Traceability for Mercury Measurements

PROJECT DETAILS

Funding Programme:
European Metrology Research Programme (EMRP)
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Joint Research Projects (JRP)
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PROJECT DESCRIPTION

The main human exposure to toxic organic forms of mercury (Hg) is consumption of higher trophic level fish, while usual exposure to Hg(0) is through inhalation (mostly related to occupational accidents). Several cases of inorganic mercury poisoning (e.g. the chemical industry and gold and mercury mines) have been reported; and recently, exposure of workers to dangerous mercury levels in a zinc manufacturing plant located in Asturias (Spain) has been considered the worst case of mercury poisoning in Europe in the last 20 years. The presence of high levels of mercury in the environment and the occasional accidental emissions of mercury in industry, cause important adverse health effects. Hence measurement of not only the total Hg level, but also the level of different Hg species in biological samples is required to evaluate mercury contamination in humans.

In workers exposed to mercury vapour, the evaluation of total mercury in blood is useful, but dietary methylmercury also contributes to the amount of mercury measured in blood. Due to its toxicokinetics, mercury in urine is a more appropriate indicator for longer exposures than blood, but some dietary methylmercury is also excreted in the urine. Hair can be used to estimate Hg exposure, however in the absence of mercury poisoning by Hg(0) in the fish eating population, methylmercury constitutes almost 100 % of the total Hg. Therefore, Hg speciation analysis in blood, urine and hair are better tools for the study of Hg intoxication routes than total Hg measurements.

The World Health Organisation (WHO) recommends a maximum weekly intake of methylmercury of 1.6 µg/kg body weight, while the United States Environmental Protection Agency uses a reference dose of 0.1 µg/kg body weight as an exposure without recognised adverse effects. However, in Europe there is no regulation for methylmercury, only for total Hg, although the European Water Framework Directive refers to "Hg and its compounds".

Studies on the isotopic fractionation of Hg species in humans contaminated as a consequence of environmental or occupational exposures may provide advances on our understanding of the impact of Hg and improve the field of traceability of mercury measurements.
The scientific and technical objectives of REG (UNIOVI) are:

- To develop multiple spiking Isotope Dilution Mass Spectrometry (IDMS) methodologies for determination of ethylmercury, methylmercury and inorganic mercury in human blood, urine and hair for both Gas Chromatography Inductively Coupled Plasma Mass Spectrometry (GC-ICP-MS) and Gas Chromatography/Tandem Mass Spectrometry (GC-MS/MS) instruments.

- To develop analytical methodologies to measure the species-specific isotopic composition of different Hg species in human blood, urine and hair by the hyphenation of Gas Chromatography with Multi Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS).

PROJECT PARTNERS

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