Mercury speciation in natural gas condensates

M ENRICO[1], H ZHOU[2], B BOUYSSIERE[1]

[1] IPREM, UMR5254, CNRS/UPPA, 64000 Pau, France
[2] Centre Scientifique et Technique Jean Feger (CSTJF), TOTAL EP, 64018 Pau, France

Mercury (Hg) is a pollutant naturally occurring in hydrocarbons. It can lead to dramatic effects within natural gas (NG) processing plants, catalyzing corrosion of aluminum equipment. Upstream Hg removal units are therefore necessary, but their implementation requires the knowledge of Hg concentration in NG. Once reaching the surface, part of the NG condensates, and Hg also partitions between the gas phase and the condensate. The prediction of the partition coefficients is notably difficult to assess. Although Hg in NG is exclusively Hg^0, other species are found in NG condensates (Hg^0, Hg^{II}, MeHg, suspended Hg). This suggests that the ability of the condensate to scavenge Hg depends on these chemical transformations that are poorly understood for now.

For a better understanding of these reactions, we monitored Hg speciation in NG condensates after exposure to a liquid Hg droplet (from one week to 6 months). This experiment was designed to simulate the transformations affecting the native Hg^0 in NG condensates. The analysis by SEC-ICP-MS allows the separation of the different Hg species according to their size. Comparison between sulfur and Hg chromatograms suggests that S is involved in the oxidation and complexation of Hg. Contrasting behaviors derive from the analysis of 20 distinct liquid hydrocarbons, pointing out the existence of different reactions affecting Hg speciation.

From our observation, we suggest that Hg^0 is first oxidized and bound to thiol ligands. Thiol-bound Hg^{II} is however only an intermediate product, as it subsequently precipitates. The nature of the precipitate still needs to be defined for a complete understanding of the Hg scavenging mechanisms by NG condensates.