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ASSESSMENT OF HEAVY METAL POLLUTION OF OLD CITY ZONES IN MOSUL CITY, IRAQ

Mohammed Zuhair Ibrahim and Riyad Abdullah Fathi

Department of Environmental Sciences, College of Environmental Sciences and Technology, University of Mosul, Iraq.

Abstract

The current field study aims to determine the level of heavy metal contamination in the Old City Zones of Mosul City, Northern Iraq, where 5 samples collected for two season and analyzed from the soil areas, the soil was at depth (0-15) cm and (15-30) cm and analyzed by the X-ray Fluorescence for 8 metals included (Pb, Cd, Ni, As, Zn, Co, Cr, Cu). The results indicated that the element (Cd, Ni, Cr, Zn, Cu) were higher than the global Average of soils and this indicates the pollution of the zone for this element. When making t-test between the two depths and during the two seasons the statistical program was used where the results indicated that significant differences between the two seasons (winter, summer) and for two depth (0-15) cm, (15-30) cm, which indicates a change in the level concentration of the element.

Key words: Heavy metals, old city, X-ray Fluorescence.

Introduction

Several wars have led to the recent war on Iraq, especially on the territory of Ninawa, which has led to the cumulative destruction of land, infrastructure, water and air. The sand particles in Iraq contain toxic substances, including those heavy metals and radioactive materials resulting from military actions that break up the desert sands and turn them into light dust and reach the cities Iraqi government, including Ninawa governorate (Brown, 2004).

Has lived in Iraq many of these conflicts that have a major impact on the environment (Faisal, 2014). There are direct and indirect effects of these wars on the environment, as the direct effect is the waste and pollutants from the missiles and chemical bombs associated with the wars, while the indirect effects were the destruction of the infrastructure (Muhannad, 2010).

Pollution of the natural environment by heavy metals is a global problem because these elements are unbreakable and most of them have adverse effects on human health and other organisms when their levels exceed the limits of these elements, where the levels of accumulation of these heavy metals are normally exceeded, such as: Volcanoes, hurricanes and weathering rocks, or through human intervention, such as: use of pesticides (agriculture and its poles) (Abdolhossein, 2010) and (Mmolawa *et al*., 2011).

Soil is contaminated by heavy metals such as Lead, Cadmium and some other elements such as Zinc, Cobalt and Arsenic (Sayadi, 2014).

As a result of human activities such as waste disposal, industrial and agricultural activities and other military operations, which increase levels of hazardous materials, including heavy elements (Van and Krivolutsky, 1996).

Heavy metals are found in quantities of diamonds and accumulate over time to become toxic levels of plant, harmful to biological processes in soil and can easily move from soil to water and air (Dreaver, 1997).

The gravity of these heavy metals lies in their accumulation, high stability, unlimited survival and long-distance transport from their areas of origin and can be doubled in their accumulation during the food chain, as some animals and plants become and because they contain high-grade concentration of some of these dangerous elements, is a source of poisoning and a significant health risk (Shutzeadedubel *et al*., 2002).

It was reported that, recently as the world economy developed and the activities caused to humanity, both the type and content of heavy metals in the soil had increased steadily, resulting in environmental degradation and thus

***Author for correspondence :** E-mail: newmosul2008@gmail.com

negatively affecting human health Human beings and the rest of living things (Jenan-Philippe, 2012).

In a study to determine the level of heavy metals (Pb, Cd, Ni, Co, Cd, Cr) in the soil of Basra, Iraq, most of the studied elements are increasing in areas west of Basra where oil facilities are located and the city center, which is a commercial area, contains fuel combustion products.

In a study he conducted (Jingliang *et al*., 2011) to measure Lead contamination in soil in Baghdad, where results showed that the concentration of lead in soil is higher than the natural value of Lead, indicating that there is contamination in the area due to car exhaust, fertilizers, pesticides and various human activities.

(Serbula *et al.*, 2013) confirmed that the main source of the chrome element in soiled soars is from the corrosion of chrome-plated engine parts. The main sources of Cadmium and nickel are the avalanation of some parts of the old vehicle and Krab engines, as well as the solder, the alloy industry, the dye stores and the gases emitted by the vehicle exhaust in On-site.

In which the elements of cobalt, Chrome, Barium and Zinc were measured in soil and water near the power plant in northern Greece, the results showed that most of the concentration were within the permitted limits (Noli and Tsamos, 2016).

It was therefore necessary to carry out an assessment of the pollution in old city zones and to know the extent of the threat to the environment.

Materials and Methods

Background and sample collection

The study area is the city of Mosul, which is located in the north-western part of Iraq, between the longitude of 41°-44° and the latitude of 35°-37°. In particular, the old city areas of the Mosul city (Fig. 1).

Sampling

Only soil samples had been collected with depth (0-15) cm (15-30) cm by using a homemade soil sampler. A total of 5 surface had been collected at industrial zone. Samples was carried in October 2019 and Febuary 2020. First of all, samples were air-dried in natural condition and the debris of animals and plants had been cleaning by hands. Samples grind and pass through a sieve (2mm), so they ready to measure.

Analysis of samples

After collecting samples they analyzed by X-Ray Fluorescence, SPECTRO XEPOS from AMETEK. (XRF) method was great used for monitoring the concentration of metals.

Result and Discussion

Table 1 shows the heavy metals of the old city zones and at a depth of (0-15) cm and (15-30) cm in Summer Season.

The results obtained were compared with the the global average and The Elements (Cd, Ni, Zn, Cu) was Exceeded the Limited Value for the same position for

Table 1: Heavy metals of soil samples the area of old city at Summer Season in unit (ppm).

Elements	Mean		Standard Deviation		Min		Max		Global Average
	0-15c	15-30c	0-15c	15-30c	0-15c	15-30c	0-15c	15-30c	
Pb	1.05	0.36	0.97	0.24	0.26	0.11	2.70	0.91	10
Cd	0.30	0.07	0.44	0.07	0.09	0.03	1.10	0.10	0.06
Ni	95.06	68.04	18.08	68.04	77.31	39.89	125.41	97.55	40
As	6.94	3.92	6.68	3.92	0	1	18.30	9.67	10
Co	7.79	5.28	1.22	5.28	6.21	1.99	9.03	7.11	8
Cr	101.66	59.63	47.25	59.63	43.24	11.66	175.02	121.04	100
Zn	325.52	205.52	439.11	205.25	106.31	85.41	1135	503.66	50
Cu	84.10	63.33	78.50	63.3	20.56	2.78	209.64	237.99	30

Table 2: Heavy metals of soil samples the area of old city at Winter Season in unit (ppm).

Elements	Mean		Standard Deviation		Min		Max		Global Average
	0-15c	15-30c	0-15c	15-30c	0-15c	15-30c	0-15c	15-30c	
Pb	0.52	0.45	0.38	0.26	0.20	0.19	1.16	0.99	10
Cd	0.07	0.09	0.02	0.02	0.04	0.03	0.11	0.13	0.06
Ni	92.94	69.31	17.79	19.28	75.70	41.20	123	99.30	40
As	5.60	4.34	5.63	3.62	0	0.25	15	10.22	10
Co	6.80	6.01	1.30	1.95	5	2.23	8	8	8
Cr	98.60	60.63	46.11	34.65	41	12	170	122.50	100
Zn	348.44	206.75	438.09	160.91	103	86.30	1130	506	50
Cu	81.80	64.07	77.84	73.43	18	3.33	206	238	30

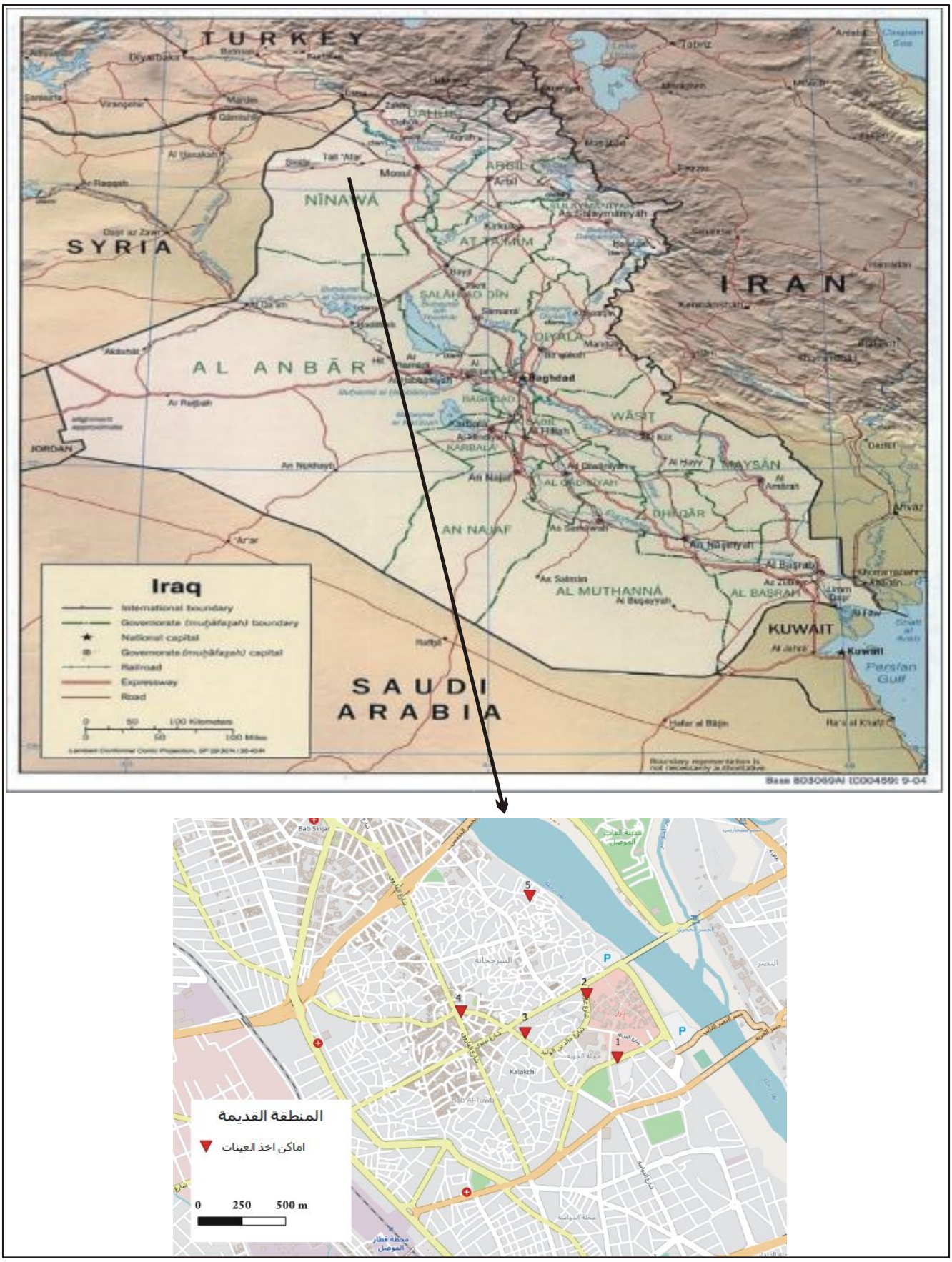

Fig. 1: Location of Study Area.

Table 3: T-test significant for Heavy metals. (Summ = Summer; Wint. = Winter).

Elements	Mean				Standard Deviation				t		df		sig.	
	Summ.	Wint.	Summ.	Wint.	Summ.	Wint.	Summ.	Wint.						
	0-15c	0-15c	15-30c	15-30c	0-15c	0-15c	15-30c	15-30c	0-15c	15-30c	0-15c	15-30c	0-15c	15-30c
Pb	1.05	0.52	0.36	0.45	0.97	0.38	0.24	0.26	6.000	4.493	4	4	0.004	0.002
Cd	0.30	0.07	0.07	0.09	0.44	0.02	0.07	0.02	5.477	5.041	4	4	0.005	0.001
Ni	95.06	92.94	68.04	69.31	18.08	17.79	68.04	19.28	7.380	4.713	4	4	0.002	0.001
As	6.94	5.60	3.92	4.34	6.68	5.63	3.92	3.62	3.325	3.701	4	4	0.029	0.005
Co	7.79	6.80	5.28	6.01	1.22	1.30	5.28	1.95	8.772	5.220	4	4	0.001	0.001
Cr	101.66	98.60	59.63	60.63	47.25	46.11	59.63	34.65	3.458	3.855	4	4	0.026	0.004
Zn	325.52	348.44	205.52	206.75	439.11	438.09	205.25	160.91	5.635	3.629	4	4	0.005	0.005
Cu	84.10	81.80	63.33	64.07	78.50	77.84	63.3	73.43	6.030	4.555	4	4	0.004	0.001

both depth (Lindsay, 1979).

Table 2 shows this compared with the global average at winter Season. the Results Showed that the elements (Cd, Ni, Zn, Cu) was Exceeded the Limited Value.

When making the t-test by using the program SPSS Statistical for the Heavy element at two season in both depth. The Result Showed high Significant in two death were.

We noticed a decrease in the concentration of the heavy metals indicate and on the depth (0-15) cm during the winter season due the washing of the soil compared to the summer season for the same depth. In contrast, result for heavy metals appeared that depth (15-30) cm in winter are high compared to the result same depth in summer. The table 3 shows the test results.

Conclusions

The results obtained for heavy metals and compared to the Global average show that these areas are already contaminated with (Cd, Ni, Zn, Cr, Cu) metals that have Exceeded the Limited values because of The war bombardment on the region during 2017 and the area was very densely populated, which led to a high number of human events and the resulting pollution of these elements.

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