RAPID RADIOACTIVITY ANALYSIS IN ENVIRONMENTAL SAMPLES IN RESPONSE TO EMERGENCIES USING A LIQUID CHROMATOGRAPHY COUPLED ON LINE TO ICP-MS

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Nuclear accidents occurred in latest years highlighted the difficulty to achieve, in a short time, the identification and quantification of alpha and beta emitters. Indeed, the protocols currently employed for environmental monitoring are very efficient and provide very low detection limits, but they are complex (many manipulations) and may require several weeks for some radioisotopes.

The first stage of the study allowed to list alpha and beta emitters susceptible to be released into the environment after a nuclear accident. These radioisotopes aren't easily measurable by gamma spectrometry. In a second phase, a rapid separation protocol was developed for the 20 radioisotopes of U, Th, Pu, Am, Cm, Np and Sr selected. The objective is the automation of the radiochemical separation and its coupling to the measurement.

The separation is achieved using chromatographic columns and the measurement is made essentially by ICP-MS. The main constraint of this coupling is the compatibility between chromatographic elution and recommended measurement media.

The definition of the separation protocol, which involves three columns, was performed with synthetic matrices which allowed having better knowledge of physicochemical properties of the different elements.

Excellent performances are obtained off-line with synthetic samples and river water. These performances are characterized by yields $\geq 80\%$ for all radioelements and standard deviations $\leq 10\%$ (after tens independent replicas). Finally, the automation and the coupling on line of the radiochemical separation to the ICP-MS allow decreasing the analysis duration for the 20 radioisotopes from several weeks to ~ 1 hour.