Investigation Into the Interference of ^{121}Sb and ^{123}Sb Measurements Using Inductively Coupled Plasma – Mass Spectrometry in a Mixed Acid Matrix

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Introduction

Measurements of mercury (Hg) and a suite of 50 trace elements in rainwater were made in Pensacola from 2005-2011 in order to determine the contribution that regional coal-fired power plants have on local Hg deposition using Hg-trace metal ratios. Antimony (Sb) is released into the environment primarily through anthropogenic activity like coal-combustion, serving as a tracer of its long-range effects [1, 2]. Although the concentration of Sb in the environment is low, it can pose an occupational hazard for those working in industries processing Sb, causing rashes and respiratory effects.

Measurements of ^{121}Sb and ^{123}Sb were complicated by consistent over-recovery of the National Institute of Standards and Technology (NIST) 1643e trace metal standard, indicating an interference in the mass-charge spectrum occupied by ^{121}Sb and ^{123}Sb. An experiment was therefore done to determine if strontium (Sr) was combining with chlorine (Cl) in solution to form $SrCl_2$ and interfering with the Sb measurements.

Experimental

Two sets of Sr standards with identical concentrations ranging from 0.1 – 100 µg/L were analyzed on the Agilent 7500cs Inductively Coupled Plasma – Mass Spectrometer (ICP-MS) at the National High Magnetic Field Laboratory (NHMFL). One set of standards was made in a 0.308M HNO_3 acid matrix solution while the other was made in a 0.045M HCl and 0.048M HNO_3 mixed acid matrix. Measurements were made for ^{121}Sb and ^{123}Sb in each standard to determine if high Sr concentrations and/or Cl^- ions caused interference on either Sb isotope.

Results and Discussion

As shown in Fig. 1, Sb measurements for both isotopes in the mixed acid matrix generated somewhat higher counts per second (cps) than in the 0.308M HNO_3 matrix, suggesting a slight, but negligible interference from $SrCl_2$. Average values for ^{121}Sb in 0.308M HNO_3 and the mixed acid matrix were 847 ± 21 cps and 1006 ± 44 cps, respectively. Also, the cps for both isotopes gave similar values across all Sr standard concentrations relative to their respective matrix blank solutions, indicating that increasing concentrations of Sr or higher Sr-Sb ratios do not contribute to the interference of Sb measurements.

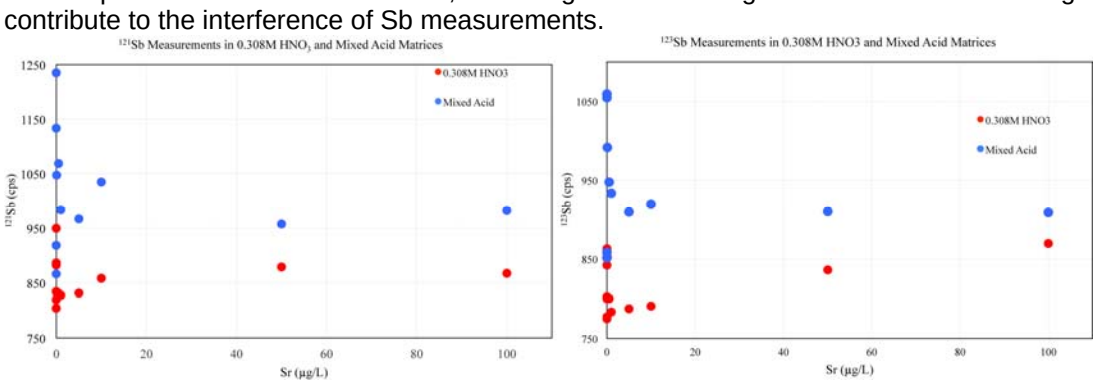

Fig. 1 Measurements of ^{121}Sb (left) and ^{123}Sb (right) in both 0.308M HNO_3 and mixed acid matrices.

Conclusions

The tests confirmed that interference of ^{121}Sb and ^{123}Sb measurements using ICP-MS was not due to $SrCl_2$, thus leaving this issue unresolved.

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References

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