

Measuring Radioactivity of ^{90}Sr based on Cherenkov Radiation in Real Time

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In March, 2011, a nuclear accident of the Fukushima Daiichi Nuclear Plant occurred, which radionuclides spread around Japan and Pacific Ocean. Recently, a problem of internal exposures by ^{90}Sr intake have been focused to study, because it is dangerous by accumulating the bone and difficult to measure radioactivity. Conventional method of measuring radioactivity of ^{90}Sr is based on chemical extraction in sample, which takes approximately a month. In a recent study, Cherenkov light emitted by beta rays from ^{90}Y was observed using silica aerogel as the silica aerogel with a refractive index of 1.0411 and PMT (type: H8100C made by Hamamatsu K. K.) or assemblies MPPCs (type: S12572-100P made by Hamamatsu K. K.) as photo detectors. Therefore, the beta ray from ^{90}Y become equilibrium condition with ^{90}Sr could be identified in environmental radiation. A new detector based on Cherenkov counter has been developed for a small seafood sample in real time. The detector has fiber tracker based on scintillating fibers (type: SCSF78MJ made by Kuraray Co., Ltd.), which can determine incident position of a beta ray. One of the background events, cosmic ray muons, is suppressed by adding veto counter based on plastic scintillator with wavelength shifting fibers which was designed to cover the Cherenkov counter. Other one of the background events, beta rays from ^{214}Bi (3.27 MeV) as uranium decay series, is suppressed by filling nitrogen gas in the detector. When the Cherenkov radiation is emitted from silica aerogel, a reacted pixel number of photo detector would be two or more. Therefore, the detector can identify beta rays from ^{90}Y and determine position of ^{90}Y in the sample. The detector performance was estimated using radiation source of ^{90}Sr , ^{137}Cs and ^{40}K . As a result, an absolute efficiency of ^{90}Sr was obtained as the ratio of approximately 100-1000 compared with other nuclides. The detector will contribute to monitoring contamination of food or water, measuring environment radiation, and scanning concentration of ^{90}Sr in sample.