**Comparison of Online and Offline XRF Techniques for Atmospheric PM10 Measurement**

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The negative impact of atmospheric particulate matter (PM) on human health has driven research toward its chemical and elemental characterization, essential for identifying pollution sources [1].

Energy dispersive X-ray fluorescence (ED-XRF) is widely used for elemental analysis of PM due to its non-destructive nature and lack of sample pre-treatment. While typically applied to Teflon filters, quartz filters are often preferred in monitoring campaigns, as they support additional analyses (e.g., organic and elemental carbon, water-soluble species) and are easier to subdivide. Recent studies confirm the reliability of quartz filters for ED-XRF analysis [2].

This study compares elemental data from two ED-XRF systems: an online instrument (Xact® 625i) using Teflon tape, and an offline benchtop ED-XRF (XEPOS05, Spectro) analyzing quartz filters. The Xact® 625i, operating at the Environmental-Climate Observatory (ECO, part of the ACTRIS network), provides near real-time elemental composition data with a 3-hour resolution. It collects PM₁₀ at 16.7 L/min and analyzes samples directly, delivering results within approximately 6 hours. It is also equipped with a meteorological station, enabling potential correlation between meteorological parameters and elemental concentrations for source apportionment.

Simultaneously, daily offline sampling is performed at ECO using a dual-channel SWAM sampler (Fai Instruments, 2.3 m³ h⁻¹), which also provides mass concentration via β-attenuation [3]. Filters collected on quartz are analyzed for elemental composition using the benchtop ED-XRF system.

Daily-averaged Xact measurements will be compared to corresponding offline data to validate the online system. While the benchtop ED-XRF is well-established, the online system offers continuous, faster data access—avoiding delays due to filter handling and analysis.

Additionally, we present the first high-time-resolution elemental data series from ECO, focusing on tracers of sources such as African dust, biomass burning, road traffic, and fireworks.

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