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Abstract Collection

Epung Saepul Bahrum, Wawan Handiaga, Yudi Setiadi, Henky Wibowo, Prasetyo Basuki, Alan Maulana, Mohamad Basit Febrian, Jupiter Sitorus Pane., *Design of Irradiation Facilities at Central Irradiation Position of Plate Type Research Reactor Bandung*. Tri Dasa Mega, 22 (1), 1.

One of the results from Plate Type Research Reactor Bandung (PTRRB) research program is PTRRB core design. Previous study on PTRRB has not calculated neutron flux distribution at its central irradiation position (CIP). Distribution of neutron flux at CIP is of high importance especially in radioisotope production. In this study, CIP was modeled as a stack of four to five aluminum tubes (AT), each filled by four aluminum irradiation capsules (AIC). Considering AIC dimension and geometry, there are three possibilities of AT configuration. For irradiation sample, 1.45 gr of molybdenum (Mo) was put into AIC. Neutron flux distribution at Mo sample was calculated using TRIGA MCNP and MCNP software. The calculation was simulated at condition when fresh fuel is loaded into reactor core. Analyses of excess reactivity show that, after installing irradiation AT and Mo sample was put into each configuration, the excess reactivity is less than 10.9 %. The highest calculated thermal neutron flux at Mo sample is 5.08×10^{13} $n/cm^2.s$ at configuration 1. Meanwhile, the highest total neutron flux at Mo sample is located at capsule no. II and III. Thermal neutron flux profile are the same for all configurations. This result will be used as a basic data for PTRRB utilization.

Keywords: Central Irradiation Position, Neutron Flux Distribution, MCNP, PTRRB

Kristina, Amir Hamzah, Muhammad Subekti, Menik Ariani., *Nuclides Composition of Experimental Power Reactor (RDE) Spent Fuel.,* Tri Dasa Mega, 22 (1), 9.

The management of spent fuel is an issue of safety for Indonesia in the phase of designing RDE. Several studies regarding spent fuel are limited by geometrical characteristics and number of nuclides library. Therefore, different methodologies utilizing MCNPX2.6.0 were applied to get better information for further research. In this study, a single fuel pebble containing UO_2, was burned using 5 cycles of multi-pass loading scheme for 1080 days to obtain the same energy as RDE's core, which is about 79.90 GWd/MTU. The multiplication factor k-inf decreased at each cycle and stopped at 1.14575. Afterwards, the fuel was decayed for 5 years as a representation of cooling time in the spent fuel storage tank. The calculation results in the nuclides composition of the spent fuel after 1080 days of burning and 5 years of cooling containing 241 nuclides, which consist of 21 actinides and 220 nonactinides. Actinides with the highest activity of 8.96 Ci is $^{241}_{94}Pu$ with mass of 0.0867 g, whose half-life is 14 years long. Nonactinides with the highest activity of 4.47 Ci is $^{137}_{55}Cs$ with mass of 0.0514 g, whose half-life is 30.17 years long. The total activity of spent fuel pebble is 22.9 Ci with total mass of 5.28 g. The mass and activity data of each nuclides contained in the spent pebble will be used in the future research for performing safety analysis of the spent fuel storage tank.

Keywords: Nuclides composition, Pebble, Spent fuel, RDE, MCNPX

Isdandy Rezki Febrianto, Puradwi Ismu Wahyono, Suharni., *The Radioactivity Estimation of The Irradiated 13 MeV Cyclotron's Concrete Shield*., Tri Dasa Mega, 22 (1), 17.

The Centre for Accelerator Science and Technology (PSTA) planned to install K500 concrete shield in its 13 MeV cyclotron facility (DECY-13). However, fast neutrons that are generated by this cyclotron could activate materials of the concrete. It may harm the radiation workers. In this work, we conducted simulations using ORIGEN2 and PHITS computer code to estimate the formed radioactivity and the neutron flux distribution in the DECY-13 cyclotron's concrete shield. Based on the simulation, the induced radioactivity is 2.3478 × 109 Bq, while its gamma dose rate is 22.09 μSv/m2h. The most contributed isotopes are Th-233, Ho-166, Al-28, Mn-56 and Si-31. This dose is quite high. Neutron fluxes in the rear of the simulated concrete shield are also still prominent. Accordingly, it is necessary to attach neutron shielding materials which do not generate high-intensity gamma-ray. The formed radioactivity is high; but it appears from the short half-life isotopes such as Th-233, Ho-166, Al-28, Mn-56 and Si-31. Its activity will diminish quickly after the cyclotron is off. Hence, it will be safe for radiation workers.

Keywords: Radioactivity, Concrete Shield, 13 MeV Cyclotron, Neutron Irradiation, DECY-13, PHITS

Amanda Dhyan Purna Ramadhani, Susilo, Irfan Nurfatthan, Yohannes Sardjono, Widarto, Gede Sutresna Wijaya, Isman Mulyadi Triatmoko., *Dose Estimation of the BNCT Water Phantom Based on MCNPX Computer Code Simulation.* Tri Dasa Mega, 22 (1), 23.

Cancer is a malignant tumor that destroys healthy cells. Cancer treatment can be done by several methods, one of which is BNCT. BNCT uses ^{10}B target which is injected into the human body, then it is irradiated with thermal or epithermal neutrons. Nuclear reaction will occur between boron and neutrons, producing alpha particle and lithium-7. The dose is estimated by how much boron and neutron should be given to the patient as a sum of number of boron, number of neutrons, number of protons, and number of gamma in the reaction of the boron and neutron. To calculate the dose, the authors simulated the reaction with Monte Carlo N Particle-X computer code. A water phantom was used to represent the human torso, as 75% of human body consists of water. Geometry designed in MCNPX is in cubic form containing water and a cancer cell with a radius of 2 cm. Neutron irradiation is simulated as originated from Kartini research reactor, modeled in cylindrical form to represent its aperture. The resulting total dose rate needed to destroy the cancer cell in GTV is 2.0814×10^{14} Gy.s (76,38%) with an irradiation time of $1,4414\times10^{-13}$ s. In PTV the dose is 5.2295×10^{13} Gy.s (19,19%) with irradiation time of 5.7367×10^{-13} s. In CTV, required dose is 1.1866×10^{13} Gy.s (4,35%) with an irradiation time of 2.5283×10^{-12} s. In the water it is 1.9128×10^{11} Gy.s (0,07%) with an irradiation time of $1,5684\times10^{-10}$ s. The irradiation time is extremely short since the modeling is based on water phantom instead of human body.

Keywords: BNCT, Dose, Cancer, Water Phantom, MCNPX

Ahmad Hasan As'ari, Saeful Yusuf, Alfian., *Quantification of Aluminum Contents in Cooked Foodstuffs from Three Regions in Java Using Neutron Activation Analysis.* Tri Dasa Mega, 22 (1), 31.

Aluminum is widely available in nature and the third most abundant element on earth. Improper intake of aluminum can increase toxicity and correlate with Alzheimer's disease. One source of aluminum comes from food. In this study, aluminum content in foodstuffs was analyzed using neutron activation analysis. Various foodstuffs were purchased from markets in three regions in Java, namely Bangkalan (East Java), Magelang (Central Java), and Cianjur (West Java) and cooked at a temperature above 80°C until the ready-to-eat condition. The cooked samples were freeze-dried and irradiated in the G.A. Siwabessy research reactor with neutron flux of 5x1013 neutrons.m2.s-1. Post-irradiation samples were analyzed using gamma spectrometry. The results show that the aluminum contents in each foodstuff from one region have a strong correlation with other regions (Pearson correlation coefficient $r>0.9$, $P<0.001$), indicating that the distribution of aluminum content does not differ from one region to another. The staple food category has a relatively low aluminum content with an average value of 24 mg/kg and a maximum value of 35 mg/kg. The dish category has higher aluminum content with an average value of 51 mg/kg and a maximum value of 77 mg/kg. The vegetable category has the highest content with an average value of 156 mg/kg and a maximum value of 710 mg/kg owned by caisim. Caisim is interesting for further research because of its ability to store large amounts of several elements. In general, the intake of aluminum sourced from these foods is still below the allowed value.

Keywords: Neutron activation analysis, Food safety and security, Alzheimer, Aluminum distribution, Pearson correlation

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