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# Investigation of aerosol trace element concentrations nearby Algiers for environmental monitoring using instrumental neutron activation analysis

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abstract

The aim of this study was to enhance the use of instrumental neutron activation analysis (INAA) for long-term monitoring of air pollution and to identify critical sources of air pollution. For the collection of total suspended particulate matter (TSP), a filter unit low volume sampler (LVS) was employed. One hundred and seventeen samples were collected during 2010, 2011, and 2012, both on weekdays and weekends at a monitoring station located in Draria city, a suburban site near Algiers, Algeria. The concentrations of 25 trace elements (As, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Eu, Fe, Gd, Hf, K, La, Mn, Mo, Na, Sb, Sc, Se, Sm, Sr, V, and Zn) were determined by INAA using short and long neutron irradiation technique. Generally lower concentration values were observed during the weekends compared to the weekdays for almost all elements. The mean TSP concentration (34.8 μg/m$^3$) showed a seasonal pattern with higher levels during summer. The weekday/weekend ratio of TSP was 1.3 higher during summer than in winter. The concentrations of the elements Sb, Se, and Cd are found to be highly enriched in atmospheric particulate matter. According to their high enrichment factors (EFs), it was possible to establish that these elements are of anthropogenic origin coming from automobile exhausts which is the main source of emission in this area. The typical suburban background TSP and trace element levels were compared with literature data from other regions around the world, and were lower than those reported in an urban site in Algiers in a previous study. Significant correlations between elements were found (Pearson's coefficients N0.5) suggesting that the contaminant trace elements may be discharged from the same sources.



## 1. Introduction

The abnormal levels of trace elements in the atmosphere are potential health hazards and hence trace element monitoring is an important aspect of atmospheric pollution studies (Almeida et al., 2011a). The distribution of trace elements in the environment at different geographical regions has been reported by many authors (i.e, Stortini et al., 2009; Jong-Myoung et al., 2010; Burt et al., 2011; Contini et al., 2012; Calvo et al., 2013; Feng et al., 2013). However, there is no recent information on trace element pollution in urban and suburban areas in Algiers. Limited data available shows that like all other major cities in the world, the capital city Algiers is also confronted with severe air pollution problems. Vehicle emissions are one of the major sources of air pollution in Algiers. Of special concerns are diesel-powered vehicles that emit a complex mixture of toxic gaseous pollutants and particulate matter (PM). Diesel vehicles contribute significantly to the particulate air pollution burden, especially in Algiers city (Oucher and Kerbachi, 2012; Belamri et al., 2009). In other regions in North Africa, very little data for the study of the total suspended particulate (TSP) and any other particulate matter (PM) fractions are collected. In Morocco, some preliminary studies on air pollution are reported (El Khoukhi et al., 2004; Bounouira et al., 2014); however, the data collected are insufficient to draw conclusion on the air quality in the study areas.

Instrumental neutron activation analysis (INAA) is an established technique used for the measurement of trace element levels in various matrices. INAA involves the neutron activation of the different trace elements in the sample and measuring the radioactivity of each radioisotope formed in order to measure the individual concentrations of the trace elements (Henderson and Pankhurst, 1984). INAA facilitates non-destructive analysis of trace elements in samples of different matrices (Tian, 2000; Lei et al., 2002) especially of environmental origin (Gallorini et al., 1999). Certified reference materials (CRMs) are used for estimation of the concentration of different trace elements in the

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