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Determination of Pb-210 in water samples by ICP-MS after cloud point extraction using crown ethers.

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Isotopes such as Sr-90, Cs-137 Pb-210 and Po-210 are often the most important contributors to human radiation exposure due to their short half-life. The radiotoxicity of Pb-210 originates from its relatively long half-life compared with time of fulfillment of environmental processes and the high energy associated with the decay of its progeny, such as Po-210.[1] For these reasons, Pb-210 has the lowest maximum acceptable concentration in drinking water, which has been set at 0.1 Bq/L.[2] Furthermore, this radionuclide is chemically similar to alkaline earth elements making its separation challenging for complex environmental matrices. The objective of this project will be to investigate an effective way to specifically extract lead-210 and achieve interesting preconcentration factor after cloud point extraction (CPE). The increase in temperature of a micellar system allows to separate the solution in two distinct phases by dehydration of non-ionic surfactants. The use of a binding agent which has great affinity with a metal ion of interest, into the system, provides the ability to recover this complexed ion in a very small surfactant rich phase with a great preconcentration factor. Crown ethers have already demonstrated their great affinity for Pb with other kinds of extraction such as solid phase extraction (SPE) and surely can be transposed to CPE.[3] Another challenge will be to couple this extraction technique with Inductively Coupled Plasma Mass Spectrometry (ICP-MS-MS) to achieve the necessary sensitivity for analysis of Pb-210 in environmental samples and to have a rapid sample throughput. The limits of detection reach by ICP-MS-MS technique will allow the quantification of Pb-210 at ultra-trace.

[1] Larivière, D.; Reiber, K.M.; Evans, R.D.; Cornett, R.J. Anal. Chim. Acta. 2005, 549, 188-196. [2] Federal-Provincial Subcommittee on Drinking Water, Guideline for Canadian Drinking Water Quality, Environment Canada, 2001. [3] Horwitz, E.P.; Chiarizia, R.; Dietz, M.L. Solvent Extr. Ion Exc. 2007, 10 (2), 313-336.

Author: Mr BLANCHET-CHOUINARD, Guillaume (Chemistry department, Laval University)

Co-author: Prof. LARIVIERE, Dominic (Chemistry Department, Laval University)

Presenter: Mr BLANCHET-CHOUINARD, Guillaume (Chemistry department, Laval University)

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