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Effect of short chain carboxylic acids on U(VI) sorption on silica and rutile studied by the use of capillary zone electrophoresis

Capillary zone electrophoresis (CZE) was used to study of uranyl sorption on silica and rutile in the presence of short chain carboxylic acids. These acids are chosen as they may be released in environment by decay of plant, animal and microbial tissues1. They can be also used as simple models of more complicated natural organic matter.
First, separation and simultaneous determination of a number of short chain carboxylic acids (oxalic, formic, acetic and propionic) and U(VI) with direct UV detection is developed for analysis of solutions after the U(VI) sorption by CZE. From literature data it is known that complex formation of U(VI) with carbonate, used as a carrier electrolyte, allows U(VI) to be determined, as negatively charged species, in a single run with organic acid anions2. Matrix effect of Si(IV) (possible silica dissolution products) and perchlorate (added for constant ionic strength in sorption experiments) on the separation of U(VI) and organic acids is investigated. The influence of methanol in carrier electrolyte on separation selectivity of given mixture is also studied. In chosen conditions calibration plots are linear in two ranges of concentration from ~1×10-5 to 1×10-3 M for oxalate, acetate, propionate, U(VI) and ~1×10-4 to 1×10-3 for formate. Accuracy of the procedure is checked by the "added-found"method in standard mixture solutions. Relative standard deviation is within the range of 2-10% and the recovery is in the range of 90-110%.
This method is applied for the analysis of real solutions after U(VI) sorption on silica and rutile in the presence of short chain carboxylic acids. The sorption experiments indicate that given organic acids decrease uranium sorption either on silica or on rutile. These experiments demonstrate that short chain carboxylic acids can influence the mobility and chemistry of uranium in the environment.

Reference:

1. F. Stevenson, Humus chemistry: genesis, composition, reactions. Wiley, New York, 1994.
2. V. Sladkov and B. Fourest, Journal of Chromatography A, 2009, 1216, 2605.

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