

### O1 EAC3

## SPECIATION ANALYSIS OF THALLIUM BY SIZE EXCLUSION/ION EXCHANGE LIQUID CHROMATOGRAPHY INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

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Metallic pipes in drinking water (DW) distribution networks are able to retain some elements over time that may be subsequently released into the water. In September 2014, researchers from the Department of Earth Sciences (University of Pisa, Tuscany, Italy) reported the presence of thallium in water samples collected from *Pietrasanta* DW wells (*Lucca*, Tuscany, Italy) at concentrations (up to 10 µg/L) much higher than US-EPA max contaminant level goal (2.0 µg/L).

We have developed an innovative extraction procedure to determine the thallium water-soluble fraction retained by contaminated pipe core samples. The target fraction is solubilized in acetic acid solution by means of consecutive sonication treatments (at least, five) carried out after changing the aliquot of the extractant. In order to characterize the inorganic species solubilized in acetic acid, first we performed speciation analyses of Tl(I)/Tl(III) released by Tl<sub>2</sub>O<sub>3</sub> using anodic stripping voltammetry (polarography with a dropping mercury electrode (DME)). The main difficulty of speciation analysis of thallium lies in extremely low concentrations of Tl(III) in comparison to Tl(I), which is the dominating form of thallium in DW samples.

To confirm and optimize the trends obtained by voltammetry, in this study, an inductively coupled plasma mass spectrometer (ICP-MS) was used as a liquid chromatographic detector for the speciation analysis of thallium. Tl(I) and Tl(III) – diethylenetriamine pentaacetic acid (DTPA), were separated by using two separation mechanisms, anion exchange chromatography and size exclusion chromatography (SEC), with 10 mmol ammonium acetate as eluent.

From a solution of Tl<sub>2</sub>O<sub>3</sub>-DTPA, the effect of the concentration of the eluent, the pH of the solution and the Tl<sub>2</sub>O<sub>3</sub>-DTPA ratio on the retention times of Tl(I) and Tl(III) was evaluated. The chromatograms show good separation of the Tl peaks at each pH and hence for the differently charged Tl(III)–DTPA complexes. Therefore, whatever the charge, Tl(III) complexes do not co-elute with Tl(I) using SEC, because the molecular size is always greater than the Tl(I) ion, which clearly results in their earlier elution from the SEC column.

The proposed method enables the separation and determination of both Tl species. The method is fast, simple, accurate and interference-free.