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# Magnitude of Air Pollution by Heavy Metals Associated with Aerosols Particles in Algiers

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**Abstract**

This study evaluated for the first time in Algeria the pollution levels reached by different size distribution of aerosol particles and heavy metals associated with them in a site influenced by the emissions of the road traffic in Algiers. The analysis of heavy metals Fe, Pb, Cu, Mn, Ni, Co and Cd transported by the aerosol particles shows that heavy metals are enriched in varying degrees in the different size distributions. The Pb and Cd and to a lesser degree the Ni and Co are more abundant in the PM-1. The Pb, for example shows a mass fraction of 0.58% in the PM-1, whereas this is only up to 0.40% in the PM-10. Conversely, Fe, Mn and Cu are enriched in the PM-10 than in the PM-1. In order to check in which extent some heavy metals present correlations between them, we compared the levels of heavy metals in pairs in size distribution PM-10, PM-3 and PM-1.These results confirm the data on the enrichment of Pb and Cd in the fraction of very fine particles and the predominant presence of Fe and Mn in coarse particles. Similar to the case of PM-10, we determined the median aerodynamic diameter $d_{50}$ of both heavy metals Fe and Pb, respectively representative of natural sources and entropy sources (road traffic). The differences in the sizes of metal particles and differences of origin or source can also be visualized by the curves of modal distribution. Distribution curves obtained both for Fe than for Pb are of the mono-modal type.



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## 1. Introduction

Transportation activities contribute significantly to air pollution by particles matter [1, 2, 3, 4]. In urban areas, traffic is in fact one of the main emission sources of fine particles [5, 6, 7, 8, 9, 10, 11]. These fine particles carry mainly unburned carbon and cores from the combustion process, secondary particles resulting from the conversion gas / particle, mineral elements associated with soil erosion and re-suspension of deposited particles and various metals toxic heavy such as Pb, Cu, Ni, Cr, etc. which may play an important role in the toxicity of the aerosol [12, 13, 14, 15]. In Algeria, the growth of the fleet-induced socio-economic development and rapid urbanization has led to the emergence in the urban population of chronic diseases related to the deteriorating air quality. Recent studies have shown that the Greater Algiers is, like any large urban area, faces severe air pollution [16, 17, 18]. The main source of emissions is traffic. However, for deploping a prevention strategy, it is necessary to have data on levels and types of pollution and the compounds it contains. Thus, heavy metals Fe, Pb, Cu, Ni, Mn, Co and Cd associated with fine particles matter PM-10, PM-2.5 and PM-1 and their contribution to global pollution have been studied in Algiers.

**Nomenclature**

| | |
|---|---|
| PM | Particles Matter |
| PM-10 | inhalable particles |
| PM-2.5 | alveolar particles |
| PM-1 | very fine particles |
| NR | National Road |
| HVS | High Volume Sampler |
| AAS | Atomic Absorption Spectrometry |
| WHO | World Health Organization |
| $D_{50}$ | median diameter |

## 2. Methodology

The chosen site for the study is classified in the category of sites such as "traffic station" also called "local site". The daily measures were carried out at the National Polytechnic School at about 10 km from the center of Algiers. The sampling station is located at an altitude of 4m and 9m from the edge of the NR n°5. In 2000, the major highway was taken by over 25,000 vehicles per day with approximately 15% of buses and heavy diesel vehicles [19]. This site is characterized by the absence of obstacles and good natural ventilation.

For the measures by size distribution, a High Volume Sampler, the HVS-PM-10 equipped of cascade impactor Sierra-Andersen with four floors was used, those four floors offer access to the 5 size classes: 10 to 7 µm, 7 to 3 µm, 3 to 1.5 µm, 1.5 to 1 µm and below 1 µm (PM-10, PM-7, PM-3, PM-1.5 and PM-1) [20]. The flow rate is set at $1m^3$/mn. The sampling time is 24 hours.

The heavy metals Fe, Pb, Cu, Ni, Mn, Co and Cd, which have a significant health impact, are then analyzed by Atomic Absorption Spectrometry (AAS) with an air / acetylene flame.