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The use of tetrathiafulvalene to improve mercury determination in air borne particulate matter

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Recent studies emphasizing the harmful effect of mercury (Hg) on the environment have increased the demand for low level mercury analysis towards improvement of global Hg pollution control. Multi-elemental inductively coupled plasma mass spectrometry (ICP-MS) determination of Hg can lack accuracy due to low stability of Hg ions in solutions that are susceptible to adsorption/volatilization with negative or positive bias. In this study, sampling and analysis of airborne Hg in Singapore was carried out using our recently developed ICP-MS method. The determined mercury levels were compared against the pollutant standards index (PSI) from 17 October to 17 November 2018, during which the air quality in west Singapore showed small oscillations from 22-66 and good/moderate conditions. We observed an improvement in accuracy for mercury determination of up to 10 times along with proven selectivity of the method evident due to little to no lithium tetrathiafulvalene carboxylate (LiCTTF) influence on other trace elements (Figure 1). Improved stabilisation of mercury ions resulted in higher precision for ICP-MS measurements with RSD ranging from 1.07 to 4.36. Statistical analysis demonstrated the preservation ability of 10 g mL⁻¹ LiCTTF for both microwave digestion procedure and for external calibration using multi-elemental standard solutions with t-values of <1.5. The results obtained in this study emphasize the utility of LiCTTF in ICP-MS determination of mercury to prevent mercury losses, especially for the low-level mercury analysis required for environmental mercury pollution trend assessment.



Figure 1: Detection of up to 10 times higher concentrations of mercury with addition of tetrathiafulvalene aids.

Recent Publications

1. Budanović M, Khezri B, Lauw S J L, Tessensohn M E, Webster R D (2017) Tetrathiafulvalene aids in the atomic spectroscopic determination of total mercury. *Anal. Chim. Acta*, 992:24-33.

Biography

Maja Budanovic is a Doctoral Researcher at Nanyang Technological University in Singapore and because of her remarkable performance during her PhD study and excellent academic records, she was selected as an SINGA (Singapore International Graduate Award) ambassador for A*STAR Agency for Science, Technology and Research. Her research was awarded with the best poster award at the 6th International Conference on Environmental Chemistry and Engineering held during July 24-25, 2017 in Rome, Italy. She has completed her Master's degree in Analytical and Physical Chemistry and Bachelor's Degree in Chemistry from the University of Zagreb.

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