EVALUATING EDXRF MEASUREMENTS OF ATMOSPHERIC AEROSOLS WITH MULTI-ELEMENTAL REFERENCE MATERIALS

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XRF analyzers used to measure loadings of aerosols deposited on filters are generally calibrated using single element/compound standards. The material and loadings of those standards do not resemble the typical ambient air aerosol composition and filter material. In this study, we generated multi-element reference materials (RMs) mimicking ambient air composition. These RMs have the potential to fill a gap in the currently available XRF quality assurance resources by providing known loadings in the range of interest for atmospheric aerosol measurements.

The RMs were prepared by aerosolizing a solution containing 28 elements, drying and mixing the aerosols into a chamber, and then sampling from the chamber onto 47 mm PTFE filters using a Partisol 2025i sampler (Thermo Inc, USA). Different filter loadings simulating different atmospheric concentrations were produced by varying the sampling duration. The source solutions were prepared in two compositions. Elemental proportions in the first solution were chosen to reflect median elemental concentrations observed in the IMPROVE (Interagency Monitoring of PROtected Visual Environments) network. The concentrations of trace elements were increased in the second solution to yield loadings higher than 3 times of typical detection limits for IMPROVE network. A subset of the RMs produced was analyzed by ICP-MS after EDXRF (Panalytical Epsilon 5, Netherlands). The reference loadings of elements were assigned assuming the measurement of K is accurate and the elemental ratios in the solution are preserved on the deposited samples. For the majority of the elements, EDXRF measured loadings were within 20% of the reference values and ICP-MS results were consistent with EDXRF.

An inter-lab comparison study with 9 XRF and 3 ICP-MS labs was conducted. RMs at 6 different loadings of the two source compositions above were sent to each lab. The methodology of ISO 13528\(^1\) was applied to evaluate the results. The labs reported loadings within 20% of the reference loadings with few exceptions. Results from individual labs remained within 3 times the standard deviation of average loadings from all labs with few exceptions. We conclude that multi-element RMs can successfully be generated to check the quality of XRF analysis.

Figure1. The Fe slopes from different laboratories vs. reference loadings.