PO 1.17

Mercury Species Stability in Crude Oil Studied by Species Specific Isotope Dilution GC-ICP-MS

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In crude oil mercury (Hg) can occur in different chemical forms associated to specific oil fractions. Hg concentrations and chemical forms vary depending on geographic locations and depth of exploitation as well as on physical and chemical conditions prevailing during oil production and transport. The most abundant Hg species found in crude oils are elemental Hg (Hg^0) and various forms of inorganic mercuric Hg (Hg^{2+}). Occasionally significant concentrations of organic Hg compounds are observed.

The main objective of this work was to study the stability of mercury species in crude oils using isotope enriched $^{200}Hg^0$ and $^{198}Hg^{2+}$. A key task was to develop reliable analytical protocols based on species specific isotope dilution GC-ICP-MS with minimal species conversions during analysis, in particular during derivatization. The suitability of different Grignard and tetra alkyl borate derivatization reagents was tested in spiked solvent- and crude oil samples. For all reagents we observed both oxidation and reduction of the added isotope tracers. For tetra alkyl borates, and in particular for sodium tetra propyl borate, these derivatization artefacts were substantially lower and more reproducible between sub samples compared to Grignard reagents.

We performed a series of experiments in which spiked crude oil samples were prepared and stored under nitrogen or air at different temperatures for up to 3 months. In all samples the added $^{200}Hg^0$ was oxidised to $^{200}Hg^{2+}$ at variable rates depending on the applied storage temperature. However, no significant reduction of the added $^{198}Hg^{2+}$ was observed with the samples and conditions used.