Persekitaran dan Kesihatan, Sains Nuklear dan Kejuruteraan, Pengurusan Teknologi dan Latihan Antarabangsa.

SENARAI KHIDMAT CoNE:

1. Melatih (*facilitate learning*) tenaga kerja dalam bidang berkaitan teknologi nuklear dan teknologi berkaitan melalui Program Latihan Awam, Program Serantau, Program Bersekutu/Kerjasama Latihan, Program Asas Agensi & Konsortia, Sangkutan Penyelidikan dan Program *E-Learning*.
2. Merekabentuk dan membangunkan produk latihan yang memfokuskan kepada keperluan pelanggan dan kehendak pasaran.
3. Menawarkan, mengendali dan menyelaras program latihan, bengkel, seminar, persidangan, simposium dan sebagainya.
4. Menyediakan khidmat profesional dalam aktiviti berkaitan latihan diperingkat tempatan dan luar negara.

PENGIKTIRAFAN:

N.U.R

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NUKLEAR MALAYSIA

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KUMPULAN APLIKASI PENYURIH ALAM SEKITAR (E-TAG)

Pusat khidmat e-TAG (*Environmental Tracer Application Group*) menyediakan khidmat penyelidikan yang merangkumi penggunaan teknologi nuklear serta disokong oleh teknik konvensional berkaitan. Penggunaan teknik/aplikasi penyurih yang disediakan oleh kumpulan ini untuk kajian pengurusan air adalah satu-satunya yang terdapat di Malaysia. Penggunaan teknik penyurih dan juga teknik isotop stabil dalam kajian alam sekitar membantu dalam pengurusan serta pencirian sumber air tanah dan juga permukaan. Penggunaan teknik ini juga telah membantu meningkatkan pengurusan sumber air di banyak negara di seluruh dunia. Penggunaan bersama teknik penyurih dan teknik konvensional seperti Geofizik digunakan dalam kajian penyelidikan seperti eksplorasi tapak, hidrologi, Kajian '*fingerprinting*', pengukuran aliran dan arah air tanah/permukaan, sedimentologi, pencemaran air tanah dan sebagainya. Bagi khidmat Geofizik, pusat khidmat ini mempunyai pakar dalam bidang geologi bertauliah yang di iktiraf oleh *Board of Geology* Malaysia.

Makmal utama yang menyediakan perkhidmatan adalah WDXRF (*Wavelength Dispersive X-ray Fluorescence*) serta *Liquid Water Isotope Analyser* (LWIA).

Senarai Khidmat Penyelidikan yang ditawarkan:

1. Kajian '*fingerprinting*' menggunakan teknik penyurih
2. Kajian alam sekitar menggunakan teknik Geofizik:
   - *i.* ***Electrical Resistivity Imaging*** – khidmat penyiasatan geologi sub-permukaan, potensi serta pencemaran air tanah, penyiasatan awal penerokaan tanah/empangan
   - *ii.* ***Seismik*** - kaedah penerokaan geofizik menggunakan prinsip seismologi untuk menganggarkan sifat-sifat bawah permukaan bumi daripada gelombang seismik yang dipantulkan
3. Pengukuran aliran dan arah air tanah/ permukaan (kadar aliran & halaju)
4. Kajian resapan/kebocoran
5. Kajian punca bahan cemar di sekitaran
6. Analisis isotop stabil 2H, 17O & 18O (cecair)
7. Penentuan elemen yang terkandung dalam unsur (cecair @ pepejal)

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MAKMAL UJIAN TANPA MUSNAH TERMAJU (LENDT)

Kumpulan LENDT menawarkan khidmat dan kemudahan Ujian Tanpa Musnah (NDT) Termaju untuk menilai integriti dan kualiti bahan, komponen atau struktur. Antara teknologi yang digunakan ialah *Radiographic Testing - Digital* (RT-D), *Phased Array Ultrasonic Testing* (PAUT) dan *Infrared Thermography Testing* (IRT).

Terdapat 3 makmal utama di LENDT, Agensi Nuklear Malaysia iaitu:

1. ***Radiographic Testing- Digital*** **(RT-D)**
2. ***Phased Array Ultrasonic Testing*** **(PAUT)**
3. ***Infrared Thermography Testing*** **(IRT)**

Kumpulan LENDT menyediakan khidmat sokongan teknikal dan kepakaran berkaitan Ujian Tanpa Musnah Termaju kepada sektor industri dalam bidang *Radiographic Testing - Digital* (RT-D) dan *Phased Array Ultrasonic Testing* (PAUT) dan *Infrared Thermography Testing* (IRT). Kumpulan LENDT juga menawarkan penilaian keselamatan, khidmat nasihat, kursus, latihan dan perkhidmatan dalam Ujian Tanpa Musnah Termaju.

Kumpulan LENDT telah dlantik sebagai pusat kerjasama untuk penyelidikan, latihan dan pembangunan dalam Ujian Tanpa Musnah Termaju oleh International *Atomic Energy Agency* (IAEA).

Perkhidmatan ditawarkan oleh Kumpulan LENDT seperti berikut:

1. Khidmat nasihat melaksanakan ujian radiografi (filem dan digital).
2. Pembangunan prosedur NDT untuk ujian radiografi (filem dan digital) dan PAUT berasaskan keperluan kod, piawaian, atau spesifikasi.
3. Pemeriksaan paip atau objek datar (plat) yang disambung melalui proses sekunder (kimpalan atau pateri).
4. Pengukuran baki ketebalan dinding paip atau lain-lain spesimen.
5. Latihan dan kursus untuk melaksanakan ujian PAUT dan radiografi digital (ISO 9712).

6. Pemeriksaan bangunan (keutuhan dinding, kebocoran bumbung dan lain-lain).
7. Pemeriksaan sistem pemasangan elektrik (MCB, LV *cable, transformer*).

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TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL FIZIK PERUBATAN (MPL)

Berpengalaman lebih daripada 20 tahun, Agensi Nuklear Malaysia merupakan salah satu pemegang Lesen Juruperunding Kelas H di bawah Akta Perlesenan Tenaga Atom 1984 (Akta 304) bagi maksud Perubatan dari Kementerian Kesihatan Malaysia (KKM) dimana MPL telah dipertanggungjawabkan memberi perkhidmatan untuk tujuan perundingan bagi aktiviti pengujian dan pengesahan (ujian kawalan mutu) radas penyinaran perubatan serta kemudahan berkaitan, pengujian dan pengesahan penentuan ketebalan plumbum bagi perisaian bilik X-ray perubatan dan bilik-bilik berkaitan serta pengujian kemudahan berkaitan dose calibrator perubatan nuklear di seluruh Malaysia. MPL juga merupakan satu-satunya makmal standard tentukuran radas ujian kawalan mutu (QC *test tools*) radiologi diagnostik di Malaysia dan Asia Tenggara yang mematuhi piawaian MS ISO/IEC 17025 dan diakreditasi oleh Skim Akreditasi Makmal Malaysia (SAMM) semenjak tahun 2013. Selain itu, MPL juga ada menawarkan perkhidmatan ujian ketebalan kesetaraan plumbum sampel perisai perlindungan sinaran, ujian intergriti PPE, ujian serakan sinaran, tentukuran pembilang tiroid. Perkhidmatan yang ditawarkan MPL adalah seperti berikut:

Perkhidmatan ujian kawalan mutu (QC) radas x-ray diagnostik perubatan dan kemudahan berkaitan

1. Pengujian dan pengesahan dibawah skop lesen kelas H yang merangkumi modaliti x-ray seperti x-ray am, Pergigian, Angiografi, densitometer tulang, C-Arm, Fluoroskopi, Mamografi dan Pengimbas CT.
2. Pemeriksaan bilik gelap
3. Ujian integriti peralatan perlindungan diri (PPE) x-ray perubatan
4. Ujian serakan radiasi.

Perkhidmatan tentukuran *dose calibrator* perubatan nuklear

1. Pengujian dan pengesahan dose calibrator perubatan nuklear. dibawah skop lesen kelas H KKM.
2. Perkhidmatan tentukuran pembilang tiroid.

Perkhidmatan tentukuran peralatan ujian kawalan mutu (QC *test tools*) radiologi diagnostik

1. Tentukuran dosemeters dalam radiologi diagnostik untuk kualiti x-ray RQR, RQA dan RQT yang mematuhi Standard IEC 61267 dan TRS 457 serta telah diiktiraf mengikut piawaian ISO / IEC 17025 oleh SAMM.
2. Tentukuran kualiti mammografi Mo/Mo
3. Tentukuran meter kVp dan pemasa (timer),
4. Tentukuran densitometer dan sensitometer.

Perkhidmatan Perlindungan sinaran

1. Ujian ketebalan kesetaraan plumbum (LET) bagi perisaian bilik x-ray perubatan dan bilik-bilik berkaitan dibawah skop lesen kelas H KKM.
2. Ujian ketebalan kesetaraan plumbum sampel perisai perlindungan sinaran dan PPE,
3. Ujian integriti PPE
4. Pengukuran dos pesakit (diagnostik)
5. Pemonitoran perlindungan sinaran
6. Perkhidmatan rundingan

N.U.A

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KUMPULAN *MATERIAL STRUCTURAL INTEGRITY* (MSI-NDT)

Pusat Khidmat Kumpulan *Material Structural Integrity* (MSI-NDT) menawarkan servis dan konsultasi berkaitan keutuhan struktur menggunakan teknik Ujian Tanpa Musnah (NDT) untuk bahan metalik/ bukan metalik spesifik untuk industri kejuruteraan awam, perkapalan dan juga minyak/gas. Pengujian biasanya terdiri daripada sampel ataupun pengujian dijalankan secara *in-situ* di lapangan.

Teknik NDT yang digunakan adalah bergantung kepada keperluan kerja samada memerlukan sumber radioaktif ataupun tidak.

Senarai Khidmat:

1. Ujian Tanpa Musnah untuk kejuruteraan awam (Bangunan, jambatan, terowong, empangan)
2. Pengesanan objek bawah tanah (kebocoran paip, lapisan tanah, harta karun, pemetaan)
3. Mengenalpasti ketidak selanjaran material (permukaan kapal, kualiti kimpalan, tangki simpanan, keadaan dalaman objek)
4. Infrastruktur pengujian kualiti kimpalan spesifik untuk '*crawler*' untuk industri minyak/gas
5. Infrastruktur latihan untuk pengujian '*underwater ultrasonic*'
6. Infrastruktur latihan untuk *ground penetrating radar*
7. Infrastuktur Pusat Kecemerlangan Aliran (pergerakan cecair dalam paip industri)

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TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL TEKNOLOGI SINARAN (MTS)

ANALISIS TERMA POLIMER

MTS menawarkan analisis haba yang sangat boleh dipercayai. Menggunakan model suhu yang terkini, data yang jitu dan tepat dapat diperoleh dari ujian seperti Suhu Peralihan Kaca (Tg), Suhu Lebur (Tm), Peralihan Fasa, Pekali Pengembangan Terma Linear (CTE), Haba Tentu dan lain-lain. Kaedah analisis terma juga boleh digunakan untuk membantu mengenal pasti bahan yang tidak diketahui, menjawab soalan tentang struktur kristal, dan membantu dalam penyelidikan dan pembangunan komposit baru.

ANALISIS UJIAN KEGAGALAN POLIMER

MTS membantu menyiasat punca kegagalan supaya tindakan pembetulan dapat dilaksanakan, mengehadkan kerosakan dan mencegah kegagalan produk berulang di masa hadapan. Makmal ujian polimer kami menggunakan kaedah proprietari dan instrumentasi analitikal untuk menjalankan pencirian dan analisis kegagalan polimer termasuk kimia, fizikal, mekanikal, haba dan unsur.

PENCIRIAN BAHAN NANO

MTS berkebolehan mencirikan pelbagai sifat bahan nano seperti saiz zarah, nilai potensi zeta dan morfologinya yang dikaitkan dengan penyelesaian yang berprestasi lebih baik, dengan margin yang lebih tinggi kepada pasaran merentas rangkaian produk termasuk salutan berfungsi, pemangkin, bahan tambahan, dakwat pengalir, terapeutik dan produk antimikrobial.

SERVIS DAN PRODUK

(1)Penyediaan Sampel
- *Internal Mixer*
- *Hot Press*

(2)Ujian Pengenalan Bahan
- *Fourier Transform Infrared (FTIR) with ATR*
- *Electron Spin Resonance (ESR)*

(3)Ujian Terma
- *Thermogravimetric Analysis (TGA)*

(4)Kajian Morfologi Sampel
- *Optical Contact Angle with Topography*
- *BET surface Analyzer*
- *Optical Microscopy*

(5)Ujian Mekanikal
- *Rheology Study*
- *Hardness Test*
- *Dynamic Mechanical Test*
- *Vibrating-Sample Magnetometer*
- *X-Ray Diffraction (XRD)*

(6)Sifat Keterlarutan Cecair
- *Rotational Viscometer*

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PUSAT PEMBANGUNAN LOJI & PROTOTAIP/ PUSAT INSTRUMENTASI & AUTOMASI (PDC/PIA)

PDC/PIA menjalankan penyelidikan dan pembangunan kejuruteraan berkaitan teknologi nuklear dan teknologi berkaitan termasuk instrumentasi dan automasi serta memberikan perundingan kejuruteraan dan perkhidmatan sokongan teknikal.

PDC/PIA menawarkan perkhidmatan rekabentuk dan pembuatan dalam membangunkan penggunaan teknologi nuklear. Selain itu, PDC/PIA juga menawarkan perkhidmatan pembangunan prototaip dan sistem automasi serta latihan penyenggaraan instrumentasi nuklear.

PERKHIDMATAN PDC/PIA:

1. Rekabentuk pintu plumbum dan perisai sinaran
2. Rekabentuk bilik penyinaran
3. Pembuatan kaca makmal
4. Rekabentuk prototaip dan komponen
5. Pemesinan bahan logam dan plastik
6. Peleburan plumbum menggunakan relau
7. Sel Aktif Mudah Alih
8. Peleraian peralatan/mesin penyinaran bagi tujuan pelupusan
9. Latihan penyenggaraan instrumentasi nuklear

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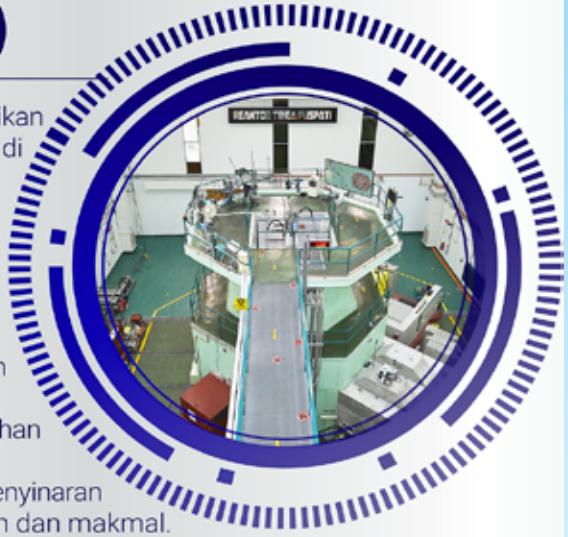
NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

PUSAT TEKNOLOGI REAKTOR (PTR)



Pusat Teknologi Reaktor (PTR) mengendalikan satu-satunya reaktor penyelidikan nuklear di Malaysia, Reaktor TRIGA PUSPATI (RTP) jenis TRIGA Mark II yang telah ditauliahkan pada 28 Jun 1982. Ia mempunyai kuasa nominal 1 MWatt yang direka untuk melaksanakan pelbagai bidang penyelidikan berasaskan sumber neutron, khidmat penyinaran untuk aplikasi nuklear di dalam bidang industri, perubatan, alam sekitar termasuk mengadakan pendidikan dan latihan di dalam teknologi reaktor nuklear. RTP dilengkapi dengan beberapa kemudahanpenyinaran di dalam teras, instrumentasi alur neutron dan makmal. Kemudahan penyinaran sedia ada menawarkan khidmat penyinaran neutron secara tetap dan stabil. RTP dilesenkan mengikut Akta 304 dan dikendalikan oleh Pengendali Reaktor yang bertauliah bagi menjamin keselamatan pada tahap tertinggi.

KEMUDAHAN PENYINARAN DALAM TERAS RTP

1. Jidal Tengah (CT)
2. Rak Berputar (RR)
3. Tiub Kering (DT)
4. Sistem Pemindahan Pneumatik (PTS)

KEMUDAHAN PENYINARAN INSTRUMENTASI ALUR NEUTRON

1. Radiografi Neutron (NUR)
2. Difraktometer Neutron (ND)
3. Penyerakan Neutron Bersudut Kecil (SANS)

KEMUDAHAN MAKMAL

1. Makmal Fizik Neutron
2. Makmal Simulasi Reaktor TRIGA
3. Makmal Simulasi Reaktor Nuklear Berasaskan Komputer

NUR

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NUKLEAR MALAYSIA

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MAKMAL RADIOKIMIA DAN ALAM SEKITAR (RAS)

Makmal Radiokimia dan Alam Sekitar (RAS) menyediakan perkhidmatan radioanalisis untuk keperluan agensi kerajaan dan swasta. Makmal RAS mengamalkan QA/QC dan mempunyai prosedur pengurusannya sendiri yang mana makmal ini telah diakreditasi dengan MS ISO/IEC 17025: 2017 sejak Disember 2005 oleh Jabatan Standard Malaysia bagi skop analisis keradioaktifan gama.

Makmal RAS merupakan makmal kebangsaan yang diluluskan dan diiktiraf oleh Kementerian Kesihatan Malaysia (KKM) untuk melakukan analisis pengukuran keradioaktifan dalam sampel makanan untuk tujuan eksport dan air mineral serta air minuman berbungkus sebagai sebahagian daripada syarat perlesenan KKM.

Sijil Akreditasi MS ISO/IEC 17025:2017


Sistem Spektrometri Gama


Sistem Pembilang Gros Alfa/Gros Beta


Sistem Spektrometri Alfa


Sistem Pembilang Sintilasi Cecair

Senarai Khidmat:

1. Pengukuran pemancar gama dalam sampel makanan
2. Pengukuran pemancar gama dalam sampel alam sekitar/industri
3. Pengukuran Am-241 dalam pengesan asap
4. Pengukuran gross alfa/beta dalam pelbagai sampel
5. Pengukuran gross alfa/beta dalam *air borne/ particulate*', penapis dan '*smear test*'
6. Pengukuran Po-210/Pb-210 dalam pelbagai sampel
7. Pengukuran U-234, U-235 dan U-238 dalam pelbagai sampel
8. Pengukuran Th-228, Th-230 dan Th-232 dalam pelbagai sampel
9. Pengukuran Pu-239+240 dalam pelbagai sampel
10. Pengukuran H-3 dalam air/ais
11. Pengukuran Sr-90 dalam pelbagai sampel

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NUKLEAR MALAYSIA

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LOJI RAYMINTEX

Loji RAYMINTEX merupakan sebuah kemudahan perintis untuk tujuan penyediaan lateks getah asli pra-pemvulkanan dengan sinaran (RVNRL) melalui penggunaan sinaran gama. Ia merupakan sebuah kemudahan semi automatik yang mampu menghasilkan sehingga 6000 tan RVNRL setahun, dengan menggunakan punca sinaran kobalt-60 sehingga 1 MCi. RVNRL ini dapat memenuhi keperluan sektor pembuatan produk celupan lateks dan industri berkaitan secara berkesan sambil menggalakkan promosi dan pemindahan teknologi RVNRL.

Lateks getah asli perlu divulkan sebelum diapplikasi dalam industri. RVNRL yang dihasilkan di Loji RAYMINTEX merupakan lateks tervulkan dengan sinaran gama yang mempunyai sifat fizikal dan mekanikal untuk memenuhi keperluan/ spesifikasi pelbagai produk celupan lateks seperti sarung tangan, belon, sarung jari, puting bayi, pelapik gigi dan lain-lain.

Loji RAYMINTEX telah membangun dan melaksanakan sistem pengurusan kualiti ISO 9001 dan diperakui oleh badan pensijilan LRQA pada tahun 2003.

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TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

LOJI MINTEC - SINAGAMA

Loji Penyinaran MINTec-Sinagama menggunakan tenaga pengion dalam bentuk sinaran gamma dari sumber Kobalt-60. Loji penyinaran ini beroperasi dengan kemudahan iradiasi JS10000 (IR-219) yang mampu menyinari pelbagai produk yang memerlukan dos yang berbeza secara serentak.

Merupakan loji penyinaran gamma yang beroperasi pada skala komersial bagi pensterilan atau dekontaminasi peranti perubatan, makanan, rempah ratus, herba dan buah-buahan. Penggunaan sinaran gamma ini akan meningkatkan kualiti mikrobiologi produk-produk berkenaan yang secara langsung akan meningkatkan keselamatan produk serta meningkatkan jangka hayat produk.

MINTec-Sinagama juga menyediakan perkhidmatan pensterilan tisu dan tulang melalui penyinaran gamma untuk tujuan perbankan tisu kepada pihak berkuasa yang berkaitan seperti hospital dan Bank Tisu Negara serta pembasmian serangga dalam komoditi pertanian, termasuk untuk tujuan kuarantin.

Perkhidmatan Penyinaran SINAGAMA:

1. Pensterilan Peranti Perubatan, Bahan Pembungkusan dan Makmal
2. Pensterilan Produk Farmaseutikal
3. Produk Veterinar
4. Makanan, Herba dan Rempah
5. Produk kosmetik
6. Sampel untuk tujuan R&D

Pengiktirafan:

1. ISO 9001
2. ISO 13485
3. Lesen Premis Iradiasi Makanan

Logo MAGUNA

N.U.R

Untuk keterangan lanjut, sila hubungi:

KETUA PENGARAH
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E-mel: syuhada@nm.gov.my

NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

MAKMAL STANDARD DOSIMETRI SEKUNDER (SSDL)

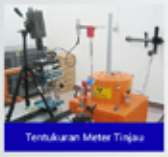
SSDL ditubuhkan pada tahun 1980 dan bertanggungjawab bagi menyedia, menjaga dan membangunkan standard-standard sinaran mengion di Malaysia untuk keperluan Akta Perlesenan Tenaga Atom 1984 (Akta 304), Peraturan-Peraturan Perlindungan Sinaran (Standard Keselamatan Asas) 1988 (pindaan 2010) yang merangkumi industri, perlindungan dan keselamatan sinaran, perubatan (radioterapi dan brakiterapi), pendidikan dan penyelidikan. SSDL pada tahun 2007 telah dilantik oleh Institut Metrologi Kebangsaan Malaysia (NMIM) sebagai '*designated institute*' untuk pusat rujukan sinaran mengion kebangsaan. SSDL telah diakreditasi MS ISO/IEC 17025 sejak Julai 2004.

Perkhidmatan yang ditawarkan oleh SSDL adalah seperti berikut:

Perkhidmatan Tentukuran:

1. Tentukuran Meter Tinjau dan Dosimeter Aras Perlindungan
2. Tentukuran Kebuk Pengionan Aras Perlindungan dan Aras Terapi
3. Tentukuran Dosimeter Peribadi (Saku & Penggera)


Tentukuran Kebuk Pengionan (Aras Terapi)


Tentukuran Meter Tinjau


Tentukuran Kebuk Pengionan (Aras Perlindungan)

Pembekalan dan Penganalisaan Dosimeter Peribadi dan kawasan:

1. Perkhidmatan TLD
2. Perkhidmatan OSL


Analisa Dosimeter TLD

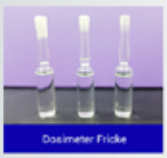

Analisa Dosimeter OSL


Dosimeter OSL

Perkhidmatan Dosimetri Aras Tinggi:

1. Perkhidmatan dosimeter Ceric-Cerous
2. Perkhidmatan Dosimeter Fricke
3. Pemetaan dos loji penyinaran gama


TLD


Dosimeter Fricke


Dosimeter Ceric Cerous

Untuk keterangan lanjut, sila hubungi:

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NUKLEAR MALAYSIA
TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023
MAKMAL TEKNOLOGI AGRO & BIOSAINS (TAB)
Makmal Teknologi Agro dan Biosains (TAB) adalah satu pusat khidmat di Bahagian Agroteknologi dan Biosains yang menawarkan pelbagai khidmat dalam bidang agroteknologi dan biosains. Dengan kepakaran dan kemudahan yang ada di pusat khidmat ini, pelanggan boleh terus memohon untuk mendapatkan khidmat yang disediakan ataupun hadir untuk perbincangan terlebih dahulu bagi mendapatkan pandangan dan khidmat nasihat daripada pegawai pakar bidang yang terlibat.
Antara khidmat yang diberikan adalah:
1. Analisa pengesanan makanan diiradiasi menggunakan teknik Photostimulated Luminescence (PSL) – Kaedah "screening PSL".
2. Khidmat Analisis isotop stabil.
3. Khidmat penyinaran menggunakan kebuk gama Biobeam GM8000.
4. Khidmat penyinaran rumah hijau gama (GGH).
5. Khidmat perundingan untuk pengeluaran komersil anak benih kultur tisu tanaman.
6. Kursus dan amali sangkutan (teori dan amali) kultur tisu tanaman (1 bulan).
7. Penyaringan mikrob berfaedah / pengiraan bakteria.
8. Benih kultur pemulaan pisang.
9. Benih kultur tisu pisang.
Kultur tisu pisang
Penyinaran di Gamma Greenhouse (GGH)
Penyaringan mikrob berfaedah/ pengiraan bakteria
Khidmat Analisis isotop stabil
Untuk keterangan lanjut, sila hubungi:
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N.U.R

NUKLEAR MALAYSIA

TECHNOLOGY PREVIEW & SHOWCASE (TPS) 2023

PUSAT PEMBANGUNAN TEKNOLOGI SISA (WasTeC)

WasTeC adalah Pusat Pengurusan Sisa Radioaktif Kebangsaan yang telah dipertanggungjawabkan oleh kerajaan bagi pengurusan sisa beradioaktif di Malaysia. WasTeC menjalankan khidmat pungutan, penanggalan, pengkondisian, penyimpanan dan pelupusan sisa radioaktif yang diperolehi dari industri pembuatan, hospital, sekolah, institusi pengajian dan makmal-makmal penyelidikan. WasTeC juga menawarkan perkhidmatan dalam bidang pengurusan sisa pepejal perbandaran (MSW).

Khidmat Rundingan dan Lawatan Tapak

Senarai khidmat yang ditawarkan di WasTeC adalah:

1. Pelupusan sisa radioaktif jenis pepejal, cecair dan sisa radioaktif jenis punca terkedap terpakai (DSRS)
2. Pelupusan alat penangkap kilat dan alat pengesan asap
3. khidmat pungutan, penanggalan, pengkondisian, pengangkutan, penyimpanan dan pelupusan sisa radioaktif
4. Analisis pencirian sisa pepejal perbandaran mengikut kaedah ASTM (persampelan, analisis proksimat dan penentuan nilai kalori)
5. Analisis tingkah laku pembakaran (combustion characterization) sisa pepejal (termasuk plastik, kertas dan bahan organic)
6. Khidmat perundingan konsep 'Sisa kepada Tenaga' melalui teknologi rawatan terma

Khidmat Pengangkutan Sisa Radioaktif kepada Pelanggan

Khidmat Kutipan Sisa Radioaktif

Khidmat Penanggalan DSRS

Pengukuran Dos Sisa Radioaktif

Pengangkutan DSRS

Penanggalan kepala teleterapi

Untuk keterangan lanjut, sila hubungi:

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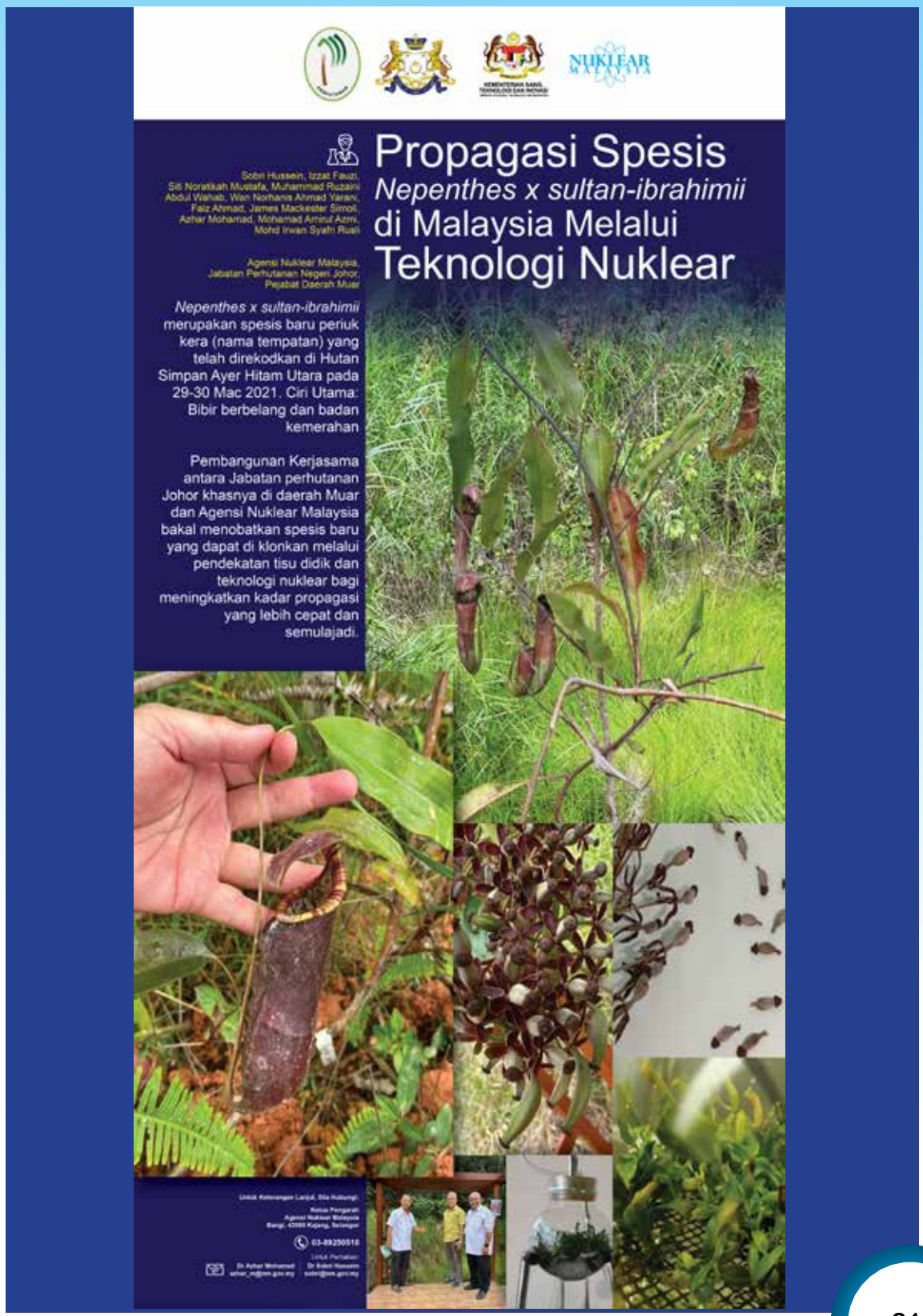
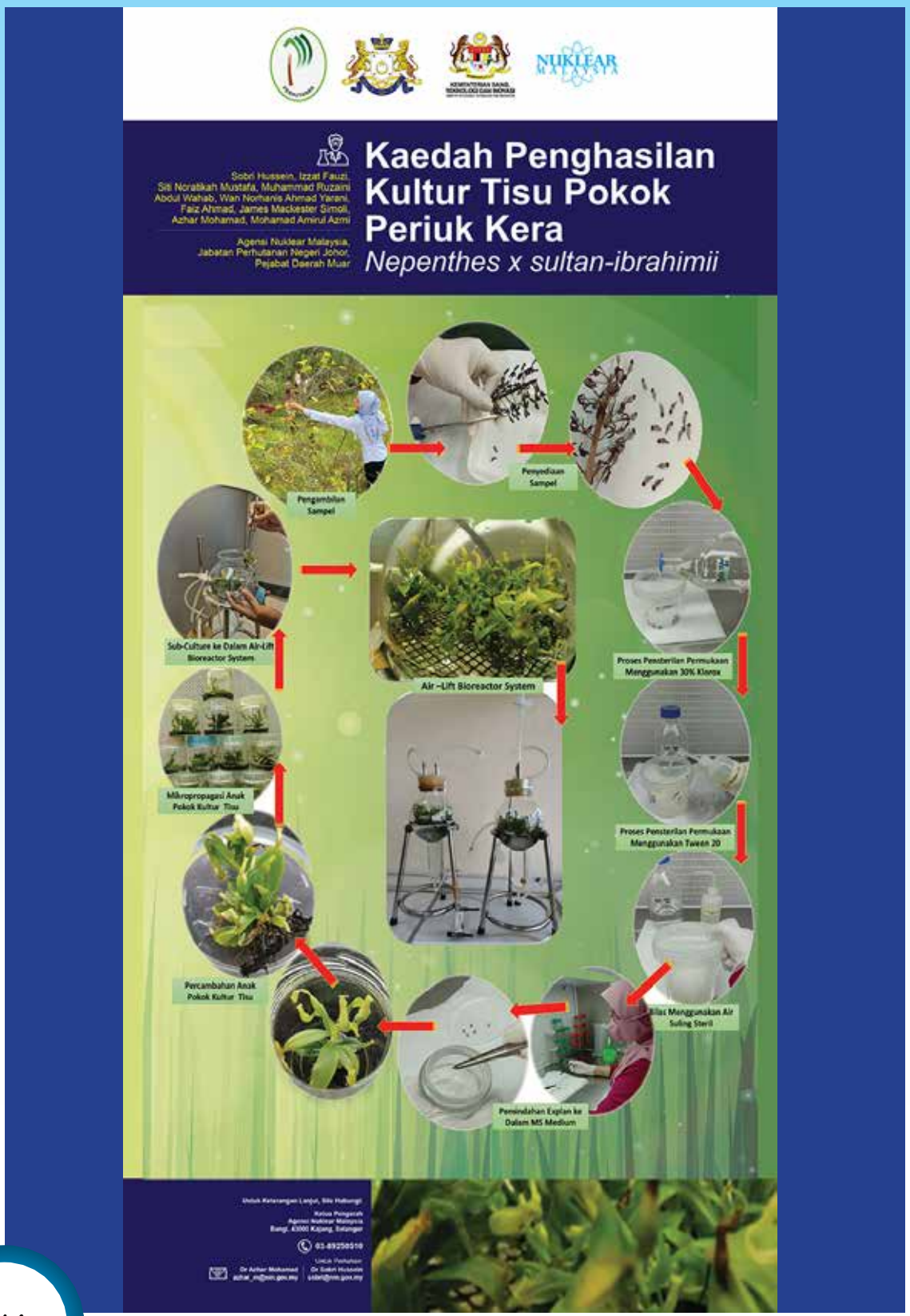
Tel. : +603-8911 2000 samb:1102
E-mel: nwahida@nm.gov.my

PAMERAN
KEMBARA
MAHKOTA

Muar, Johor
07 Ogos 2023

PAMERAN KEMBARA MAHKOTA




NUKLEAR MALAYSIA
Kaedah Penghasilan Kultur Tisu Pokok Periuk Kera
Nepenthes x sultan-ibrahimii
Sobri Hussein, Izzat Fauzi, Siti Noratikah Mustafa, Muhammad Ruzaini Abdul Wahab, Wan Norhanis Ahmad Yarani, Faiz Ahmad, James Mackester Simoli, Azhar Mohamad, Mohamad Amirul Azmi
Agensi Nuklear Malaysia, Jabatan Perhutanan Negeri Johor, Pejabat Daerah Muar
Pengambilan Sampel
Penyediaan Sampel
Proses Pensterilan Permukaan Menggunakan 30% Klorox
Proses Pensterilan Permukaan Menggunakan Tween 20
Bilas Menggunakan Air Suling Steril
Pemindahan Explan ke Dalam MS Medium
Percambahan Anak Pokok Kultur Tisu
Mikropropagasi Anak Pokok Kultur Tisu
Sub-Culture ke Dalam Air-Lift Bioreactor System
Air –Lift Bioreactor System


NUKLEAR MALAYSIA
IS21
BENIH PADI BAHARU TEKNOLOGI NUKLEAR
Benih padi IS21 dihasilkan melalui kaedah BIAKBAKA MUTASI ARUHAN ke atas padi MR 219 menggunakan Teknologi Sinaran GAMA
Padi baharu IS21 adalah singkatan bagi nama Perdana Menteri yang ke sembilan iaitu Dato' Sri Ismail Sabri bin Yaakob dan angka 21 pula mewakili tahun 2021. Padi ini telah didaftarkan (Plant Variety Protection) di Jabatan Pertanian sebagai varieti NMR152.
Ujian Multilokasi (MLT) IS21 dimulakan pada tahun tahun 2016 dan 2017 di pelbagai lokasi jelapang padi Semenanjung Malaysia.
Ujian penentusahan Tempatan (LVT) telah dijalankan pada tahun 2018 hingga 2020 di plot petani di beberapa kawasan jelapang padi. Padi ini menunjukkan hasil yang tinggi dan stabil di pelbagai persekitaran dan sesuai di tanam di siri tanah yang berbeza. Ia juga sangat respon kepada pengambilan baja nitrogen dan rintang kepada beberapa penyakit padi utama.
Padi IS21 telah ditanam di jelapang padi utama seluruh Semenanjung Malaysia seperti di Intergrated Agriculture Development Area (IADA) Barat Laut Selangor, Kerian, Seberang Perak dan MADA di Kedah.
PURATA HASIL BOLEH MENCECAH HINGGA 9 tan/ha
KERINTANGAN PENYAKIT DAN PEROSAK
Karah
Hawar Daun Bakteria (BLB)
Bena Perang
Hawar Seludang
Tungro
Rintang
Sederhana Rintang
Sederhana Rentan
Rintang
Sederhana Rentan
CIRI-CIRI PADI IS21
Masa Berbunga (50% berbunga) 82 hari
Tinggi kulma 82 cm
Panjang tangkai 30 cm
Bilangan tangkai per pokok 17
Bilangan anak per pokok 20
Masa kematangan 100 - 110 hari
Berat 1000 biji 31.1 g
Panjang biji 11.1 mm
Lebar biji 2.75 mm
CIRI KUALITI BERAS IS21
Ciri-ciri | Keputusan
Peratus beras perang 75.76%
Peratus beras putih - milling yield 65.33%
Peratus kepala beras 80.09%
Peratus beras hancur 8.9%
Peratus beras temukut 0.59%
Kadar kelembapan 10.3%
FISIKOKIMIA BERAS
Ciri-ciri | Keputusan
Amilosa 20.3%
Kandungan Air 8.6%
pH 6.67
Darjah Keputihan 60.26%
Panjang Beras (mm) 7.14
Lebar Beras (mm) 1.95
Nisbah Panjang : Lebar Beras 3.67
Panjang Nasi (mm) 11.7
Nisbah Pemanjangan Kernel 1.75
ASV 3
NILAI PEMAKANAN DAN NUTRISI
Ciri-ciri | Keputusan
Protein g/100g 8.0
Lemak g/100g 2.1
Karbohidrat g/100g 76.5
Abu (Ash) g/100g 1.1
Kelembapan g/100g 12.3
Tenaga Kcal/100g 357 (1495kJ)
Untuk Keterangan Lanjut Sila Hubungi
Ketua Pengarah
Agensi Nuklear Malaysia
Bangi, 43000 Kajang,
Selangor
Untuk Perhatian:
Dr. Sobri bin Hussein
Bahagian Agroteknologi dan Biosains
sobri@nuclearmalaysia.gov.my


NUKLEAR MALAYSIA
TEKNOLOGI KULTUR TISU DAN BIOREAKTOR UNTUK MICROPROPAGASI ANAK BENIH
Agensi Nuklear Malaysia berkeupayaan mengaplikasikan teknologi nuklear dalam bidang pembaikbakaan tanaman dan bioteknologi melalui teknik kultur tisu dan bioreaktor.
Kemajuan dalam bidang tenologi nuklear dan bioteknologi memungkinkan penghasilan baka baru dan produk berasaskan biosumber berskala besar dengan menggunakan teknologi kultur tisu dan bioreaktor.
KELEBIHAN
• Pengeluaran skala besar anak benih kultur tisu dan tanaman
• Pengeluaran anak benih bebas penyakit dan berkualiti
• Pertumbuhan cergas dan seragam
• Menjimatkan masa pengeluaran anak benih tanaman
BIOREAKTOR
Untuk maklumat lanjut, sila hubungi:
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Selangor
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Tel.: 03-8911 2000

KITOGAMA SEBAGAI SUPLEMEN DALAM SISTEM AKUAPONIK

Sarada Idris, Maznah Mahmud, Khomsaton Abu Bakar dan Norhashidah Talip

KITOGAMA

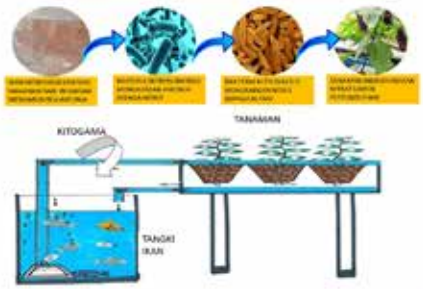
KITOGAMA adalah kitosan larut air (oligokitosan) yang terhasil dari penyinaran gama digunakan sebagai suplemen bagi ikan. Sisa buangan, lebihan makanan ikan menghasilkan amonia yang diuraikan oleh mikroorganisma kepada nitrat sebagai baja untuk tumbesaran tanaman.

KITOGAMA juga sebagai suplemen kepada ternakan ayam, itik, lembu , kambing serta ternakan lain bagi meningkatkan tumbesaran, sistem imun, peningkatan hasil ternakan serta dapat percepatkan masa tuaian.

PENGENALAN

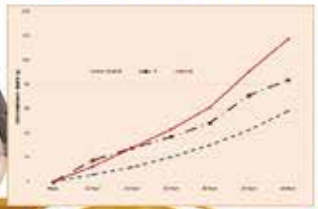
- Kitosan adalah sejenis polisakarida berasal dari sumber kulit udang dan ketam, mempunyai sifat bioserasi, bebas toksik, mesra alam, polimer terbiodegradasi dan larut dalam larutan berasid.
- Kegunaan kitosan agak terhad kerana mempunyai berat molekul yang besar dan tidak larut dalam kebanyakan larutan.
- Kelarutan kitosan dapat diperbaiki dengan mengubah berat molekulnya (proses degradasi) menggunakan bahan kimia atau tindak balas enzimatik
- Di Agensi Nuklear Malaysia, kitosan disinarkan dengan sinaran gama (kobalt 60) untuk menghasilkan kitosan berat molekul rendah dengan tujuan meningkatkan kelarutan bagi meluaskan aplikasi nya dalam sektor pertanian dan penternakan.

KONSEP AKUAPONIK



HASIL TANAMAN

HASIL TERNAKAN IKAN



Director General
Malaysia Nuclear Agency
Dr. Sarada Idris

OLIGOCHITOSAN ENRICHED FISH FOOD PELLET

Sarada Idris, Maznah Mahmud, Khomsaton Abu Bakar, Norhashidah Talip, Marina Talib, Nurul Aizam Idayu Mat Sani, Norafifah Ahmad Fabillah and Mohamad Nafrazmi Mohamad Azmi

KITOGAMA

Water soluble chitosan (oligochitosan) produced by gamma irradiation for use as dietary supplement for fish and crustaceans to enhance growth, immunity, increase yield and shorten harvest time

INTRODUCTION

- Chitosan is a natural polysaccharide, biocompatible, nontoxic, biodegradable polymer and soluble in acidic aqueous solutions.
- Because of its large molecular weight and low solubility in most solvents, chitosan's applications are limited.
- Chitosan's solubility can be improved by reducing its molecular weight (degradation) using chemical or enzymatic reaction
- In Malaysia Nuclear Agency, chitosan was irradiated by gamma ray (cobalt 60) to produced low molecular weight chitosan in order to increased its solubility hence broaden its application in agriculture and aquaculture sectors.

TECHNOLOGY/METHOD

WHY KITOGAMA

- Green technology
- Waste to wealth
- Excellent FCR
- Excellent PER
- Cost effective
- Enhanced growth
- Enhanced immunity
- Reduced mortality
- Shorten harvest time
- Increased yield

COMMERCIALIZATION POTENTIAL

KITOGAMA FOR

- Fish/fresh water fish Crustaceans
- Poultry
- Ruminants

NM OLIGOCHITOSAN: GAMMA-PROCESSED CHITOSAN AS PLANT ELICITOR & PLANT GROWTH PROMOTER

Maznah, M., Norhashidah, T., Norzita, Y., Sarada, I., Marina, T.,Norafifah, A. F., Nurul Aizam Idayu, M. S. & Mohammad Nalrazmi, M. S.
Biopolymer Group, Radiation Processing Technology Division, Malaysian Nuclear Agency

INTRODUCTION

NM Oligochitosan is the plant growth promoter (PGP) and plant elicitor (PE) prepared via radiation-induced-chain degradation of chitosan. The NM Oligochitosan contains low molecular weight chitosan with average molecular weight ranging from 10 000 – 20 000 Dalton. The study carried out showed that application of NM Oligochitosan at 80 – 100 ppm increases the germination rate of chili, rice and kale > 98% with high survival rate. Its PGP activity induces growth acceleration of shoots and roots, increases number of flower and enhances the quality of plants and yield.

The NM Oligochitosan classified as natural based protective agrochemical which is safe to be applied regularly to reduce damage from bacteria, fungi and insects. Accumulation of phytoalexins induced by NM Oligochitosan inhibits growth of blast in rice, prevents chili seedlings from "damping off" during early stage of planting and increases chili disease resistance caused by aphids. The seed dressing and foliar application with NM Oligochitosan increase yield in rice and chili to 25% and 50%, respectively compared to Control. The NM Oligochitosan also enhances propagation of orchids, banana and pineapple tissue culture at 40 ppm and 80 ppm, respectively. The application of NM Oligochitosan in the field showed the insignificant change in the soil quality especially on pH dan CEC compared to conventional PGP based on study at rice field in Kampung Gajah, Perak.

NM-OLIGOCHITOSAN

Chitosan is deacetylated chitin derived from crustacean shells.

Chitosan powder can be irradiated at dry or wet states to produce low molecular chitosan.

Product validation

NM Oligochitosan

BENEFITS

- Value-added product from food waste
- As an alternative to the conventional agro-inputs
- Not harmful to the environment and human
- Reduce harmful chemicals exposure to farmers
- Reduce operation cost, yield increased
- Application of nuclear technology for agriculture

NM Oligochitosan also roles as biopolymer-based film coating which enhances shelf life of perishable fruit (chili).

The combination treatment of NM Oligochitosan and biofertilizer increases size and sweetness of sweet corn. (Sungkai, Perak).

The foliar application of 80 ppm NM Oligochitosan on kailan increases the number of leave, shoot height and plant fresh weight compared to untreated plants.

NM Oligochitosan induces drought resistance via multiple complex network, including metabolism, transport, transcription and signaling under osmotic stress.

NM Oligochitosan improves seed germination and accelerates growth of rice. (Rice field in Kg Gajah, Perak).

NM Oligochitosan enhances growth of pineapple tissue culture and reduces fungal and bacterial infection during the *in vivo* culture . (Tissue culture Lab, Nuclear Malaysia).

NM Oligochitosan increases plant growth rate, yield quality and compatible to used with other agro-inputs.

The foliar application of NM Oligochitosan on mature plant should be done twice a week for growth enhancement.

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