Low-Pressure Detection of Methylmercury and Inorganic Mercury using the SC-DX chrom*FAST* system with ICPMS Detection

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Introduction

Mercury (Hg) exists in the environment in several forms, all of which are toxic to humans to some degree. Obtaining precise, timely measurements of Hg in environmental samples—especially methylmercury (MeHg) in water samples—is essential to monitoring potential toxicity issues. However, detecting trace amounts of the element is an obstacle that can prevent accurate analysis of Hg and MeHg levels.

The chrom*FAST* system by Elemental Scientific, coupled with the SC-DX *FAST* automated sampling system, is an economical and easy-to-use system that operates using a peristaltic pump for low-pressure speciation. With chrom*FAST*, Hg and MeHg can be detected in a sample at sub-ppt concentrations.

The SC-2 DX *FAST* Low-Pressure Elemental Speciation System

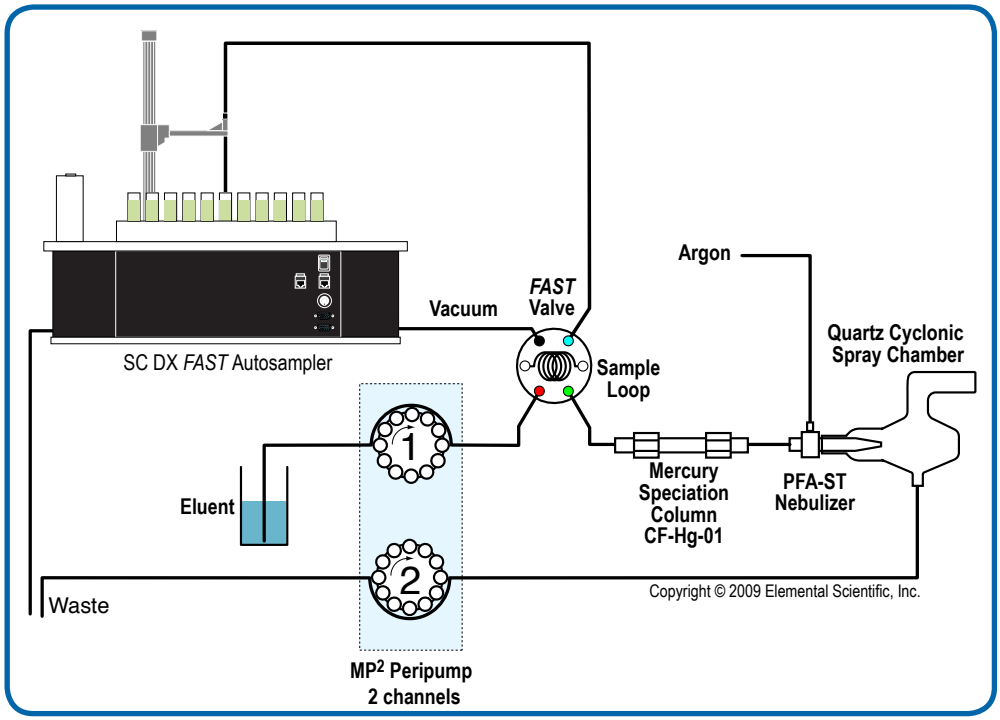

Figure 1. A diagram of the addition of a chrom*FAST* speciation column to an existing SC-DX *FAST* system for separation of mercury species by isocratic elution.

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Instrumentation, Sample Introduction, and ICPMS Parameters

- ESI chrom*FAST* speciation kit (CF-KIT MeHg)
- ESI MP² micro peripump
- periSPEC software
- ICPMS detection

Procedure

Samples and standards were automatically loaded into the *FAST* valve sample loop and injected onto the Hg speciation column. The Hg species were separated on the column using isocratic elution and nebulized using a low dead volume PFA-LC nebulizer.

Data Analysis

The collected data were analyzed with the ESI peri*SPEC* Peak Area Finder software. This simple and relatively-inexpensive software utilizes an Excel-based spreadsheet to integrate the chromatographic peak areas. The resulting data can then be used for calibration and determination of Hg species.

Calibration and Separation Studies

Standards of Hg and MeHg were used to perform both calibration and separation studies. Species separation was obtained by using an isocratic elution. With this single-phase elution, the species are eluted in the following order: Hg, MeHg.

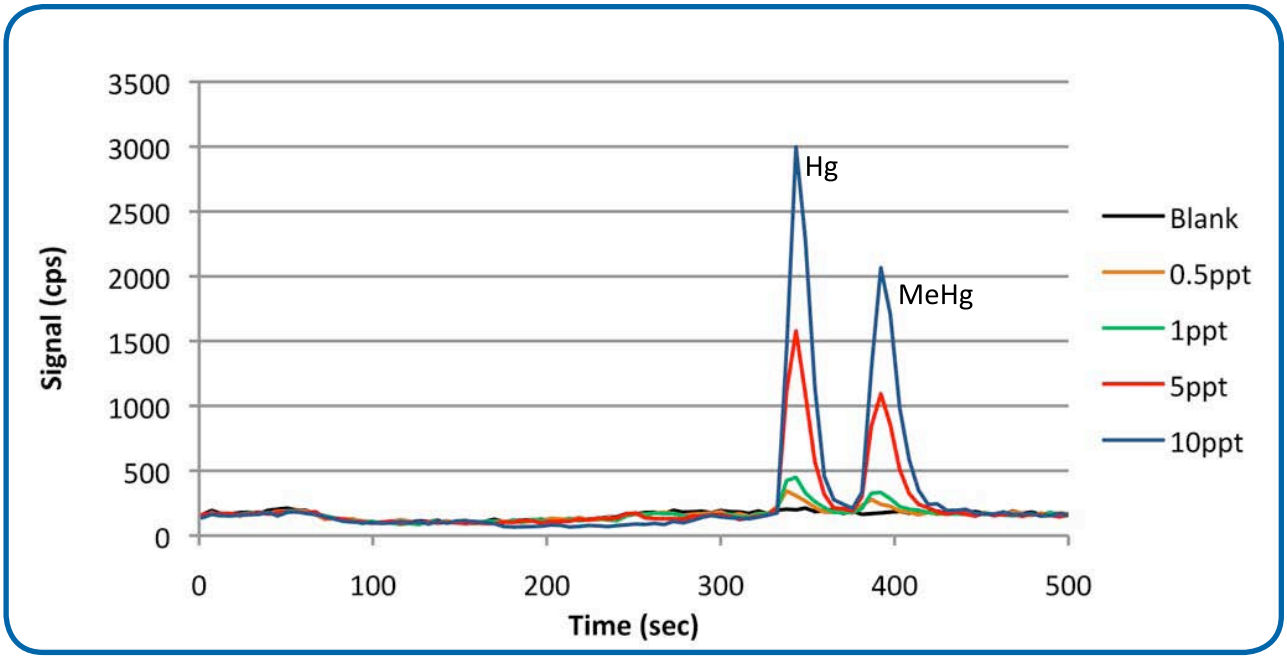
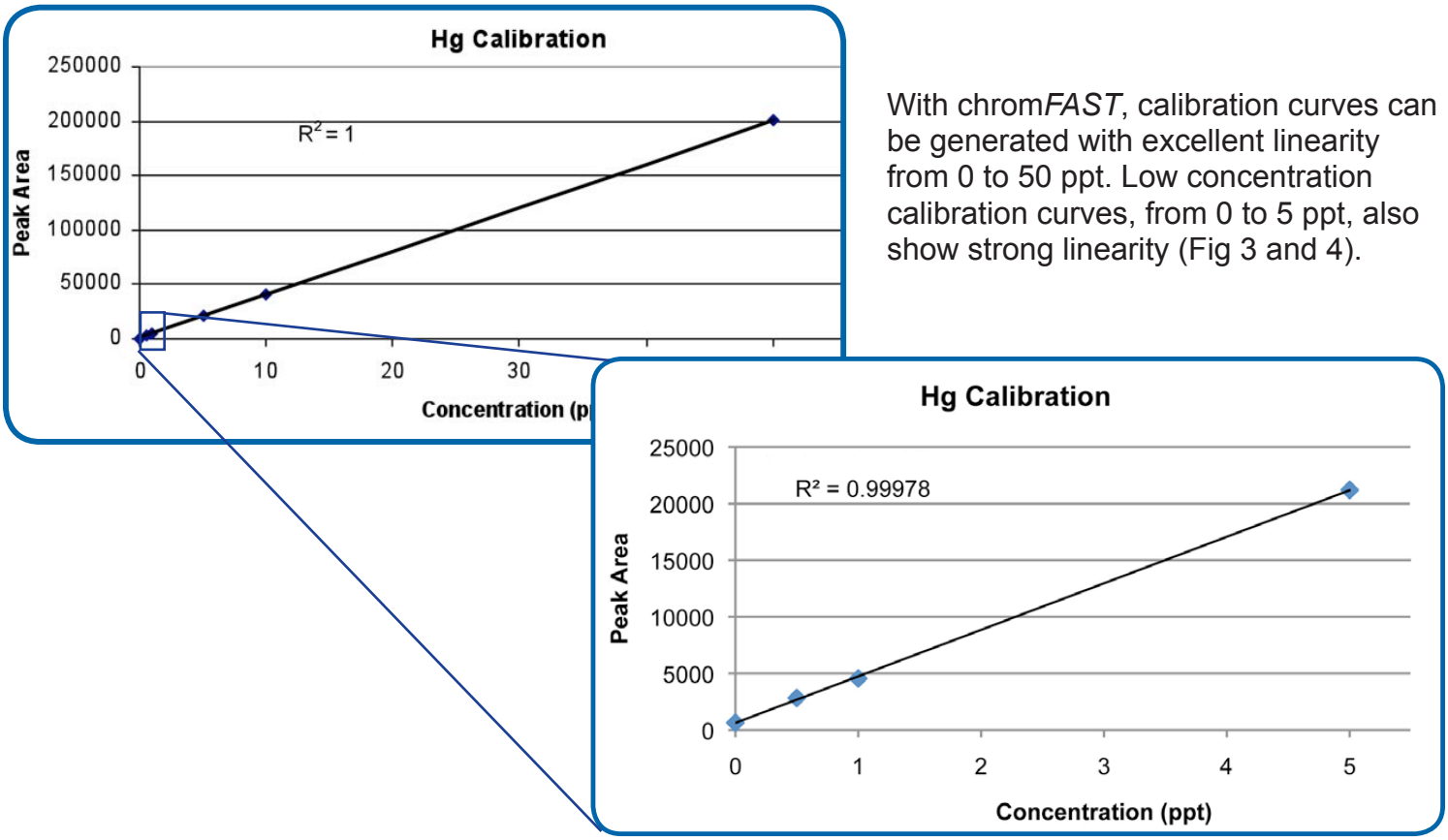


Figure 2. Calibration chromatographs for Hg and MeHg.



With chrom*FAST*, calibration curves can be generated with excellent linearity from 0 to 50 ppt. Low concentration calibration curves, from 0 to 5 ppt, also show strong linearity (Fig 3 and 4).

Figure 3. Hg calibration curves for 0 to 50 ppt (top) and 0 to 5 ppt (bottom).

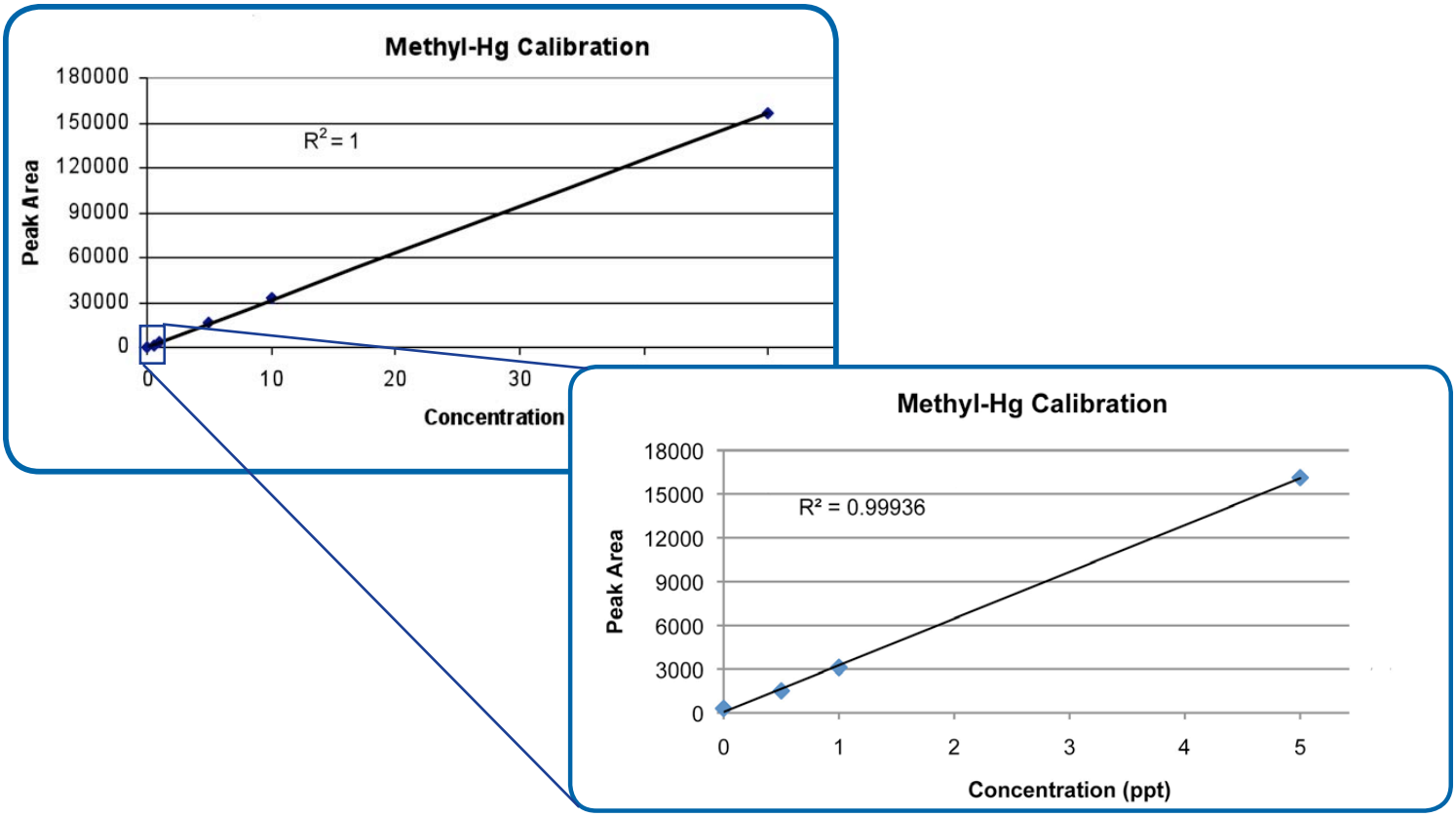


Figure 4. MeHg calibration curves for 0 to 50 ppt (top) and 0 to 5 ppt (bottom).

Conclusion

chrom*FAST* and SC-DX *FAST* systems achieve detection of ppq levels of MeHg and Hg using low-pressure speciation ideally suited to ICPMS applications. The highly-flexible system allows switching between multi-element ICPMS sample analysis to elemental speciation detection modes within minutes. The unique peri*SPEC* peak finder software provides a straightforward method for data analysis, while the robust, long-life speciation column can be used for multiple samples and efficiently separates Hg species providing a cost-effective solution for speciation needs.

Table 1. Detection Limits

Species	Detection Limit (ppt)
Hg	0.05
MeHg	0.1

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