Research in Environmental Analytical Chemistry/Chemical Metrology/Speciation Analysis

PROJECT DETAILS

Funding Programme:
European Metrology Research Programme (EMRP)
Sub-Programme:
Joint Research Projects (JRP)
Funding Scheme:
Researchers Grants
Project Reference:
ENV08 WFD;
UE-12-ENV08-REG2
Project Duration:
41 Months (from 2012-09-01 to 2014-08-31)
Total Project Value:
€ 2.051.276'44
EU Grant-Aid:
€ 2.051.276'44
Funding to UniOvi:
€ 141.715'80

PROJECT DESCRIPTION

Chemical pollution of surface water presents a threat to the aquatic environment with effects such as acute and chronic toxicity to aquatic organisms, accumulation in the ecosystem and losses of habitats and biodiversity, as well as a threat to human health. As a matter of priority, causes of pollution should be identified and emissions should be dealt with at source, in the most economically and environmentally effective manner. The Water Framework Directive (WFD) 2000/60/EC of the European Parliament establishes a framework for Community action in the field of water policy, lays down a strategy against pollution of water and requires further specific measures for pollution control and environmental quality standards (EQS) for priority hazardous substances.

The most effective tool to implement the requirements of the WFD is the development and implementation of reference or primary measurement methods directly traceable to the International System of Units for the determination of the 33 priority substances listed in the Directive 2008/105/EC. Among them, Tributyltin (TBT) is the substance with the lowest annual average concentration (0.2 ng/L) and maximum allowable concentration (1.5 ng/L) in inland and surface waters.

In order to meet the WFD requirements, the development of a reference method with an Limit of Quantitation (LOQ) lower than 30% of the EQS (0.06 ng/L) with an uncertainty lower than 50% at the EQS level is required. Such low concentration levels are often below the instrumental detection limits offered by conventional mass spectrometric techniques widespread in European analytical laboratories such as Gas Chromatography–Mass Spectrometry (GC-MS).

Thus, the use of effective pre-concentration methods or more sophisticated instrumentation (such as the hyphenation of gas chromatography to an Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) instrument) is required. Nevertheless, even if the instrumental sensitivity provided by Gas Chromatography– Inductively Coupled Plasma-Mass Spectrometry (GC-ICP-MS) is adequate, the blank values of the method do not normally allow quantification at such a low levels.

Isotope dilution mass spectrometry (IDMS) is the most appropriate calibration technique to achieve the WFD requirements. The determination of TBT in water samples by IDMS requires the hyphenation of a chromatographic technique to a mass spectrometer. GC-ICP-MS systems are expensive and not widespread in European analytical laboratories. In contrast, GC-MS and GC-MS/MS systems are less expensive and widespread but they offer a lower instrumental sensitivity and a more complicated isotope ratio measurement procedure. Therefore in order to address this need REG(UNIOVI) will develop a reference method for the determination of TBT by IDMS with an LOQ lower than 30% of the EQS (0.06 ng/L) and with an uncertainty lower than 50% at the EQS level using GC-MS or GC-MS/MS instrumentation.

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