University of Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

Estimation of some Heavy Metals in the Agricultural Lands Surrounding the Oil Isolation Site in the Gharraf Field

Atarid Talib Kazim

Department of Soil Sciences and Water Resources, College of Agriculture, University of Sumer, Iraq

Email: ataridtalib4@gmail.com

Abstract

This study was conducted on three sites (isolation area, Al-Mubarak area, Al-Burhan area) in Al-Bu Hamza area affiliated to Al-Rifai district/Dhi Qar Governorate - southern Iraq. These areas were on three dimensions from the oil isolation site. Soil samples were collected on (2/11/2024) for to estimat the concentration of some heavy metals which are Cadimium (Cd), Lead (Pb), Zinc (Zn), Cupper (Cu), and Nicle (Ni) in soil samples of the study sites. The results showed a high concentration of Cd in the isolation area closest to the oil isolation site, which reached (0.097) mg/kg compared to Al-Burhan area, the farthest from the oil isolation site, which reached (0.082) mg/kg. The concentration of Pb in the isolation area reached (9.47) mg/kg, which is the highest compared to the Al-Burhan area, which reached (9.15) mg/kg. The concentration of Zn reached (72.48) mg/kg in the isolation area, compared to its concentration in the Al-Burhan area, which reached (53.09) mg/kg. The concentration of Cu in the isolation area was (31.4) mg/kg, which was the highest compared to its concentration in the Al-Burhan area, which reached (20.4) mg/kg. As for the Ni, its concentration in the isolation area was (74.9) mg/kg, which was higher than its concentration in the Al-Burhan area, which reached (43.8) mg/kg.

Keyword: Heavy metals, Oil isolation, Gharraf fiels, Al-Cadimium, Zink.

I. INTRODUCTION

Pollution is defined as any undesirable change in the chemical, physical, and/or biological properties of the environment caused by the transfer of pollutants from various sources and in varying quantities, causing health and economic damage to humans as well as to other living organisms, including plant life (Al-Wahaibi, 2007). Specifically, soil pollution can be defined as the presence of certain substances in the soil at rates higher than the natural level of its components or substances not included in its composition, which further delays its reclamation (Al-Asadi and Al-Samee, 2002).

Soil pollution is caused by the continuous and irregular release of industrial waste, which leads to its decomposition and exposure to environmental influences, leading to the contamination of the areas in which it is located (Al-Barrak, 2010. Heavy or trace metals are the most dangerous cause of pollution, as their danger lies in their tendency to accumulate in the soil horizons as well as in the living organisms' tissues due to their lack of decomposition (Dalmano and Baici, 2006).

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

Although heavy metals are natural materials of the crust of our planet and has been used by humans in many agricultural and industrial applications, these chemical elements has led to environmental pollution (soil, water, and air) when they exceeds their normal limits , its subsequent absorption by plant roots, and its subsequent accumulation over a long period of time in the food chain, until it reaches the point of posing a potential and significant threat to human being health as well as animal health. This issue has recently caused significant concern and attention in the scientific and health circles (Sprynskyy, et al., 2007).

Ogbonna et al. (Otuu, et al., 2014)[6] also demonstrated that Pb poisoning causes neurological and behavioural disorders and can affect the Pb levels in blood of human body. Lead is known to cause mental retardation, damage to the central nervous system, and inhibit hemoglobin synthesis.

Yan et al. (Yan, et al., 2013) stated that copper and zinc are essential elements in the human body, but their excessive concentration can cause diseases. Therefore, heavy metal pollution should not be ignored. Heavy metals such as Pb, Cd, and Zn are hazardous materials that pollute environmental components such as soil, water, and air. Copper is present in soil in small quantities because of Cu found in composition of rocks, the total soil content of this metal varies according to the nature of the parent material, as it is deposited in the soil according to the soil's location and its physical and chemical properties (Kabata-Pendias and Pendias, 2001)

The most important sources of this pollution are vehicle engines, industrial waste, metal smelting, and fossil foul burning. Some of these heavy metals remain in the polluted area for a long period without undergoing any chemical changes, while others remain for a short period as they undergo chemical changes due to heat, humidity, light reactions, microbes, and other environmental factors. Soil pollution leads to reduced soil fertility and reduced crop production. It also affects plants and their natural composition, leading to a decrease in their nutritional value (Singh and Agarwal, 2011).

II. MATERIALS AND METHODS

Study site

This study was carried out at three sites in Al-Bu Hamza area, located within Al-Rifai District/ Thi-Qar governorate southern Iraq, Figure 1, Table 1. These sites were located at different distances (200, 2500, 4500)m from the pollution source (the oil isolation site), with 10 samples foe each site. Samples were taken on November 2nd, 2024.

University of Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

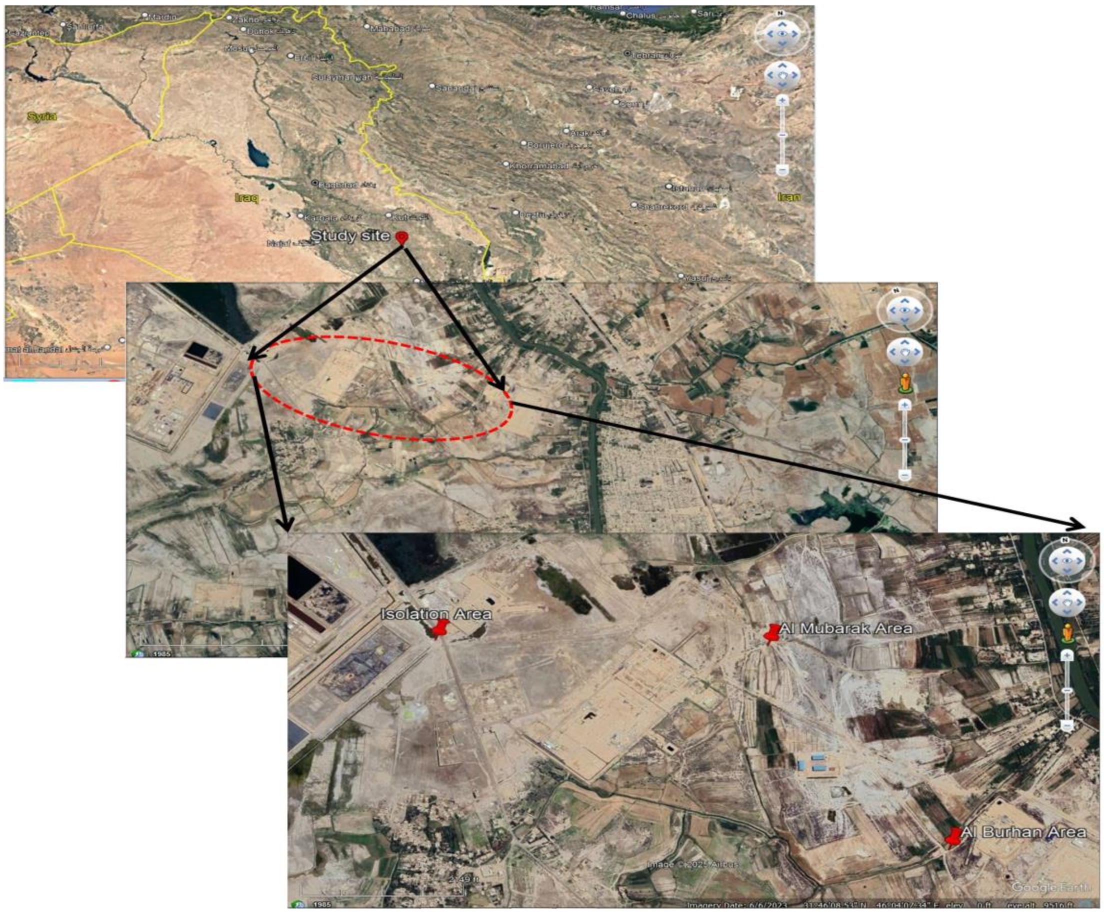

Fig. 1. Google Earth map representing the location of the study area on the map of Iraq.

TABLE 1. Study sites, distance from the pollution source, and administrative location names.

Site	Distance from the pollution source (m)	Administrative location name
Site 1	200	Isolation Area
Site 2	2500	Al Mubarak Area

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312
https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

Site 3	4500	Al Burhan Area

Determination of heavy metals

Cd, Zn, Cu, Ni, and Pb ions were extracted according to the method of (Yi, 2007) as follows:
1- After the soil samples were prepared and dried at (70)°C for three days, mixed well, and foreign materials were removed, they were ground using a ceramic mortar, passed through a (63) micron sieve, and kept in polyethylene containers.
2- After that, (2) grams of each dry sample were weighed and placed in a (250) ml glass beaker. (70) ml of concentrated HCl and HNO3 were added using a digestion device.
3- Add (3) mm of concentrated hydrofluoric acid and perchloric acid and evaporate to near dryness.
4- Separate the solution using a centrifuge at (3000) rpm for (30) minutes.
5- Measure the sample using the atomic absorption spectrometer.
6- The concentration of the element was determined according to the following equation (APHA, 2003):

$$E_{CON} = \frac{A*B*df}{D}$$

Where:
A: Concentration of the element used from the calibration curve
E_{CON} : Concentration of the element in each sample
B: Final volume in ml.
df: Dilution factor
D: dry weight of sample (gm)

III. RESULTS AND DISCUSSION

Cd soil content

Natural cadmium levels in the environment are generally low, but urban development has contributed to an increase in these levels, including increased engine emissions (vehicle exhaust fumes), combustion products from fossils fuel, and industrial production processes (Malan and Farrant, 1998).

In the current study, cadmium recorded its highest concentration, reaching 0.097 mg/kg, in the soil of the isolation area, which is considered closest to the pollution source compared to the other study areas. Its lowest concentration, reaching 0.082 mg/kg, was recorded in the soil of the Al-Burhan area, which is considered farthest from the pollution source compared to the other study areas Table (2). Cadmium values were lower than the international limits issued by the WHO (World Health Organization, 2013), as shown in table (3).

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

TABLE 2. Cadmium values for soil samples (mg/kg) at the study sites.

Site	Cd concentration (mg/kg)
Isolation Area	0.097
Al Mubarak Area	0.087
Al Burhan Area	0.082

TABLE 3. Permissible heavy metals concentration in soil according to WHO, expressed in mg/kg of soil (WHO, 2013)

The heavy metals	**The concentration (mg/kg)**
Cadmium	1-3
Copper	50-140
Nickel	30-75
Lead	50-300
Zinc	150-300

Pb soil content

Table (4) shows the Pb values recorded during the study period, indicating the highest and lowest values based on sampling locations. The highest Pb value in the current study was 9.47 mg/kg in the isolation area, and the lowest value was 9.15 mg/kg in the Al-Burhan area. The results showed that the Pb concentration was lower than the limit of Pb concentration set by the WHO.

TABLE 4. Pb values for soil samples (mg/kg) at the study sites.

Site	Pb concentration (mg/kg)
Isolation Area	9.47
Al Mubarak Area	9.22
Al Burhan Area	9.15

Zn soil content

University of Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

Table (5) shows Zn concentrations measured during the study period, indicating the highest and lowest values based on the sampling sites. The results showed the highest value was (72.48) mg/kg in the isolation area, and the lowest value was (53.09) mg/kg in the Al-Burhan area. All recorded values for the sites were lower than the limits WHO (WHO, 2013).

TABLE 5. Zn values for soil samples (mg/kg) at the study sites.

Site	Zn concentration (mg/kg)
Isolation Area	72.48
Al Mubarak Area	69.41
Al Burhan Area	53.09

Cu Soil Content

Table (6) shows the Cu concentration measured during the study period, indicating the highest and lowest values based on the sampling location. Cu in the soils samples recorded its highest value, which was (31.4) mg/kg in the isolation area, and its lowest value was (20.4) mg/kg, in the Al-Burhan area. Copper values were also lower than the international standards of WHO (WHO, 2013).

TABLE 6. Cu values for soil samples (mg/kg) at the study sites.

Site	Cu concentration (mg/kg)
Isolation Area	31.4
Al Mubarak Area	29.3
Al Burhan Area	20.4

Ni soil content

Table (7) shows the Ni values recorded during the study period, indicating the highest and lowest concentration of Ni in the studied soil samples. Nickel highest concentration was 74.9 mg/kg in the isolation area, which was close to the minimum permissible standard limit. The lowest value was 43.8 mg/kg in the Al-Burhan area, which was below the minimum permissible standard limit. Rapid industrial growth and transportation systems contribute to increased pollution levels in the region, which contains heavy elements (Qing, 2000).

TABLE 7. Ni values for soil samples (mg/kg) at the study sites.

Site	Ni concentration (mg/kg)
Isolation Area	74.9
Al Mubarak Area	59.3
Al Burhan Area	43.8

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312
https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

VI. CONCLUSIONS

From the results obtained from the study, researcher can conclude:
1 - The oil isolation area near the oil isolation site recorded the highest levels of the concentration of the studied heavy metals, while the Al-Burhan area, far from the oil isolation site, recorded the lowest values for all elements in the current study (Cd, Pb, Zn, Cu, Ni).
2 - All the studied heavy metals concentrations in the soils surrounding the isolation area were behind the values specified by the WHO.

V. REFERENCES

Al-Asadi, K. S. and Al-Samee, M. B. (2002). The impact of waste discharged from the Basra refinery on the pollution of surrounding agricultural lands. *Proc. the Natio. Geographic Conf 115*. (In Arabic)

Al-Barrak, A. H. A. 2010."*A geographical analysis of soil pollution in Basra Governorate"*. Master Thesis College of Education University of Basra. (In Arabic)

Al-Wahaibi M. B. H. (2007). The phenomenon of heavy metal accumulation in plants. *Saudi J. Life Sci. 14 (2): 1-28*. (In Arabic)

APHA, American Public Health Society. (2013). Standard methods for the examination of water and waste water. 2nd ed. Washington DC, USA.

Dalmano, D. A. and Baici, A. (2006). Determination of heavy metals (cd, pb)ant trace element (cu, zn)in sediments and fish of the Southeastern Aegean sea (Turkey) by atomic absorption spectrometry. *Food Chem. 95:157-162.*

Kabata-Pendias, A. and Pendias, H. (2001). Trace elements in soils and plants. 3rd ed. CRC Press Boca Raton Florida.

Malan, H. and Farrant, J. M. (1998). Effects of the metal pollutants cadmium and nickel on soybean seed development. *Seed Sci. Res. 8 (04): 445-453*. DOI:10.1017/S0960258500004414

Otuu, C., Ogbonna, C., Ogbogu, O., Johnson, O., Inya- Agha, S. (2014). Assessment of Lead content of Leaves of some Roadside Trees in Enugu Urban Environmental Health implications. *International J. Environ. Biol. 4(1): 6-9*.

Qing, Q. (2000). Assessment on pollution of heavy metals and metalloid in soil along road. *J. Environ. Health. 17 (5) 284-286*.

Singh, A., Kumar, C., and Agarwal, A. (2011). Phytotoxicity of Cadmium and Lead in Hydvilla verticillata (I.f.). *Royle J. Phytol. 3 (8): 01–04*.

Sprynskyy, M., kosobucki, P., Kowalkowski, T. and Buszewski, B. (2007). Influence of clinoptilolite rock on chemical Speciation of selected heavy metals in sewage sludge. *J. Hazard. Mater 149 (2): 310-316.* https://doi.org/10.1016/j.jhazmat.2007.04.001

Winther, M. and Slentø, E. (2010). Heavy Metal Emissions for Danish Road Transport. National Environmental Research Institute Aarhus University, Denmark pp 99 NERI Technical Report no. 780. http://www.dmu.dk/Pub/FR780.pdf.

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 306-312

https://iasj.rdd.edu.iq/journals/journal/issue/18682 *https://doi.org/10.54174/utjagr.v13i1.323*

World Health Organization. (2013) Report on the use of wastewater in agriculture: a guide for planners. Regional Office for the Middle East Regional Centre for Environmental Health Activities Amman Jordan. (In Arabic)

Yan, X., Zhang, F., Gao, D., Zeng, C., Xiang, W., and Zhang, M. (2013). Accumulations of Heavy metals in Roadside soils close to zhaling, Eling and Nam Co Lakes in the Tibeten Plateau. *Int. J. Environ. Res. Public Health 10 (6): 2384-2400*. https://doi.org/10.3390/ijerph10062384

Yi, Y. (2007). Heavy metal contamination in clinical and pathophysiological terms.