

Study on Beta-Ray Detection System in Water Using a MCNP Simulation

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Abstract : In the modern days, the use of radioactive substances is on the rise in the areas like chemical weaponry, industrial usage, and power plants. Although there are various technologies available to detect and monitor radioactive substances in the air, the technologies to detect underwater radioactive substances are scarce. In this study, computer simulation of the underwater detection system measuring beta-ray, a radioactive substance, has been done through MCNP. CaF_2 , YAP(Ce) and YAG(Ce) have been used in the computer simulation to detect beta-ray as scintillator. Also, the source used in the computer simulation is Sr-90 and Y-90, both of them emitting only pure beta-ray. The distance between the source and the detector was shifted from 1mm to 10mm by 1 mm in the computer simulation. The result indicated that Sr-90 was impossible to measure below 1 mm since its emission energy is low while Y-90 was able to be measured up to 10mm underwater. In addition, the detector designed with CaF_2 had the highest efficiency among 3 scintillators used in the computer simulation. Since it was possible to verify the detectable range and the detection efficiency according to modeling through MCNP simulation, it is expected that such result will reduce the time and cost in building the actual beta-ray detector and evaluating its performances, thereby contributing the research and development.

Keywords : Beta-ray, CaF_2 , detector, MCNP simulation, scintillator

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