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Rapid separation of actinides from water samples on TEVA/TK221 stacked columns

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Extraction chromatography is widely used in radioanalytical methods for the separation of actinides. The most commonly applied extractants for the separation of tetravalent actinides are quaternary amines (e.g., in TEVA resin), tetra- and hexavalent actinides are often separated with trialkyl phosphonates (e.g., in UTEVA resin), and tri-, tetra- and hexavalent ones can be separated using carbamoylmethylphosphine oxides (CMPO, e.g., in TRU resin), and tetraalkyldiglycolamides (DGA, e.g., in DGA resin). Recently, a mixed resin, the Triskem TK221 Resin that contains i.e. DGA and CMPO on a PS-DVB based inert support became available. Distribution coefficients (k') of actinides on this new resin were determined, k'values for actinides (Th, U, Pu, Am) were higher than 1000 from 3M HNO₃. This is a unique property of the new material offering excellent retention of all actinides, including trivalent ones such as Am(III).
A novel method has been developed, tested and applied for the simultaneous determination of actinides from water samples using TEVA/TK221 stacked columns.
Water samples (tap and sea water) were spiked with actinide tracers (Th, U, Np, Pu, Am). Calcium phosphate pre-concentration procedure was followed by dissolution in 3M nitric acid/1M aluminum nitrate and redox state adjustment was performed with sulfamic acid, ascorbic acid and sodium nitrite. Np(IV), Th(IV) and Pu(IV) were retained on TEVA resin, U(VI) and Am(III) were retained on TK221 resin. The stacked columns were separated and the actinides were sequentially eluted. Elution conditions were optimized. Alpha sources were prepared by NdF₃ micro-coprecipitation. Chemical recoveries were acceptable high (61-90% for Th, 59-100% for U, 92-93% for Np, 87-100% for Pu and 89-92% for Am). No contamination in the actinide sources was detected.
These promising results encourage experiments with more difficult matrices, such as soil and sediment samples.

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