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Americium winning for its determination in boric-acid containing NPP evaporator concentrate

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The aim of this research was to develop a method for pre-concentration of americium from operational radioactive waste for its determination. In these experiments, the attention was paid to separation of americium from boric acid containing evaporator concentrate coming from the Dukovany Nuclear Power Plant by an extraction chromatographic system, where extraction agent used was N,N,N',N'-Tetraoctyl Diglycolamide (TODGA) incorporated in polyacrylonitrile (PAN) matrix. For the elution of retained americium, the oxalic acid solution was chosen. Eluted americium has been, subsequently, determined by alpha spectrometry. Alpha samples were prepared using constant current electrodeposition technique from oxalate-sulfate electrolyte.

The system characterization consisted of several experiments. At first, the dependence of americium weight distribution ratios on pH (ranging between 1.5 and 5.5; adjusted with nitric acid solutions) for four different dilutions of evaporator concentrate was studied, as well as blank experiments where americium weight distribution ratios dependences on pH for every dilution curve were determined for sorption on polyacrylonitrile matrix itself. Next, kinetics of this process, capacity of the used solid phase extractant, and elution profile of americium stripped by oxalic acid and loaded from various solutions were determined. Also the extraction behavior of americium in presence of various anions (namely nitrates, sulfates, oxalates, citrates and chlorides) in scale which can occur in real samples was investigated. The parameters of the electrodeposition process were optimized in an independent series of experiments; the most effective parameters were applied for the alpha samples preparation. Effectiveness of the electrodeposition method was monitored by comparing with simultaneously used liquid scintillation counting (LSC) method.

As a result of a kinetics study, it was found out that about 97 % of americium uptake has been reached after half an hour of phase contact. The study of americium elution from TODGA-PAN resin filled column of bed volume equal to 0.24 mL, after its loading from the boric acid containing evaporator concentrate, revealed that almost all of the approximately 6 kBq of Am-241 loaded (97.43 ± 0.97 % or 98.26 ± 1.77 %, depending on the detection method used) could be eluted by about 1.7 mL of 0.25M oxalic acid solution.

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