Accreditation No.: 204/E/KPT/2022

atom indonesia

Exist for publishing the results of research and development in nuclear science and technology

Publisher	: Directorate of Repository, Multimedia and Scientific Publishing
Mailing Address	: National Research and Innovation Agency Kawasan Sains dan Teknologi - BRIN, KST B.J. Habibie, Gedung 120 TMC, Jl. Raya Puspiptek Serpong, Tangerang Selatan 15314, Indonesia Phone (+62 21) 7560009, 7560562 ext. 4082 Web: http://atomindonesia.brin.go.id, E-mail: atomindonesia@brin.go.id
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atom indonesia
vol. 51 no. 2
August 2025

Contents

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EDITORIAL

Dear readers,

We are delighted to present the second issue of Atom Indonesia, Volume 51 No. 2 (2025), featuring ten articles that highlight the advancements and applications of nuclear science and technology. These contributions come from a diverse group of authors representing both national and international institutions, emphasizing the global importance and collaborative nature of nuclear research.

We begin with the first article, **"Atmospheric Plasma-Assisted Synthesis of Biomass-Based Graphene Oxide: Characterization and Elemental Analysis,"** aim to synthesize graphene oxide (GO) from biomass precursors using atmospheric plasma and analyze its properties and elemental composition. The synthesis successfully produced GO within five minutes, achieving a C:O ratio above 80 % and identifying 22 inorganic elements naturally present in biomass. This method is economically promising for large-scale GO production due to the material's excellent mechanical strength, electrical conductivity, and biocompatibility.

Following this, "**Brain Tumor Segmentation in MR Images Using Swin Transformer**," investigates the effectiveness of the Swin Transformer architecture for segmenting brain tumors in MR images using BraTS 2021 dataset consisting of 1,250 images. The segmentation process involved hierarchical feature mapping and attention mechanisms, achieving DSC, IoU, and sensitivity scores of 0.97313, 0.94767, and 0.96450, respectively. The results demonstrate that Swin Transformer can effectively segment brain tumors in MRI scans, making it a promising tool for accurate medical image analysis.

The next article, "**Dosimetric Evaluation of Very High Energy Electron (VHEE) Beams in the Male Pelvic Region Using Geant4/TOPAS**," evaluates the dosimetric advantages of using focused VHEE beams compared to collimated beams for prostate cancer treatment through Monte Carlo simulations. The results indicated that focused VHEE beams increased prostate dose delivery by 5.24 %, while substantially decreasing exposure to surrounding healthy tissues, including the bladder (16.93 %), rectum (50.81 %), and femoral heads (68.75 %). Thus, focused VHEE beams show significant promise for precise dose delivery in deep-seated tumors, reducing unintended damage to adjacent organs.

Focusing on environmental safety, the fourth article, "**Safety Assessment of TENORM Waste Landfill on Bangka Island Using Resrad Offsite 4.0**," assesses the radiological safety of a class II landfill designed for disposing of TENORM waste from tin mining. Using Resrad Offsite 4.0 software, the simulation results indicated a maximum radiation dose of 0.40537 mSv/year at 200 meters from the landfill center, persisting for 29,265 years post-closure, with a cancer risk probability of 4.25×10^{-4}. These findings confirm that the landfill design meets safety standards set by BAPETEN (1 mSv/year), making it safe for public health and the environment.

Discussing related the radiotherapy quality assurance, "**A Multicenter Study of IMRT Dosimetry Audit Testing Using C-shape Phantom**," presents an independent dosimetry audit of IMRT radiotherapy using a compact C-shaped phantom across multiple centers in Jakarta. The audit involved measuring point doses with TLD-rods and 2D dose distributions using Gafchromic Film EBT3, with gamma evaluation criteria of 3%/3 mm and 3%/2 mm. Results showed all IMRT plans met the ±5 % tolerance for point doses, and nearly all passed the minimum gamma passing rates (≥95 % for 3%/3 mm, ≥90 % for 3%/2 mm). The study confirmed the suitability of the C-shaped phantom for remote dosimetry audits, laying the foundation for broader multicenter quality assurance in Indonesia.

Next contribution article, "**Development of a Vietnamese PET/CT Dataset for Machine Learning-Based Analysis of Non-Small Cell Lung Cancer Images**," creates a publicly accessible dataset of PET/CT images specifically for NSCLC cases collected from three Vietnamese hospitals to support AI-based medical image analysis. The dataset includes 416 PET/CT scans (300 NSCLC cases) with manually segmented malignant lesions validated by experienced radiologists, achieving segmentation accuracy with a dice similarity coefficient of 80.3 % and volume similarity of 81.9 %. This dataset contributes valuable resources for AI-driven NSCLC research and global efforts in automating PET/CT analyses.

On the topic of nuclear safety, "**Seismic Risk Analysis of the Serpong Nuclear Complex and the RSG-GAS Reactor Using Microseismic Methods**," examines the seismic safety of Indonesia's RSG-GAS reactor using HVSR and FSR techniques. Results showed average natural frequencies and amplification factors indicating generally low-to-moderate seismic vulnerability, with the HK9 site showing reduced risk. However, FSR analysis revealed critical concerns at certain points, notably at FU8 where peak ground acceleration reached 272.63 gal, exceeding safety limits. The study concludes that while the facility is mostly safe, structural reinforcements are needed at specific locations to ensure long-term seismic resilience.

From a diagnostic imaging perspective, "**Exploring the Effect of Different Scanning Protocols on the Modulation Transfer Function**," evaluates how various reconstruction algorithms and scanning doses affect in-plane resolution across three CT scanner brands. Using IndoQCT software for automated MTF analysis, the study found that image resolution (MTF10) varied depending on the scanner type, dose, and algorithm. Siemens showed improvement with iBHC, Philips showed minimal change with iDose4 but a slight decline with BC, and GE showed dose-dependent variation. These results highlight the importance of selecting optimal reconstruction methods and dose protocols to balance image quality and patient safety.

The next article on theoretical nuclear physics, "**The Dependence of the Rupture Probability on the Mass Number of the Fissionable Nucleus**," introduces a new technique for calculating fission yield by incorporating the dependence of rupture probability on the mass number of the fissionable nucleus. The study improves upon previous methods by simplifying the calculation process through the Neck Rupture Model, which reduces the number of calculation stages. This technique provides more accurate fission yield data compared to earlier approaches. The paper specifically demonstrates improved fission yield calculations for Uranium isotopes at an energy of 14 MeV, highlighting the model's potential for more efficient and precise nuclear fission analysis.

Closing this edition, the tenth article, "**Investigation of Dose Effect of ICRP110 Male and 4 Female Head Phantoms During BNCT and PBFT by Monte Carlo Simulations**," explores the radiation dose effects of Boron Neutron Capture Therapy (BNCT) and Proton Boron Fusion Therapy (PBFT) on the brain using GEANT4 Monte Carlo simulations. By employing ICRP110 male and female head phantom models, the study compares the impact of both therapies on brain tissue, a sensitive organ. The article also includes necessary Linear Energy Transfer (LET) calculations and provides detailed dose, LET, and energy deposition values for BNCT and PBFT treatments in both male and female phantoms, highlighting the differences and potential advantages of each therapy.

Each article reflects significant contributions to nuclear science applications, including reactor safety, radiation protection, and environmental monitoring. On behalf of Atom Indonesia, I would like to thank you all for your contributions and endless support that have enabled Atom Indonesia to achieve an outstanding performance over all the years. This outstanding performance could not have been achieved without the great efforts and cooperation of the editors, reviewers, management personnel, authors, and readers. Enjoy reading.

Editor in Chief