Element Mass Concentrations in Ambient Aerosols, a Comparison of Results from Filter Sampling / ICP-MS and Cascade Impactor Sampling / Mobile Total Reflection X-ray Fluorescence Spectroscopy

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Quantitative chemical analysis of airborne particulate matter (PM) is vital for the understanding of health effects in indoor and outdoor environments and required by EU air quality regulations. Typically, airborne particles are sampled on filters, followed by lab-based analysis, e.g., with inductively coupled plasma mass spectrometry (ICP-MS). Within the EURAMET EMPIR AEROMET project [1,2], cascade impactor aerosol sampling was combined with on-site total reflection X-ray fluorescence (TXRF) spectroscopy. The study aimed at a proof of principles for this new mobile and on-size tool for the quantification of aerosol element compositions and element mass concentrations within short time intervals of less than 12 h. In a field campaign the method's technical feasibility could be demonstrated [3]. The TXRF results were traced back to a stationary, reference-free XRS setup in the laboratory of the German national metrology institute PTB at the BESSY II electron storage ring in Berlin, Germany. Simultaneous PM10-filter sampling, followed by standardized lab-based analysis, allowed for a comparison of the field campaign data of both methods. As Fig. 1 shows, the correspondence between PM10 filter sampling and ICP-MS, and on the other hand, cascade impactor sampling and TXRF is quite encouraging. However, for some of the analysed elements, e.g. V and Pb, the observed deviations are higher than expected and this highlights the fact, that spectral deconvolution strategies for TXRF on cascade impactor samples still need some improvement.

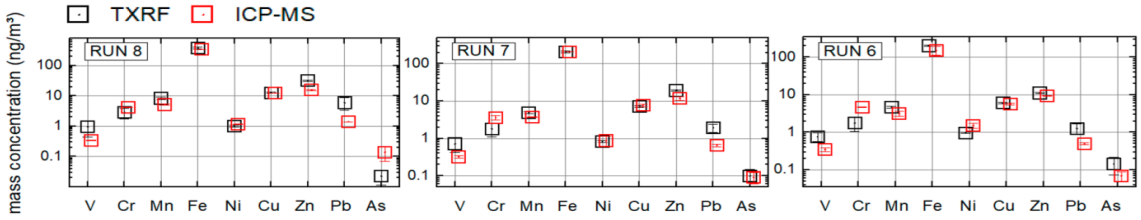

Figure 1. Comparison of element mass concentrations in the PM10 fraction during three runs of a field campaign. Absolute errors determined by respective spectroscopy software.

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References

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