World Journal of
Experimental Biosciences

Volume 4, Number 1: 75 -78
ISSN: 2313-3937
2016

Research article

# Assessment of some heavy metals pollution in water and plants in agricultural land on the banks of the Euphrates River in Nasiriya city, Iraq

Aliaa Hussein Talib [1], Sanaa Talib Jawed[1]*

**ABSTRACT**

The human health affected by plants that grown in contaminated area. Therefore, this research was done to estimate the heavy metals pollution in a part of the Euphrates River water, soil and plants for land on both sides of the river were collected. The area (Alasforeh) was located between the high way bridges. People in (Alasforeh) used the river water for irrigation. Ten samples of river water, 10 samples of soil and 10 other samples of dry weight of plants such as *Aplum graveolens, Hordeum vulgare, Medicago sativa and Raphanus sativus* were used. The concentrations of some heavy metals like Pb, Cd, Ni and Zn were analyzed. The results showed that the concentration of Pb in irrigation water was 7.38 mg/L, which was higher than an acceptable level that mentioned in WHO reports. The Ni concentration of soil was high, it was 73, 60 and 53.2 mg/kg in *A. graveolens, H. vulgare,* and *M. sativa,* respectively. Concentration of heavy metals in the lower layers of the soil was more than surface layer. Concentrations of Cd were high in the *M. sativa* and *A. graveolens* plants, 0.608 and 0.325 mg/kg, respectively. Consequently the increasing of consumption for these contaminated plants by community could cause health problems in the future.

**Keywords:** Euphrates River, heavy metal, pollution, Water

**Citation:** Talib AH, Jawed ST. (2016) Assessment of some heavy metals pollution in water and plants in agricultural land on the banks of the Euphrates River in Nasiriya city, Iraq. *World J Exp Biosci* **4**: 75-78.

**Received February 21, 2016; Accepted March 12, 2016; Published March 22, 2016.**

## INTRODUCTION

Heavy metals and other chemical elements that found in contaminated food affect the human health. These chemicals have biologic advantage and the other have harmful functions to human health. Mercury and organic compounds are toxic to the nerve neurotoxins. Moreover, lead compounds harmful to the nervous system and loco-motor arsenic non- organic carcinogen. Cadmium affects renal and guest. There were many health problems that can created as a result of exposing to a high level of exposures to heavy metals.

Subjecting organisms to an elevated level of Tin affected the stomach [1]. Furthermore, there were many elements, such as copper, chromium, zinc and selenium which were essential for life and can be toxic if human exposure to high level of them [2, 3]. Heavy metal contaminated the soil and vegetation as a result of human activity from industrial refractory metals, paint and other metal which were work as environmental pollutions. Activities resulting from urbanization and evolution increased high concentrations of these chemical elements which made risk for consumer's

*Correspondence: JawedST.stjawed@ualr.edu
Department of Biology, College of education for pure science, University of Thi-Qar, Thi-Qar, Iraq.
Full list of author information is available at the end of the article.

life [4, 5]. In many cases, plants could contaminate from soil as a result of excessive use of chemical fertilizers, pesticides, watering with polluted water remnants from factories and add sewage [6, 7]. Researches and studies for some vegetables farms watered with polluted water proved that these plant containing high concentrations of heavy elements. As a result they made them hazard for consumption [8, 9, 10]. Euphrates River water began to degradation due to the high pollutant elements during its course. This happened consequently by increasing of proportion particles in the air, such as dust and sand as a result of soil erosion. There were significant reasons for the lack of vegetation yield and plants such as drought, lack of rain. Another reason was silt that results from the drainage operations of irrigation water which increases the level of concentration of salinity. High temperatures and low amount of water reaching the river increased the evaporation and salinity in the river [11]. There were many element that increase salt and metal as a result from the drainage operations of Lands salt on both sides of the banks of the river. The impact of other pollutants, such as household waste, pesticides, chemical fertilizers, heavy metals, petroleum derivatives and Sewerage could increase the contamination. The aim of the current research was studying the concentrations of heavy metals in the Euphrates River, soil and plants that are irrigated from the river.

# MATERIALS and METHODS

## The study area

The study was conducted in agricultural land located on bank of Euphrates River and confined between the high way bridge (Alasforeh), which lies about 12 km from the bridge. The river water is used for irrigation. In this study, the area was divided into four stations away. The distances were almost equal to facilitate the process of taking sample. The time of study was during June 2015.

## Collection of samples

The studied samples were taken from the river water; soil and vegetables found in the study area. The study area was divided into four stations and samples from the river water were taken at a rate of 3 samples from each station. We took 10 samples of cultivated plants in the region, for example, *Aplum graveolens, Hordeum vulgare, Medicago sativa* and *Raphanus sativus*. All soil samples were taken from different depths. Plant samples were taken from depth 0-25 cm and 25-50 cm (10 samples).

## Laboratory analyzes:

All samples were taken from water; soil and plant were analyzed in the laboratories of Agriculture College, University of Basra, in order to measure the concentrations of heavy elements by using the Flame Atomic Absorption.

## Measurement of trace element

## Extraction of trace elements from the water

The trace element in water samples were measured by taking 50 ml of water and added to 5 ml of nitric acid then heated at 70 0C up to appear white salt crystals, then 1 ml of HCL (0.5N) was added to melt the salt. Then the volume was completed with 25 ml of free ions distilled water. Finally, the sample was kept in plastic bottles until the measurement of trace element by using flame atomic absorption [12].

## Extraction of trace elements from the plants

Chemical digestion was conducted for plant samples and process according to the previous study [13]. First, the plants washed in order to clean up from sticking material, and then dried. The plants were cut into small pieces (2 gm). Forty milliliter of nitric acid (HNO3) was added, then covered the plants and left for overnight. All samples were heated until the evaporation then left them to be cold. After that, 3 ml of acid pyrochloric (HCLO4) was added and reheated again with lifting the lid to dry. Leaving the remainder to cool then we added 2 ml of hydrochloric acid with the addition of 2.3 ml of distilled water. The samples were heated until the melting point. Finally, the samples were filtered and added 50 ml of distilled water and then get ready for reading device by FAAS.

## Extraction of trace elements from the sediments

First, the samples were dried under 60 $^0$C for 24 h after removal of solid fraction and grinded in porcelain mortar and passed through a fine mesh of 65 u and conserved in cleaned and dark polyethylene tubes [14,15]. In order to extract trace elements, 1 gm of the sediment sample was taken and mixed with a mixture of 1 ml of HCL and HNO3 in 1:1 ratio. Evaporate the solution by heating at 80 $^0$C and evaporated to almost prior drying. Four milliliter of concentrated pyrochloric and hydrochloric mixture were added in 1:1. The mixture was evaporated for second time to prior drying stage. The remainder was dissolved with HCL acid (0.5N). Finally, the concentration of trace elements was measured by FAAS apparatus.

# RESULTS and DISCUSSION

## Water samples

**Table 1** showed results of concentrations of heavy metals in the river water samples. The table interrupted that the concentrations of heavy metals in the river water did not exceed the stander limits that mentioned in WHO report [4,5,16], except Pb. Lead concentration was 7.38 mg in station 2 and at this concentration exceeds the allowable unit 5 mg/L. Station 2 showed the highest ratio of trace elements. Lead is one of the most hazardous and toxic elements, which is found in the most plants. Accumulation of Pb in environment because split the waste of batteries coefficient dyes and remnants of cars (oils and fuels) in water [17]. All of these sources embedded randomly in most of the region lands and this causes the increasing concentration of this element in the waters of the river. The concentration increase by contamination of sewage that is now in the Euphrates River Station and indicates the risk of the use of the Euphrates River water in irrigation.

## Soil samples

**Table 2** showed the result of concentrations of heavy metals in the soil. Interestingly, the result demonstrated that there was increase in Ni concentration more than allowable

**Table 1.** Concentrations of some heavy metals in the Euphrates River in the search areas. Station 2 had the highest ratio of heavy metal and Pb element had the highest ratio in the four stations.

| Stations | Cd | Pb | Ni | Zn |
|---|---|---|---|---|
| **Station 1** | 0.006 | 1.77 | 0.03 | 1.107 |
| **Station 2** | 0.008 | 7.38 | 0.061 | 1.38 |
| **Station 3** | 0.007 | 3.18 | 0.065 | 0.73 |
| **Station 4** | 0.002 | 2.52 | 0.060 | 0.315 |
| **The average of Concentration** | 0.0057 | 3.71 | 0.054 | 0.883 |
| ***Determinants of WHO*** | **0.01** | **5** | **0.2** | **2** |

limit for the WHO of (50 mg / kg). The highest concentration of this element was high in soil plants, including *A. graveolens, H. vulgare and M. sativa*, 73, 60 , 53.2 mg/kg, respectively; while the soil as a result of *Raphanus sativus*(23 mg/kg) is within the allowable limit. Ni is one of the elements that come by using agricultural pesticides and chemical fertilizer [6,7]. Resides nickel is one of the natural components that found in soil and it should not exceed 50 mg/kg [18]. The significant increase of concentration of this element in the research paper due to the using of pesticides and chemical fertilizers is a result of soil contamination by pollutants landfill, which embedded randomly. Also it used in electroplating and in the manufacture of batteries and this element caused respiratory diseases [19]. We observed that the concentrations of heavy metals in the soil to a depth of 0-25 cm were higher than their concentrations at the depths of 25-50 cm. This indicates and supports the idea that the presence of a transitional movement of these elements through the soil layers, more ever the surface of soil is subject to contamination than other classes.

**Table 2.** Concentrations of some heavy metals in soil samples within the search area (mg/kg).

| Soil | Depth (cm) | Cd | Pb | Ni | Zn |
|---|---|---|---|---|---|
| **Soil of *R. sativus*** | 0 - 25 | 0.41 | 46 | 26 | 25 |
| | 25 -50 | 0.31 | 34 | 20 | 10 |
| | Average | 0.36 | 40 | 23 | 17.5 |
| **Soil of *A. graveolens*** | 0 - 25 | 0.6 | 52 | 66 | 28.2 |
| | 25 -50 | 0.42 | 44 | 80 | 30.4 |
| | Average | 0.51 | 48 | 73 | 29.8 |
| **Soil of *H.* vulgare** | 0 - 25 | 0.3 | 35 | 95 | 36.3 |
| | 25 -50 | 0.15 | 27 | 25 | 34.2 |
| | Average | 0.22 | 31 | 60 | 35.2 |
| **Soil of *M. sativa*** | 0 - 25 | 0.2 | 18 | 55 | 40.1 |
| | 25 -50 | 0.16 | 14 | 52 | 38.3 |
| | Average | 0.18 | 16 | 53.2 | 39.3 |
| **The average of Concentration** | | 0.31 | 33.75 | 52.3 | 29.33 |
| ***Determinants of WHO*** | | 3 | **100** | **50** | **300** |

## Plant samples

**Table 3** showed results of the heavy metals concentrations in plant samples. We observed that Cd had the highest concentration in most of the samples which were exceeding the allowable limit for the WHO (0.3 mg/kg). The highest concentration in *M. sativa* (0.608 mg/kg), while in *A. graveolens* the concentration was (0.225 mg/kg), in *R. sativus* and *H. vulgare* was 0.183 and 0.066 mg/kg, respectively.

**Table 3.** Concentrations of some heavy metals in plant within the search area (mg/kg).

| Plants | Cd | Pb | Ni | Zn |
|---|---|---|---|---|
| ***A. graveolens*** | 0.325 | 0.20 | 51.7 | 36.8 |
| ***R. sativus*** | 0.283 | 0.16 | 35.7 | 19.3 |
| ***H. vulgare*** | 0.066 | 0.17 | 42.6 | 17.7 |
| ***M. sativa*** | 0.608 | 0.18 | 19.24 | 30.6 |
| ***Determinants of WHO*** | 0.1 | 0.3 | 100 | 100 |

The increase of concentration came as a result of the growth of these plants in contaminated soil with this element. Surprisingly, the concentration of the soil did not exceed the allowable limit of WHO ratio which indicates that the ability of the high absorption of the plant for these elements, even if the concentration was low. Furthermore, this result indicates the seriousness of the growing plants in contaminated soil with this element. Cd is a risky element that sometimes traffics from the plant to the consumer's body of the humans and animals through the food chain. The accumulation of the Cd which is very harmful element causes of its capacity to affect the physiological damage, such as mental retardation and the failure of the vital functions [8,17,20]. Cadmium exists in most of the remnants of paint factories, plastic, rubber, electrical panels and batteries factories [17] that are often embedded and left randomly in of most land regions.

In conclusion, the result of the present study proved that the concentration of some heavy metal has exceeded the permissible limits in Alasforeh. Pb and Ni present in high concentrations more than other elements. High concentration of heavy metal was observed due to the industrial plants nearby the agricultural land. The heavy metal element exposed to bioaccumulation in foods chain which made it very harmful to health.

### Conflict of interest

The authors declare that they have no conflict of interests.

# REFERENCE


1. **Murray RK, Granner DK, Mayes PA, Rodwell VW.** (2000) Harper's Biochemistry, 25th. ed. Appleton and Lange,p.660.
2. **World Health Organization** (1989). Toxicological Evaluation of Certain Food Additives and Contaminants. 33 meeting of the JECFA. WHO Food Additives Series, No 24. WHO Food (Cambridge: Cambridge University Press).
3. **Ysart G, Miller P, Croasdale M, Crews H, Robb P, et al.** (2000). UK Total Diet Study-Dietary Exposures to Aluminum, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Tin and Zinc. Food Additiv and contaminants, **17**: 775-786 .
4. **Codex Alimentarins Commission (FAO/WHO).** (2001) Food Additives and Contaminats. Joint FAO/WHO Food Standards Program, ALLNORM 01/12A. 1-289.
5. **Anonymous.** (1998) Health guide line for the use of waste water in agriculture and aquaculture. Tech. Rep. Sci. 778, 10, Report of WHO Science Group. WHO. Geneva, Switzerland.
6. **AZita BH, Seid AM.** (2008) Investigation of heavy metals up take by vegetable crops from metal contaminated soil. Warld Academy of Science, Engineering and Technology **43**: 56-58.
7. **Hussein SA, Fahad KK.** (2008) Monthly Variation in Concentrations of Trace elements of Waters from Al- Garafe, one of the Main Branches

of Tigris River. Department of Fisheries and Marine Resources, College of Agriculture. University of Basrah.
8. **Delibacak S, Elmaci OL, Secer M, Bodur A.** (2002) Trace element and heavy metals concentration in fruit and vegetables of the Gediz River region. *Int J Water* **2**: 196- 211.
9. **Durdana RH, Shahnaz I, Shaikh GH.** (2007) Assessment of the level of trace metal in commonly edible vegetables locally available in the market of Karachi city. *Pak J Bot* **39**: 747-751.
10. **Lone MI, Saleem S, Mohmood T, Saifullah K, Hussan G.** (2003) Heavy metals contents of vegetable irrigated by sewage/tube well water. *Int J Agr Biol* **5:** 533-535.
11. **Hussein SA, Al-Sabunji AA, Fahad KK.** (2006) Environmental characteristics of the Euphrates River in the city of Nasiriyah ": Quarterly differences in some physical and chemical factors. Thi-Qar University J **2**: 6-2.
12. **APHA**. (2003) Standard methods for the examination of water and waste water. 20th Ed. Washington DC. USA.
13. **Haswel SJ.** (1990) Atomic Absorption Spectometery Theory, Designe and Application. 5th ed. University of HUL- HUG, W.K.
14. **Chester R, Voutsinou FG.** (1981) The initial assessment of trace metal pollution in coastal sediment. *Mar Pollu Bull* **12**: 84 - 91.
15. **Allen J, Robert DR, Jonathan W.** (2000) Partial skills in environmental Science, Pearson Bolection Asia pelted. Singapore, 25.
16. **World Health Organization** (2003) Report wastewater use in agriculture – guide Heuristic for planners. Regional Office for the Middle East. Regional Centre for Environmental Health Activities. Amman. Jordan.
17. **The Ministry of Environment.** (2007) Study of pollution with heavy metals in the soil in the city of Baghdad. The Department of Environment Baghdad.
18. **Mohsen B, Mohsen S.** (2008) Investigation of metals accumulation in سome vegetables irrigated with waste water in share Ray- Iran and toxicological application. American-Eurasian. *J Agr Environ Sci* **4**: 86-92.
19. **Poggio L, Vrščaj B, Schulin R, Hepperle E, Ajmone-Marsan F.** (2009) Metals Pollution and Human Bioaccessibility of Topsoils in Grugliasco (Italy), *Environ Pollution*. 157 **2**: 680-689.
20. **Nirmal K, Hiren SJ, Rita NK.** (2007) Characterization of heavy metal vegetables using inductive coupled plasma analyzer. *J Appl Environ Manag* **11**: 75-79.

*Author affiliation*

1. *Department of Biology, College of education for pure science, University of Thi-Qar, Thi-Qar, Iraq.*