Determination of ^{210}Po in seafood using large-area grid ionization chamber alpha Spectrometry

Liangliang Yin,[1] Yanqin Ji,[1,*]

[1]National Institute for Radiological Protection, Chinese Center for Disease Control and Prevention, 100088 Beijing, China

** e-mail: jiyanqin@nirp.chinacdc.cn (corresponding author)*

yinliangliang@nirp.chinacdc.cn(presenting author)

Polonium-210 (^{210}Po), a naturally occurring radionuclide in the ^{238}U decay series, exists at trace concentrations in the environment. As a pure alpha emitter, ^{210}Po ranks among the most radiotoxic nuclides known. With wide dispersion in the environment, ^{210}Po enters human body via food chains, thus being a serious threat to human health. ^{210}Po was known as one of the most important sources of internal dose received by humans from foods[1]. The maximum permissible human body-burden of ingested ^{210}Po was 1.1×10^3 Bq[2]. Consequently, rapid analysis capability for diverse sample matrices is essential for risk assessment and post-incident decision-making. The purse of this study is to develop a rapid and reliable method for determination of ^{210}Po using large-area grid ionization chamber α spectrometry.

In the experiment, the soft tissues of clam sample were taken out, dried at 105 ℃, and grinded into powder. 0.1-0.5 g of power was digested with HNO_3-H_2O_2 in microwave system, ^{209}Po standard solution was added as the tracer. Followed eliminating acid, adding ultrapure water to disperse sample solution under ultrasonic. Then the sample solution was transferred directly into dish (ϕ25cm), and the sample dish were then put in the vacuum oven, evaporated to dryness. The counting source prepared in this way can be put in large-area grid ionization chamber directly. The sample source were counted using large-area grid ionization chamber. The chamber filled with commercially available mixed gas of 90% Ar and 10% CH_4 to about 48.26 kPa[3]. Standard source (^{237}Np-^{239}Pu-^{241}Am mixed source, ϕ25cm) was used for energy calibration and efficiency determination.

The ϕ25cm blank dish was counted for 24 h, while mixed standard source for 30 min, to obtain detection efficiency 33% of the large-area grid ionization chamber α spectrometry. The minimum detectable activity (MDA) was 1.0×10^{-3} Bq. ^{209}Po standard solution was spiked in calm powder and the present method was used to prepare source. The recovery was 98.5%. The dry clam samples were analyzed using two methods. The result of 0.057 Bg/g activity in clam samples is good agreement with the commonly used method that the spontaneous deposition source (ϕ2cm) measured using multichannel α spectrometer. The method developed for measurement of seafood could achieve higher recovery (above 98%) and lower MDA, using small quantity of sample (0.1 - 0.5 g of dry sample).

Compared with the traditional method, the developed method can avoid separation process, using less quantity of sample and simplify the measurement process. The method is useful for measurement of other biological or environmental sample.

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