

## ***Efficient generation of volatile cadmium species using Ti(III) and Ti(IV) and application to determination of cadmium by cold vapor generation inductively coupled plasma by mass spectrometry (CVG-ICP-MS).***

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### ***Abstract***

A chemical vapor generation (CVG) method is developed for determination of cadmium (Cd) by ICP-MS. Titanium (III) and titanium (IV) were utilized for the first time as novel additives to enhance generation of volatile Cd species, and their synergistic effects were investigated for thiourea, L-cysteine and potassium cyanide (KCN) with different mineral acids. Both Ti (III) and Ti (IV) provided the highest enhancement with KCN. The improvement with thiourea was marginal (ca. 2-fold), while L-cysteine boosted signals slightly only with Ti (III) in H<sub>2</sub> SO<sub>4</sub>. Optimum CVG conditions were 4% HCl + 0.03 M Ti(III) + 0.16 M KCN and 2% HNO<sub>3</sub> + 0.03 M Ti(IV) + 0.16 M KCN. A 3% (m/v) NaBH<sub>4</sub> solution was adequate for successful vapor generation. Under these conditions, sensitivity was enhanced 40-fold with Ti(III) and 35-fold with Ti(IV), that are the highest enhancement factors achieved so far in Cd vapor generation. Detection limits (3s) were 3.2 and 6.4 ng L<sup>-1</sup> for <sup>111</sup>Cd isotope using Ti(III) and Ti(IV), respectively. Evidence indicated that Ti (III) and Ti(IV) enhanced Cd vapor generation catalytically. Effects of transition metal ions, including Co(II), Cr(III), Cu(II), Fe(III), Mn(II), Ni(II) and Zn(II) were not significant up to 1.0 µg mL<sup>-1</sup>. Among hydride forming elements, Bi, Pb, Sb and Sn depressed signals above 0.1 µg mL<sup>-1</sup>. No interferences were observed from As(III) and Se(IV). The method was validated with determination of Cd by CVG-ICP-MS in certified reference materials, including Nearshore seawater (CASS-4), Bone ash (SRM 1400), Dogfish liver (DOLT-4), Mussel tissue (SRM 2976) and Domestic Sludge (SRM 2781).

### ***Biography:***

Zikri Arslan received his PhD in 2000 from the University of Massachusetts at Amherst in analytical chemistry with an emphasis on applied plasma source mass spectrometry. He was a National Research Council (NRC) post-doctoral scholar between 2000 and 2002; worked at NOAA/NEFSC Howard Marine Sciences Laboratory in Sandy Hook, NJ. He also worked as research scientist (2002-2003) at the University of Maryland, Chesapeake Biological Laboratory on otolith micromilling protocols for identification of bluefin tuna stocks. His research interests span from nanoparticle detection to analytical method development involving plasma spectrometry. He published more than 50 papers, served as guest editor and reviewer for major analytical and environmental chemistry journals.

### ***Speaker Publications:***

1. "Efficient generation of volatile cadmium species using Ti(III) and Ti(IV) and application to determination of cadmium by cold vapor generation inductively coupled plasma by mass spectrometry (CVG-ICP-MS)"; Journal of R&D. / 2020 / 8(8) /pp 2311-3278

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