Bringing total and species specific Hg isotopic analysis to ultra-trace levels using hyphenated MC-ICP-MS

S. BERAIL[1*], S. BOUCHET[1], J. CAVALHEIRO[1], E. TESSIER[1], J.P.G. BARRE[1], Z. PEDRERO ZAYAS[1], O.F.X DONARD[1] AND D. AMOUROUX[1]

[1]LCABIE, IPREM, Université de Pau et des Pays de l'Adour/CNRS UMR 5254, Hélioparc, 2 avenue du président Pierre Angot, Pau, 64053, France (* correspondence: sylvain.berail@univ-pau.fr)

Stable Hg isotope analysis is now widely used in environmental sciences, essentially for discriminating Hg sources and better understanding its bio-geochemical cycle. Up to now, total Hg isotopic information has been mainly studied. Further, the species specific Hg isotopic analysis is an emerging tool providing the isotopic signature of each different Hg species (InHg and MeHg).However, for both total and species specific isotopic analysis, the main limitation remains the low Hg concentration in some environmental compartments, especially in waters. In this presentation, we propose to overcome this barrier using new online Hg pre-concentration strategies with specific sample introduction systems coupled to MC-ICP-MS allowing then isotopic analysis of ultra-trace levels of Hg.

For total Hg isotopic analysis, a double stage gold trap pre-concentration mercury analyzer (Tekran 2600) was coupled to a Nu Plasma MC-ICP-MS. For species specific isotopic analysis, the MC-ICP-MS was coupled to a Gas Chromatography system fitted with a Programmable Temperature Volatilization (PTV) injector. The main difficulty for both hyphenated systems was to deal with very short transient signals (down to 11 s) and this aspect was solved using a suitable data treatment strategy. These methods were successfully validated with the analysis of environmental CRM and with comparison to the actual reference technique.

The main advantage of the proposed methods is the high pre-concentration capability which allows the analysis of 5 $ng.L^{-1}$ samples for total isotopic analysis (introduced Hg mass of 340 pg) and 50 $ng.L^{-1}$ samples for species specific isotopic analysis (introduced Hg mass of 1500 pg). At these levels, the two methods give a good accuracy and a maximum uncertainty of 0.30‰ (as 2SD) for both δ and Δ. We will present critical steps of technical validations as well as new results on rainwaters, seawaters and other low concentrated environmental samples.