PIXE Characterization of Atmospheric Aerosols Emitted from Construction Works at The University of Jordan

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ABSTRACT

Particle-induced X-ray emission (PIXE) was employed to evaluate the atmospheric impact of construction work on the air quality at the campus of the University of Jordan. Fine particulate matter (PM2.5) aerosol samples were collected during three sampling stages: “No Construction”, “Pouring Concrete”, and “Bleaching”. Gravimetric and reflectance measurements were performed in order to calculate mass and black carbon cencentrations, respectively. Elemental characterization was obtained by PIXE analysis and twenty three elements (Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Br, Rb, Sr, Zr, Ba, and Pb) were detected. It was observed that the concentrations of anthropogenic elements decreased during construction stages compared with their values before construction, while soil-related elements were more abundant during construction stages. In particular, sulfar was found to be the dominating element before construction, whereas calcium was the main aerosol component during construction stages.

To account for the fingerprint of the potential air pollutants accompanied with natural and anthropogenic sources, source apportionment study was performed using positive matrix factorization (PMF) modeling. The model predicted six factors representing the potential pollution sources: heavy oil combustion, soil, city dust, automobile, salt, and chlorine. The soil, city dust, and heavy oil combustion were the dominant sources during the sampling stages. The predicted PM2.5 concentrations agreed well with the experimental measurements.