Study on the direct introduction of solvent condensed mainstream smoke for trace elements analysis by inductively coupled plasma mass spectrometry with an octopole reaction cell

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In conventional element analysis, samples of various types are usually prepared or digested and then introduced as solutions to a plasma by a nebulizer. However sample digestion is a tedious, labor-intensive and time-consuming process, and there is a risk of analyte loss and contamination that may occur during sample preparation. The analysis of the trace elements in smoke is not exceptional. Tobacco smoke is composed of around 4,800 compounds, and there are difficulties in the ultratrace analysis of the metallic elements out of various compounds due to he complicated pretreatment. Diverse analytical methods for the metallic elements in mainstream smoke have been presented by specialized institutes in foreign countries, but the outcomes are not coherent.

This study is conducted through gathering the smoke in isopropyl alcohol (IPA) solutions and injecting it into ICP-MS with the collision reaction cell in order to minimize the preprocesses for the ultratrace analysis of metallic elements of the smoke. The collision and cell techniques help to eliminate spectral interference occurring in the midst of injecting the solvent and reducing remarkably the poly-atomic interference caused by Ca, P, Na, K, C, S, Ar and Cl. The sample used for this analysis is the reference cigarette 2R4F. The concentrated sample in the pure IPA solutions is diluted with 10 times with ultra-pure water of 18.2

$M\Omega cm^{-1}$.Major and minor elements of particulate phase gathered by EP (Electrostatic Precipitator)and of gas phase gathered by impinger are confirmed by the semi-quantitative method respectively. In addition, the elements of Hoffmann's List including As, Se, Cr, Ni, Pb and Cd are quantified. This new analytical method shows some advantages such as saving time for digestion, saving solvent for extraction, improvement of reproducibility. The precision of measurement was excellent with %RSD values typically less than 5% for the majority of elements, despite the complex matrix. The recovery was in the range of 85~120%.