**Analysing Nanodisperse Material of Platinum Group Elements in the Environment Using Single Particle ICP-MS**

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The rising production and utilization of engineered nano-materials calls for the investigation of these products and their fate and behaviour in the environment. Furthermore, other nano-materials, which are not produced intentionally, may be released into the environment. Also these materials should attract our attention.

Inductively coupled plasma mass spectrometry (ICP-MS) provides the means to sensitively detect and to characterize nanodisperse materials, provided that they contain elements that are detectable by ICP-MS.

This special means are denoted as single particle ICP-MS (DEGUELDRE et al 2004).

Using a very short sampling timeranging from 50 microseconds to a few milliseconds (≤10ms), it is possible to record the signals of ion plums caused by single particles introduced into the ICP. The half width of these particle signals is in the range of 0.5 milliseconds.

The frequency of measured particle signals gives indication on the number density of the particles.

The measured intensity for such a particle signal can be evaluated in terms of quantity of material by calibration of the analytical system. Applying some additional assumptions (e.g. the material consists of spherical homogenous particles, density of the material is known) the size of the particles can be estimated.

By statistical analysis of a sufficient number of events size distribution of the particulate material can be established.

Particles do not behave like ions; if particles are diluted their signals do not become weaker – but only less frequent. Because of this, the single particle-ICP-MS is well suited to track particles even in high “dilution”, as it is often the case if they are disposed in the environment.

Single particle-ICP-MS was chosen to analyze sediments for the ocurrence of platinum group elements in nanodisperse form derived from vehicle catalyst exhaust.

For sample preparation the sediment samples were suspended in deionized water containing 1mg/L polyvinylpyrolidon and filtered by a membrane filter (Sartorius, Minisart 5.0µm) to remove coarse material. Analyses were carried out using the double focussing ICP-MS Element XR (Thermo).

The investigations showed the presence of a few disperse particles containing platinum, palladium as well as zirconium, all most frequent in a range of about 1 femtogram mass. Moreover, heavier aluminium containing particles of about 200 femtogram mass were detected, which are assumed to originate from the catalysts supporting material.

However, IPC-MS is not suited to derive information about the physical composition of this disperse materials. For this purposeother techniques have to be used such as electron microscopy.

This study shows that single particle-ICP-MS is a usefull tool for analysing nanodisperse materials in environmental samples.

Reference:

Degueldre, C., P.-Y. Favarger and C. Bitea (2004) Zirconia colloid analysis by single particle inductively coupled plasma–mass spectrometry. Anal. Chim. Acta 518, 137 - 142