

Assessment of some atmospheric heavy metals in selected sites within Baghdad city

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To cite this article:

Al-Obaidy, A.H.M.J.; Hamza, N.H.; Shakir, E.; Al-Mashhady, A.A.M. Assessment of Some Atmospheric Heavy Metals in Selected Sites within Baghdad City. *Mesop. environ. j.*, 2016, Vol. 2, No.3, pp.42-46.

Received Date: 17/2/2016,

Accepted Date: 1/4/2016,

Publishing Date: 15/5/2016

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Abstract

Atmospheric wet depositions have distinct characteristics in terms of associated pollutant types and influential parameters. This paper discusses the concentration of some heavy metals (Pb, Cd and Ni) in selected urban areas for wet depositions. Wet deposition samples, which are represented as rainwater collected from October 2013 through April 2014. The results indicated that industrial area exhibits the higher mean concentrations of Cd, Ni and Pb. Overall results imply that important anthropogenic sources are likely the most sources of heavy metals in this region.

Keywords; Heavy metal, Wet deposition, Residential area, Industrial area.

Introduction

Atmospheric deposition may be especially important as a source of pollutants to rainwater in urban areas because significant quantities of heavy metals and other pollutants are emitted into the atmosphere daily [1,2], and the ultimate fate of the heavy metals in particular is unknown.

Heavy metal were play important roles in human health, While some trace elements including copper, selenium, zinc, etc., are necessary for life, some of them like arsenic, and lead are hazardous for man [3,4,5]. The determination of the levels of heavy metals in the different environmental samples, including natural waters, geological and biological samples, dusts, soils, sediments, etc. [6,7,8]. It is continuously performed by researchers, in order to monitor heavy metal pollution in the environment. People have their most serious exposures to heavy metals in the environment by inhaling airborne particles, ingesting heavy metals dissolved in food and in water and from contaminated dust, sediment, and soil, etc. [9,10,11,12].

Heavy metals are emitted into the atmosphere due to industrial, motor transport and volcanic activities, soil erosion, forest fires, evaporation, etc. [13].

Most of heavy metals are soluble in water, thus they can migrate in ecosystems by water pathways. Even small amounts and low concentrations of heavy metals can damage ecosystems and are dangerous for human health [14,15]. Therefore, it is important to know the amount and trends of deposit toxic compounds on the Earth's surface.

This present study aimed to assess some heavy metal concentrations in the atmospheric wet deposition in the selected urban areas within Baghdad city.

Materials and Methods

Study Area

Baghdad is the capital of the Iraq, as well as the coterminous Baghdad Province. The population of Baghdad, as of 2011, is approximately 7,216,040, making it the largest city in Iraq. The city includes 457 sectors. Located along the Tigris River, which divided into two main parts: the eastern side (Rusafa) and the western side (Karkh). The area is characterized by arid to semiarid climate with dry, hot summers and cold winters; the mean annual rainfall is about 151.8 mm (Figure1).

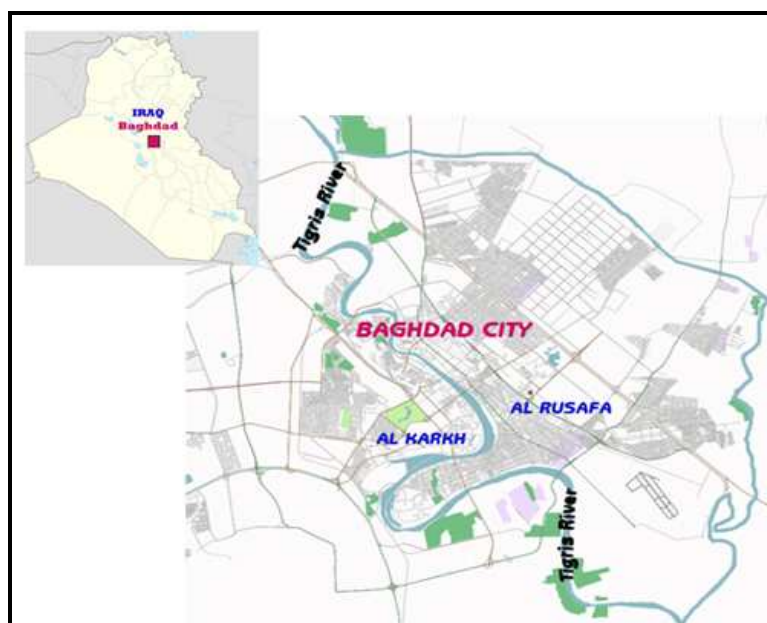


Fig. 1: Map of Rusafa and Karkh Sides of Baghdad City in Iraq

Sampling and Analysis

The examination for three some metals: Cadmium (Cd), Nickel (Ni) and Lead (Pb), covered three types of urban areas (Residential, Commercial and Industrial areas) in Rusafa and Karkh Sides within Baghdad city. Wet deposition samples, which are represented as rainwater collected from October 2013 through April 2014. After the collection, samples were digested and determined heavy metals Cd, Ni, and Pb by Atomic Absorption Spectrophotometer (AA-6300) according to Standard methods [16].

Results and Discussion

Descriptive statistics of heavy metal concentrations in the urban areas are summarized in (Table 1). The concentrations of Cd varied from 0.0009–0.044 mg/L, with a higher mean value (0.0223 mg/L) observed in the industrial area. Cd is released as a combustion product in the accumulators of motor vehicles or in carburetors [17,18].

Table 1: Descriptive statistics of HM concentrations in the Residential, Commercial and industrial areas

Residential area	Minimum	Maximum	Mean	Std. Deviation
Cd, mg/L	0.01	0.02	0.0146	±0.005
Ni, mg/L	0.03	0.12	0.0744	±0.029
Pb, mg/L	0.07	0.25	0.1904	±0.042
Commercial area	Minimum	Maximum	Mean	Std. Deviation
Cd, mg/L	0.0009	0.044	0.0179	±0.015
Ni, mg/L	0.04	0.18	0.0899	±0.044
Pb, mg/L	0.13	0.29	0.1970	±0.059
Industrial area	Minimum	Maximum	Mean	Std. Deviation
Cd, mg/L	0.0033	0.04	0.0223	±0.010
Ni, mg/L	0.01	0.17	0.0981	±0.057
Pb, mg/L	0.12	0.27	0.2135	±0.043

The Ni concentration varied from 0.01-0.18 mg/L with a higher mean value (0.0981 mg/L) observed in the industrial area. Ni pollution on a local scale is caused by emissions from vehicle engines that use Ni gasoline and by the abrasion and corrosion of Ni from vehicle parts [19].

The Pb concentration varied from 0.07-0.29 mg/L with a higher mean value (0.2135 mg/L) observed in the industrial area. Pb pollution comes from combustion of gasoline that contains tetraethyl lead as an anti-knock agent [20].

In order to evaluate the degree of contamination, Pollution load index (PLI) for each area was calculated as indicated by Tomilson et al. [21].

$$\text{Pollution load index} = (\text{CF}_1 \times \text{CF}_2 \times \dots \times \text{CF}_n)^{1/n} \dots\dots\dots (1)$$

Where, n is the number of metals and CF is the contamination factor.

The contamination can be calculated from; Contamination factor (CF) = metal concentration in rainwater/Background values of the metal (rivers maintaining system and general water from pollution) [22]. The PLI value >1 is polluted whereas PLI value <1 indicates no pollution [23].

Table (2) were showed that the calculated of PLI is higher than 1 in the all study areas with extent contamination being more in the industrial area reflecting attributed principally to the anthropogenic activities.

Table 2: Calculated PLI of the heavy metals in the selected areas

Residential area	Commercial area	Industrial area
2.03	2.33	2.65

Conclusions

- The concentrations of Cadmium (Cd) have been a higher mean value (0.0223 mg/L) observed in the industrial area.
- The Nickel (Ni) concentrations have been a higher mean value (0.0981 mg/L) observed in the industrial area.
- The Lead (Pb) concentrations have been a higher mean value (0.2135 mg/L) observed in the industrial area.
- Pollution load index (PLI) is higher than 1 in the all study areas with extent contamination being more in the industrial area.

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