RAD

rad-conference.org

EIGHTH INTERNATIONAL CONFERENCE ON RADIATION IN VARIOUS FIELDS OF RESEARCH

BOOK OF ABSTRACTS

2020 | Virtual Conference

Radiochemical bioassay on Am-241 traces for internal contamination evidence

Mirjana Radenković[1], Jasminka Joksić[2], Marija Janković[1], Nataša Sarap[1]

1 University of Belgrade, Vinča Institute of Nuclear Sciences, Belgrade, Serbia
2 Serbian Radiation and Nuclear Safety and Security Directorate, Belgrade, Serbia

Americium-241 is an artificial transuranic radionuclide with high specific activity of 0.13 TBq/g and long half-life $T_{1/2}$=432.2 years. Besides the nuclear and space industries it has a wide application in non-destructive testing, as a thickness gauge and in smoke detectors. Due to a high radiotoxicity surpassing its chemical toxicity a long-term internal contamination by low americium quantities may be a serious health issue. We have developed a bioassay procedure for americium-241 tests for persons occupationally exposed to risk of americium intake by inhalation and ingestion. The procedure is suitable for low-level activities determination and it includes decomposition and pre-concentration of complex organic samples, precipitation of lantanide group elements, followed by selective multiple solvent extractions and acid/alcohol-based separations using the anion-exchange (DOWEX resin) chromatography. Optimization of the acidity of alcohol solutions especially for final fraction eluation was the crucial step in this procedure. The concentration measurements may be performed by ICPMS immediately, while in the case of alpha spectrometry using properly calibrated PIPS detectors, thin layer americium alpha sources had to be prepared by modified Talvitie's electroplating procedure prior to activity measurements. The efficiency of the proposed radiochemical separation procedure had been evaluated by the Am-243 tracer addition and it exceeded 30% that is quite good in compare with other reported values. On the contrary, the electroplating efficiency was about 50% that is significantly low if compared with over 90%, reported for uranium and thorium, probably due to a low distribution coefficient for trivalent Am against lanthanides. It has consequences on the thickness of the alpha source and measurement efficiency. The advantage of the procedure is high sensitivity but issues with selectivity may be avoided by using ICPMS measurement technique instead of alpha-spectrometry in order to avoid electrodeposition step and time consuming activities counting. This procedure may be recommended in cases when there is a doubt on systematic low-level internal contamination so that operational procedures may be modified accordingly, and the workers awareness and risk perception affected. The internal dose assessments based on the bioassay results on Am-241 contents in analyzed samples may be assessed using available biokinetic models.

rad-conference.org