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ORAL PRESENTATION - Nuclear Forensics: age determination by the 231Pa/235U ratio

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The increase of traffics of illegal nuclear materials requires the improvement in nuclear forensics. The age of the sample, which corresponds to the determination of the date of the last purification, can give information about its origin. The aim of this work is to develop an efficient procedure which allows the determination of the age of micro-quantities. Dating micro-quantities of uranium is possible with two daughter/parent nuclide ratios: 230Th/234U and 231Pa/235U. The procedure of age determination using the 230Th/234U ratio is already effective [1,2]. The development of the 231Pa/235U dating procedure will allow to confirm results obtained with 230Th/234U. In the same time, it will provide a survey of the 235U isotope, i.e. of the enrichment rate.
In order to measure such low quantities, mass spectrometric detection was chosen. Thus, the isotopic dilution method will be used with the aim of determining the quantity of each isotope. 233Pa is the appropriate tracer for the detection of 231Pa. Therefore, 233Pa was milked from 237Np, fixed on AG1-X8 resin.
A procedure of separation has been established in order to date uranium. However, experimentally, the separation of protactinium from uranium was not effective. Consequently, distribution coefficients of protactinium have to be determined for different media (HCl and HNO3) and different type of resins (AG1-X8, TEVA, U-TEVA, TRU-SPEC) in order to optimize the procedure.
After the determination of the distribution coefficients, the different elements, i.e. protactinium and uranium, will be separated from each other without any residual amount present in each fraction.

References

[1] S. P. LaMont, G. Hall, J. Radioanal. Nucl. Chem., 2005, 264, 423
[2] M. Wallenius, A. Morgenstern, C. Apostolidis, K. Mayer, Anal. Bioanal. Chem., 2002, 374, 379

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