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Author(s)	Yau, HPM; Chan, WT
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Preconcentration of Trace Metal Ions Using Freshwater Algae for Inductively Coupled Plasma – Mass Spectrometry

M. H. P. Yau, W. T. Chan

Department of Chemistry, The University of Hong Kong, Pokfulam Road, Hong Kong SAR, China

E-mail: mhpyau@hkucc.hku.hk, wtchan@hku.hk

A novel analyte-preconcentration method for the inductively coupled plasma – mass spectrometry (ICP-MS) has been developed in our previous study [1]. Analyte ions adsorbed on nanoparticles in sample solution were detected as current spikes in the mass spectrometer. The sample modulation method improves the ICP-MS detection limits by at least one order of magnitude.

Fe(OH)₃ particles [1] and carbon nanotube (CNT) [2] have been used successfully to spatially preconcentrate part-per-trillion levels of Ba²⁺, Cd²⁺ and Co²⁺ ions from aqueous sample solutions. In this study, a unicellular green algae *Chlorella vulgaris* was used as the adsorbent. Algae has high metal loading capacity and great selectivity for transition and heavy metals [3]. In our preliminary study, ICP-MS spikes were readily observed for trace metal ions of part-per-billion (ppb) level (Figure 1). Spikes were not observed for the corresponding standard solution. The effects of experimental conditions of analyte preconcentration (equilibration time, temperature, and solution pH) and ICP-MS operating parameters (sampling depth and carrier gas flow rate) on the analytical performance of the new method will be presented.

In addition, time-resolved inductively coupled plasma-atomic emission spectrometry (ICP-AES) was used to investigate the vaporization process of the analyte-adsorbent particles in the ICP. The details of the experiment set-up and signal characteristics will be discussed.

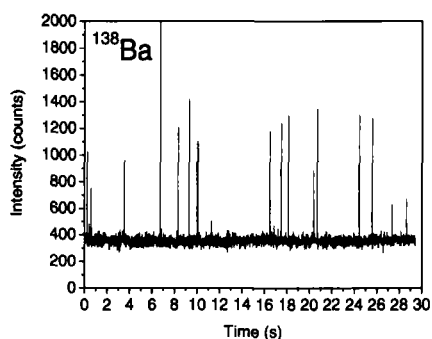


Fig. 1 Time-resolved ICP-MS temporal profile of Ba – *Chlorella vulgaris* mixture at pH 6.

References

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