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Alpha radiometry of uranium by liquid scintillation counting after pre-concentration by cloud point extraction

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The aim of this study is the radiometric determination of uranium in waters by liquid scintillation counting (LSC) after pre-concentration of the element by cloud point extraction (CPE). For CPE, tributyl phosphate (TBP) is used as the complexing agent and (1,1,3,3-Tetramethylbutyl)phenyl-polyethylene glycol (Triton X-114) as the surfactant. The measurement is performed after phase separation by mixing of the surfactant phase with the liquid scintillation cocktail. The effect of experimental conditions such as pH, reactant ratio (e.g. V(TBP)/V(Triton), ionic strength (e.g. [NaCl]) and the presence of other chemical species (e.g. Ca2+ and Fe3+ ions as well as humic acid and silica colloids) on CPE has been investigated. According to the experimental results the total method efficiency is (13±2)% and the separation efficiency (60±10)% for the optimum pH and reactant ratio (V(TBP)/V(Triton)=0.1). Regarding the other parameters, generally Ca2+ and Fe3+ ions as well as the presence of colloidal species in solution (even at low concentrations) results in significant decrease of the separation efficiency. On the other hand increasing [NaCl] leads to enhancement of separation efficiency. The detection limit under optimum experimental conditions has been found to be 0.5 Bq/l indicating that the method could be applied only to waters samples with increased uranium concentration. Moreover, the negative effect of the chemical species found in natural waters limits the applicability of the method with the respect to environmental radioactivity measurements.

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