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ESTIMATION OF HEAVY METALS IN WATER, SEDIMENTS AND BIOACCUMULATION IN *PSEUDODONTOPSIS EUPHRATICUS* AND *BELLAMYA BENGALENSIS* IN EUPHRATES RIVER IN AL-NASSIRIYAH CITY/ SOUTH OF IRAQ

Qasim M. Al-Taher[1], Manal Mohammad Akbar[2] and Imad Hadi Al-Qarooni[2]

[1]General Directorate of education in Thi-Qar, Iraq.

Email : qasim20020@gmail.com

[2]Department of Biology - College of Education for Pure Sciences - University of Basrah, Iraq

Abstract

The current study was conducted from December 2018 to November 2019. The present investigation tried to measure the concentrations of some heavy metals in water and sediments and their bioaccumulation in soft tissues of mollusca *Pseudodontopsis euphraticus* and *Bellamya bengalensis*. Mollusca, water and sediments were collected from four stations, that is, reference and polluted stations, along the Euphrates river, Iraq. The metals order in the water was Mn > Pb > Zn > Cu > Fe > Cd, in sediments it was Fe> Mn > Zn > Cu > Pb > Cd, and in the *P. euphraticus* the order was Fe > Mn > Zn > Pb > Cu > Cd and *B. bengalensis* order was Fe > Zn > Mn > Cu > Pb > Cd. The highest concentrations of metals were in second and third stations, while the lowest concentrations were in first and fourth stations. The results found a seasonal and local variation in the concentrations of heavy metals in water, sediments and soft tissues of molluscs in the Euphrates river which indicated to a high pollution rates in the waters of the Euphrates.

Keywords: pollution, heavy metals, *P. euphraticus*, *B.bengalensis*, mollusca.

Introduction

Pollution is the entry of substances or compounds into environment causing disturbance and imbalance in their component including biotic and a biotic compared to natural conditions. This might be resulted from human activity, causing physical, chemical and biological changes in main environment metals including water, air and soil (Irabii, 2001). In recent years, an aquatic environment has suffered from increased concentrations of pollutants especially heavy metals (Shariati *et al.*, 2019).

Heavy metals are inorganic metals that exist in very small quantities in water and sediments. It have a high specific density greater than 5g/cm^3. Heavy metals have a high toxicity even at low concentration, there for they cause severe effect on all form of life. Because of its accumulation in environment and its non-decomposition, heavy metals are difficult to remove by natural processes as it does for organic pollutants (Mahmood, 2008; Eze *et al.*, 2018).

The heavy metals can interact with many contents of aquatic environment and can be related with all geochemical phases in the sediments (Morillo *et al.*, 2004). Geochemical distribution and speciation of heavy metals in the defined chemical fraction have also been used in predicting the contamination, mobility and bioavailability (Kabala and Singh, 2001; Pueyo *et al.,* 2003; Caeiro *et al.,* 2005).

One of the main reasons for the entry of heavy metals into aquatic ecosystems and in particular to fresh water is the development of metals in civil and rural life and the increasing population growth in which pollution occurs, as pollution with these metals comes from two sources, either natural or human, and Anthropogenic and often the main source of pollution with this type of pollutant is resulting from various human events (Aldwila *et al.,* 2018).

B. bengalensis and *P. euphraticus* are two species of mollusca phylum. Because of its ability to accumulate pollutants in their tissues in a manner that reflects the levels of pollutants in the environment, Mollusca is considered, a good example of bioindicaters (Ndome *et al*., 2010; Jazza, 2015). In addition, the large size, slow movement, and availability of mollusca helped researchers in studying these organisms as a bioindicaters (Jamil, 2001; Al-Haidary, 2009).

Materials and Methods

Four stations along the stretch of the Euphrates river in / Al-Nassiriyah - south of Iraq, were selected (Figure 1). The upstream station is located in the northwestern part of the city of Nasiriyah, near the Sharif site1, (N=$31^0$3' 36.46" , E=$46^0$7' 42.45").Three other downstream stations at power plant (site 2, N=31^0 2' 74.35, E=46^0 11' 63.69"), city center (site 3, N=31^0 2' 5.88", E=46^0 16' 84.24"), and Ur district (site 4, N=30^0 58' 59.69", E=46^0 19 '76.35") were designated as polluted/ experimental stations.

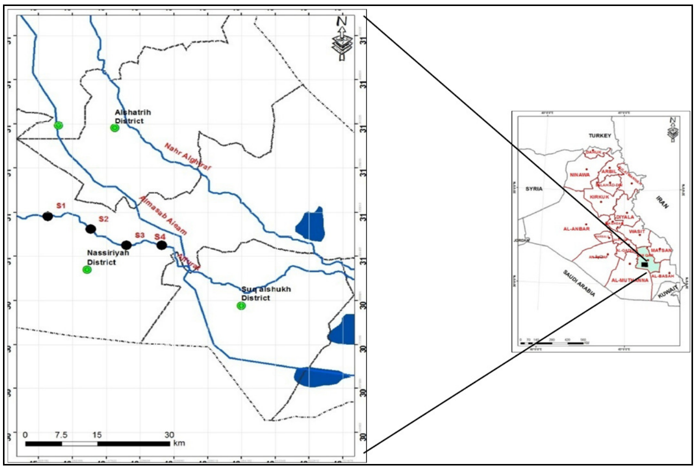

Fig. 1 : Map of Euphrates river showing the four sampling stations.

Collection of Water and Sediments

Water samples were collected from the station in 2.5 litters cleaned bottles. The samples were collected below the surface about 15 cm away from the river banks. These water samples were preserved by adding 5ml of HNO_3 (55%) per liter of water and stored at 5°C before their analysis.

In each station, the samples of sediment were collected from a depth of 5 inch from the surface of water, using a collector of sediment and then taken by polyethylene bags to the laboratory. They were dried and ground with a ceramic mortar. After that, they were sifted with a 2 mm diameter sieve to get rid of stones and impurities then kept in labeled plastic bottles until the heavy metals were extracted.

Collection of Mollusca Samples

Mollusca were seasonally collected from freshwater from their natural inhabitants at the four stations involved. Species that were sampled for this study are *P. euphraticus* and *B. bengalensis*. Mollusca were collected by hand and washed with distilled water several times, then placed in clean cold container. They were taken to the laboratory. The soft tissues was isolated by a plastic forceps on the filter papers to dry in the laboratory temperature, and put in the Freeze Dryer device until it reached drought, then transferred to the dryer until it reached a degree of room temperature. The samples were thoroughly ground using a ceramic mortar, and the powder was kept in clean, labeled plastic tube tightly closed until the heavy metals were extracted.

Metal Estimation in Water and Sediment Samples

The water sample was digested depending on the method used by APHA (1995) as follow-"Place 50 ml of the water sample in a 150 ml volumetric flask, and add 5 ml of nitric acid. The sample was placed on the hot plate and before boiling a little later, then it was returned to the plate to remain on it until completely dry to form white salt. Add 2 ml of nitric acid until it becomes black and returned to the hot plate with adding 5 ml of deionized water until digestion dissolve the white salt with a few drops of dilute hydrochloric acid (HCl) 0.5 N, transfer to a 50 ml volumetric flask and wash the volumetric flask several times with deionized water and add to the sample to complete the volume to 100 ml with deionized water". The sample was filtered with a filter paper (hole size of 0.45 µm) and kept in closed bottles until the measurement was performed. Then, the samples were analyzed through ICP-Mass Inductivity Coupled Plasma apparatus. The procedure for sediment digestion was carried out on 1g of dried sediment samples depending on Yi *et al*. (2007).

Metal Analysis in Mollusca

Heavy metals detection in dried soft tissue of mollusca was estimated by using the method followed by ROPME (2002). "About 1 g of dried sample (Three repetitions) was placed in 100 mL test tube. The digestion of dry sample done by mixing 5 ml of perchloric acid and nitric acid. The next day, a new mixture of acids was added to sample. The test tube containing samples was placed on block heater at 250°C until a clear solution was obtained". The digested sample was cooled and diluted to 100 ml with deionized water. Metals were analyzed through ICP-Mass Inductivity Copuled Plasma apparatus.

The various sets of data collected from the stations were compared with One-way ANOVA test using SPSS v.17software.

Results

Heavy Metals Concentration (µg/l) in Water

The given results in Table 1 showed heavy metal concentrations in water samples collected from stations during all study seasons. The highest concentration of Pb was in Summer at st.3 (20.457)µg/ l, while the lowest concentration was in Autumn at st. 4 (9.653) µg/l with significant differences among stations in all seasons. Also, Cd concentration was elevated in Summer at st.3 (0.843) µg/ l but the lowest concentration of Cd was in Winter at st. 1 (0.013) µg/ l with significant differences among stations in all seasons. This study found that the Cu concentration was higher in winter at st.3 (9.42) µg/ l, but in Spring at st. 1, Cu was decreased (1.86) µg/ l. Zn concentration was elevated in Summer at st.3 (17.26) µg/ l but the lowest concentration of Zn was in Winter at st.4 (3.93) µg/ l with significant differences among stations in all seasons. The highest concentration of Mn was in Summer at st.3 (41.51)µg/ l, while the lowest concentration was in winter at st. 1 (6.75) µg/ l with significant differences among stations in all seasons. Fe concentration was elevated in Summer at st.3 (4.77) µg/ l but the lowest concentration of Fe was in Winter at st.4 (1.59) µg/ l with significant differences among stations in all seasons.

Table 1: Mean concentration of heavy metals (µg/l) in water

Season	St.	Pb		Cd		Cu		Zn		Mn		Fe	
		M	SD±	M	SD±	M	SD±	M	SD±	M	SD±	M	SD±
Winter	St.1	10.156c	0.877	0.013d	0.002	6.73c	0.25	4.36b	0.17	6.75c	0.17	1.73bc	0.14
	St.2	11.054b	0.136	0.025b	0.001	8.13b	0.40	4.52b	0.55	7.51b	0.14	1.88b	0.05
	St.3	12.971a	0.501	0.030a	0.003	9.42a	0.47	5.56a	0.15	8.44a	0.08	2.49a	0.19
	St.4	10.253c	0.120	0.021c	0.0003	6.98c	0.75	3.93b	0.26	7.42b	0.28	1.59c	0.08
LSD		0.33		0.003		0.95		0.62		0.35		0.24	
Spring	St.1	11.076c	0.250	0.040d	0.002	1.86c	0.12	7.07b	0.16	7.23c	0.33	2.52c	0.08
	St.2	11.251c	0.199	0.076c	0.001	3.55b	0.01	8.91b	0.11	9.94a	0.19	2.64c	0.08
	St.3	13.89a	0.155	0.130b	0.01	5.85a	0.02	10.24a	1.05	8.39b	0.04	3.65a	0.04
	St.4	12.049b	0.149	0.193a	0.002	3.73b	0.15	8.09b	0.24	6.44d	0.14	3.22b	0.11
LSD		0.36		0.02		0.18		1.84		0.39		0.16	
Summer	St.1	11.998d	0.151	0.220c	0.003	2.96c	0.01	13.51c	0.12	30.25c	1.06	2.83d	0.07
	St.2	16.008c	0.152	0.800b	0.01	4.53b	0.01	15.64b	0.40	35.43b	1.67	3.74c	0.12
	St.3	20.457a	0.301	0.843a	0.03	6.53a	0.02	17.26a	1.04	41.51a	0.84	4.77a	0.03
	St.4	17.068b	0.251	0.125d	0.004	2.50d	0.31	14.90b	0.51	36.22b	1.62	3.91b	0.02
LSD		0.42		0.03		0.29		1.17		2.54		0.14	
Autumn	St.1	9.921b	0.264	0.131c	0.002	3.77c	0.22	6.77c	0.48	22.40c	1.32	2.34d	0.02
	St.2	11.841a	0.201	0.178b	0.001	4.74b	0.07	7.79b	0.54	24.0bc	1.00	3.24b	0.12
	St.3	11.938a	0.207	0.192a	0.001	6.06a	0.73	9.44a	0.56	28.77a	0.68	3.71a	0.10
	St.4	9.653b	0.471	0.085d	0.001	4.25bc	0.25	7.81b	0.52	25.48b	0.80	2.76c	0.08
LSD		0.057		0.010		0.77		1.00		1.85		0.17	

Heavy Metals Concentration (µg/g) dry weight in Sediments

The given results in Table 2 showed heavy metal concentrations in sediments samples collected from the stations during all study seasons. The current study showed that highest value of pb concentration was (12.14) µg/g dry weight measured in Summer at st.3, whereas the lowest value (2.46) µg/g dry weight was measured in Winter at st.1. The highest value of Cd concentration (0.399) µg/g dry weight has been recorded at st. 4 in Summer while the lowest concentration value (0.014) µg/g dry weight was showed at st.1 in Winter. Seasonally the highest concentration of Cu were noted during spring at st.3, while the lowest values were in winter at st.1. This study also reported that the highest value of Zn concentration was (112.96) µg/g dry weight recorded at st. 3 Summer, however the lowest value (38.29) µg/g dry weight was recorded at st.4 in Spring. The highest concentrations of Zn have been noted during Summer (112.96) µg/g at st.3, whereas the lowest levels were recorded during spring (38.29) µg/g dry weight at st.4. The highest value of Mn concentration (768.3) µg/g dry weight has been recorded at st. 3 in Summer while the lowest concentration value (269) µg/g dry weight was showed at st.1 in Winter. In addition the current study showed that highest value of Fe concentration was (19547) µg/g dry weight measured in Summer at st.2, whereas the lowest value (9747) µg/g dry weight was measured in Winter at st.1

Table 2: Mean concentration of heavy metals (µg/g) dry weight in Sediments

Season	St.	Pb		Cd		Cu		Zn		Mn		Fe	
		M	SD±	M	SD±	M	SD±	M	SD±	M	SD±	M	SD±
Winter	St.1	2.46c	0.16	0.014d	0.001	23.41d	0.81	55.79b	0.98	269d	0.99	9747d	16
	St.2	3.24b	0.14	0.030c	0.002	30.48b	1.05	60.47a	1.34	303c	1.07	10245b	26
	St.3	4.31a	0.16	0.050a	0.001	35.23a	1.27	61.53a	0.82	403a	1.53	10996a	14
	St.4	3.05b	0.21	0.036b	0.001	26.10c	1.13	39.22c	1.12	392b	2.25	10119c	6
LSD		0.32		0.005		2.03		2.04		2.91		33.09	
Spring	St.1	3.08c	0.12	0.088a	0.004	23.56c	1.36	35.14d	1.25	504c	2.27	11143d	4.72
	St.2	4.01b	0.12	0.397a	0.50	42.58b	1.35	63.73b	0.66	643a	2.08	13335c	6.65
	St.3	5.01a	0.06	0.133a	0.015	51.63a	1.20	80.63a	1.45	628b	2.09	15413a	12.00
	St.4	3.04c	0.18	0.099a	0.003	20.26d	0.76	38.29c	1.34	241d	1.13	14144b	1.52
LSD		0.77		1.5		2.24		2.29		3.67		13.7	
Summer	St.1	5.31c	0.19	0.212c	0.002	37.18a	1.08	80.51ac	1.33	479.8d	1.61	10547d	19.13
	St.2	6.36bc	0.36	0.315b	0.01	38.14a	1.34	99.47b	1.50	651.8c	1.17	19547a	3134
	St.3	12.14a	1.06	0.399a	0.003	46.66a	1.52	112.96a	3.25	768.3a	3.05	18519b	8.14
	St.4	7.09b	0.64	0.166c	0.05	41.04b	0.94	40.25d	0.77	707.5b	1,74	14691c	7.57
LSD		1.23		0.05		2.33		3.35		3.81		102	
Autumn	St.1	5.51b	0.21	0.020c	0.0009	25.42d	0.80	63.61c	1.44	392c	1.32	11660d	4.16
	St.2	7.16a	0.25	0.027b	0.001	32.48b	0.90	51.83b	1.24	422b	2.21	12889c	6.0
	St.3	7.43a	0.57	0.032a	0.001	38.07a	1.16	84.40a	1.50	502a	1.6	14011a	12.5
	St.4	5.27b	0.33	0.028b	0.0004	30.18c	0.97	40.14d	0.89	306d	1.0	12997b	11.67
LSD		0.7		0.002		1.82		2.44		3.03		17.56	

Heavy Metals Concentration (µg/g) dry weight in *P. euphraticus*

The given results in Table 3 showed heavy metal concentrations in *P. euphraticus* samples collected from stations during all study seasons. The present study showed that the maximum concentration of Pb (21.34) µg/g dry weight was found in sample of *P. euphraticus* collected from st.3 in Summer, while the minimum concentration (9.923) µg/g dry weight which was collected from st.4 in Winter. The maximum concentration of Cd (0.378) µg/g dry weight was showed in *P.euphraticus* collected from st.3 in Summer, while the minimum concentration of Cd (0.01) µg/g dry weight was showed in st.4 in Autumn. The maximum value (35.40) µg/g dry weight of Cu was found in *P. euphraticus* collected from st.3 in Summer, while the minimum concentration (3.00) µg/g dry weight was found in which collected from st.4 in Autumn. The maximum level of Zn (303.34) µg/g dry weight was recorded *P.euphraticus* collected from st.3 in Summer, while the minimum level (34.23) µg/g dry weight was found in st.1 in Winter. The maximum concentration of Mn (486) µg/g dry weight was showed in *P.euphraticus* collected from st.3 in Summer, while the minimum concentration of Mn (113) µg/g dry weight was showed in st.1 in Winter. The present study showed that the maximum concentration of Fe (1130) µg/g dry weight was found in sample of *P. euphraticus* collected from st.3 in Summer, while the minimum concentration (551) µg/g dry weight which was collected from st.1 in Winter.

Table 3: Mean concentration of heavy metals (µg/g) dry weight in *P. euphraticus*

Season	St.	Pb		Cd		Cu		Zn		Mn		Fe	
		M	SD±	M	SD±	M	SD±	M	SD±	M	SD±	M	SD±
Winter	St.1	11.176b	0.492	0.020d	0.0003	3.03c	0.07	34.23d	0.81	113c	0.40	551c	7.09
	St.2	11.377b	0.131	0.032c	0.0007	6.56a	0.55	66.27c	1.13	191b	1.22	558c	51.59
	St.3	13.278a	0.042	0.040a	0.0007	5.55b	0.56	115.51a	2.14	209a	1.80	865a	6.42
	St.4	9.923c	0.450	0.034b	0.0006	3.04c	0.17	88.12b	2.01	192b	0.41	813b	3.52
LSD		0.48		0.001		0.76		3.06		2.12		49	
Spring	St.1	9.953d	0.459	0.014d	0.001	22.31b	1.07	69.13d	1.09	172d	6.21	760d	1.46
	St.2	12.434b	0.115	0.031b	0.001	25.04a	0.15	88.45c	1.51	210c	0.75	801c	7.25
	St.3	14.399a	0.241	0.043a	0.0003	25.35a	0.722	110.07a	1.35	318a	5.92	872a	1.19
	St.4	11.52c	0.810	0.021c	0.001	22.59b	1.32	92.31b	1.42	246b	0.20	813b	1.87
LSD		0.91		0.006		1.74		2.55		8.12		7.27	
Summer	St.1	15.836c	0.505	0.075c	0.004	23.43c	1.45	234.95d	1.62	134d	0.20	919d	1.32
	St.2	18.15b	0.436	0.280b	0.004	28.10b	1.18	258.25c	1.17	315b	0.10	1103b	1.52
	St.3	21.341a	0.663	0.378a	0.012	35.40a	1.39	303.34a	1.39	486a	0.15	1130a	1.58
	St.4	13.516d	0.408	0.087c	0.006	28.15b	1.07	267.53b	1.33	224c	0.15	929c	1.58
LSD		0.96		0.02		2.42		2.62		0.3		2.83	
Autumn	St.1	12.213b	0.245	0.03c	0.001	3.99b	0.21	125d	1.71	232d	0.11	600c	2.3
	St.2	12.358b	0.192	0.04b	0.0007	4.99a	0.13	176c	1.34	257c	0.15	645b	5.0
	St.3	13.050a	0.099	0.05a	0.001	4.07b	0.16	321a	10.06	360a	0.27	832a	1.1
	St.4	12.26b	0.137	0.01d	0.000	3.00c	0.11	250b	2.29	273b	0.19	637bc	46.2
LSD		0.33		0.009		0.3		9.92		0.36		43.87	

Heavy Metals Concentration (µg/g) dry weight in *B. bengalensis*

The given results in Table 4 showed heavy metal concentrations in *B.bengalensis* samples collected from stations during all study seasons. This study found that the highest concentration of Pb (13.273) µg/g dry weight was found in sample of *B.bengalensis* collected from st.3 in Summer, while the lowest concentration (2.23) µg/g dry weight which was collected from st.1 in Winter. The maximum value of Cd (0.223)) µg/g dry weight was found in *B.bengalensis* collected from st.2 in Spring, while the minimum value of Cd (0.012)) µg/g dry weight was also collected from st.1 in Autumn. The maximum level of Cu (90.88)) µg/g dry weight was recorded in *B.bengalensis* collected from st.3 in Summer, while the minimum level (40.81)) µg/g dry weight was found in st.1 in Spring. The maximum level of Zn (399.18)) µg/g dry weight was recorded *B.bengalensis* collected from st.3 in Summer, while the minimum level (73.99± 0.76) was found in st.4 in Spring. The maximum level of Mn (297.15)) µg/g dry weight was recorded *B.bengalensis* collected from st.2 in Summer, while the minimum level (77.62) was found in st.1 in Winter. In addition this study found that the highest concentration of Fe (2270) µg/g dry weight was found in sample of *B.bengalensis* collected from st.3 in Winter, while the lowest concentration (714) µg/g dry weight which was collected from st.1 in Autumn.

Table 4: Mean concentration of heavy metals (µg/g) dry weight in *B.bengalensis*

Season	St.	Pb		Cd		Cu		Zn		Mn		Fe	
		M	SD±	M	SD±	M	SD±	M	SD±	M	SD±	M	SD±
Winter	St.1	2.23c	0.0274	0.123a	0.009	50.63d	1.42	89.12d	1.14	77.62d	1.19	1736c	45.96
	St.2	3.06b	0.213	0.080b	0.003	64.82a	1.40	140.13a	1.65	97.92c	0.99	2179b	17.89
	St.3	4.75a	0.308	0.083b	0.008	62.23b	0.89	130.54b	1.71	161.52a	1.35	2270a	18.02
	St.4	3.07b	0.175	0.130a	0.01	57.61c	1.50	99.58c	1.34	128.50b	1.32	1003d	4.04
LSD		0.46		0.01		2.5		2.78		2.3		49	
Spring	St.1	4.123d	0.209	0.037d	0.001	40.81c	0.73	67.32d	0.72	82.77d	1.13	1302c	4.00
	St.2	7.180b	0.267	0.223a	0.002	56.03a	0.72	100.74b	1.01	103.14a	2.73	1943b	13.05
	St.3	8.650a	0.514	0.195b	0.004	50.33b	1.19	109.31a	1.12	94.88b	1.18	2058a	35.55
	St.4	5.864c	0.240	0.076c	0.001	41.14c	0.79	73.99c	0.76	91.25c	0.75	1246d	2.51
LSD		0.62		0.01		1.66		1.74		3.08		35	
Summer	St.1	6.654d	0.320	0.021c	0.0002	62.36d	1.26	300.09d	1.06	154.17d	0.89	844.00c	3.60
	St.2	8.564c	0.502	0.030b	0.001	85.99b	0.59	391.78b	0.69	297.15a	1.07	900.50b	1.32
	St.3	13.273a	0.802	0.040a	0.001	90.88a	0.83	399.18a	1.04	274.10b	1.01	925.33a	5.50
	St.4	10.887b	0.416	0.020c	0.0002	66.11c	0.30	330.74c	1.55	195.74c	1.29	749.63d	1.70
LSD		1.01		0.004		1.55		2.13		2.03		6.52	
Autumn	St.1	6.345b	0.610	0.012a	0.001	42.38d	0.53	201.12c	0.97	121.07b	1.00	714c	1.89
	St.2	7.421a	0.529	0.021a	0.002	45.13c	1.05	204.91b	1.75	143.14a	1.02	799b	3.60
	St.3	7.742a	0.609	0.042a	0.001	57.39a	0.56	232.53a	2.20	144.99a	0.87	809a	3.60
	St.4	4.839c	0.457	0.039a	0.05	47.13b	1.37	165.21d	1.19	100.70c	1.52	600d	1.54
LSD		1.04		0.05		1.78		3.02		2013		5.32	

Discussions

The results of the current study showed that heavy metals into the aquatic environment changes over time, and the concentrations of metals in the water was took the following order Mn > Zn > Pb > Cu > Fe> Cd, as the metals of Mn recorded the highest cumulative average of the concentrations of the metals studied in water while the metals of Cd recorded the lowest cumulative rate of those metals may be the reason for this, because the metals of Mn enters the composition of many compounds of fertilizers and agricultural fertilizers, and may be the reason for the low concentrations of some Metals such as Cd indicate the tendency of these metals to accumulate in the bodies of phytoplankton, plants and aquatic organisms with nominal nutrition and to be adsorbed by sediments and this is consistent with a study (Al-Saad, 2000; Salman, 2006; Akbar & Khazali, 2012).

The reason for the lack of these metals may be due to the low rate of industrial activities near the study stations, which leads to the lack of additions that cause an increase in the concentrations of these metals in the aquatic environment (Al-Saadi, 2006) attributed the decrease in the values of the concentrations of heavy metals due to the lack of industrial pollutants, as well as the presence of a density of biological diversity. This opinion confirms that the rates of heavy metals concentrations in water are lower than the rates of their concentrations in sediments and organisms due to the sediments at the bottom of the different bodies of water represent a different collection or storage tank water pollutants that have the ability to settle and adsorb on the surface of the particles that make up these sediments (clay, silt and sand grains) and descend to the bottom region in the aqueous medium, as heavy metals are one of the most important of these pollutants in the aquatic environment (Juned *et al*., 2018; FAO, 1994) and due to the presence of the organic matter presented directly from the sewage plant, or perhaps as a result of great biological diversity, as the water of the Euphrates river contain large numbers of fish, invertebrates and aquatic plants that become an organic matter when they die (Hussein, 2014) this is supported by the fact that the deposits of the third station recorded the highest concentrations of heavy metals under study except for the iron component, as it recorded its highest concentration in the second station in the summer and that the highest percentage of total organic carbon was recorded in the deposits of the third station except the spring season was in the second station.

The concentrations of heavy metals in the water of the current study recorded a lower concentration than the previous studies recorded for the concentration of the Pb component, including the study of the (Khairallah, 2017) conducted by the Euphrates river at the city of Souk Al-Shuyukh recorded a concentration (`127.7) µg / l and higher than that recorded by the study (Al-Kanani, 2015) for Pb concentration (13.87) µg /l and less than the Cd concentration for the same study above, it was (2.66) µg / l. The study also recorded a higher concentration than the Cd constrationt (0.0837) µg / l and an approximate of Pb metals concentration (17.189) µg / l metals it is less concentrated than the Cu (9,566) µg / l and the Zn (59.703) µg / l which were recorded in a study (Sharhan, 2018).

The present study recorded lower heavy metals concentration than those recorded by Al-Qarooni *et al.* (2012) in Shatt Al-Arab river water because of the difference in nature between the two rivers and the sources of pollution in each of them.

Polluted bottom sediments mean that these pollutants can spread under different conditions to the rest of the water body layers as a result of any changes occurring inside the water as a result of the difference in the thermal distribution that occurs as a result of the different seasons or because of the movement and activity of aquatic animals or due to the strength of the water currents therefore, sediments play an important role in returning these pollutants to the water systems (Al-Salman *et al.,* 2013; Keenan, 2006) as these metals are released back to the water column when mixing occurs or is transmitted through the food chain (Kazar, 2009).

The concentrations of heavy metals in the sediments of the four study stations for Pb, Cd, Cu, Zn, Mn and Fe (5.279, 0.127, 31.98, 62.99, 478.65, 17477.5) µg / g dry weight, respectively.

These rates were taken in sediments, respectively Fe >Mn > Zn > Cu > Pb >Cd the results of the study were consistent with the study of Khan *et al.* (2018) that he conducted on Nehr-kabur in Pakistan, who cleared the arrangement of the heavy metals in their study was the highest present in the share of iron and the lowest available in the metals Cd (Fe > Cd) which attributed the high iron in it to the abundance of its presence in the earth's crust.

The highest concentrations of heavy metals were recorded in the current study in summer, the reason may be due to the rise in temperatures and the increase in the evaporation processes, the decomposition of dead organisms and the role of some anaerobic bacteria such as sulfur bacteria in the analysis and release of metals from those decomposed bodies. The results of the current study agreed with (Al-Qarooni, 2011; Al-Khafaji & Hussein, 2015; Farhood, 2017) that this heterogeneity and variation in the concentrations of heavy metals between the current study area and other studies may be due to the difference in the nature of the bottom and levels of water and sources of pollution and human activities as well as the influence of climate and the study season.

The current study recorded a lower concentration of Cd, Fe, and Cu than that of Al-Qarooni *et al.* (2012) perhaps the reason for the existence of low concentrations of these metals due to the decrease in pollutants that are exposed to rivers due to the self-purification carried out by the river as is the case in the current rivers which are characterized by the speed of their currents and the continuous movement as well as their richness in biological diversity, amount of organic matter in sediments, salinity and pH (Salvado *et al.,* 2006; Schweitek *et al.,* 2017) compared with Shatt Al-Arab river.

Two species of Molluscs *B. bengalensis* and *P. euphraticus* were chosen as vital signs to monitor the bioaccumulation in the soft tissues despite the presence of many species in the freshwater environment, for two important features the first of which is large in size second, the limited movement, in addition to its availability, ease of collection and diagnosis, (Al-Haidary, 2009; Jamil, 2001).

This study showed high level of heavy metals in molluscs than those found in water except for Pb and less than their concentrations in sediments. This study is consistent with some studies, including (Al-Haidarly, 2009; Al-Qarooni *et al*., 2012) who indicated that the higher level of heavy metals in molluscs is higher than that in water.

The high level of these metals in the tissues of the organism is the result of increased absorption from the external medium, whether in water or sediments in constant with the chemical and physical properties of these media (Naaz & Pandy, 2010; Nazeer *et al*., 2015) as there are levels of concentrations of heavy metals in the organisms it is due to the presence of these metals in water and sediments (Bai *et al.,* 2018).

The *B.bengalensis* recorded the levels of Pb, Cd, Cu, Zn, Mn and Fe metals and followed the following order Fe > Zn > Mn > Cu > Pb > Cd. The rates for the metals in *P.euphraticus* were in the following order Fe > Mn > Zn > Pb > Cu > Cd .

As it was found through the results that the Fe component is the highest in both species, perhaps the reason is that the Fe is one of the metals that fall within the components of the earth's crust and molluscas depends on the filtration nutrition, so it is concentrated in a high percentage in its bodies. The results of the study differed from what it indicated Salman (2011) that showed that the *P.euphraticus* bioaccumulation coefficient of metals followed the following order Pb >Zn >Fe.

The concentration of the Zn in both species of study, it was high in the summer and at the third station, perhaps the reason behind this is that the third station is near the sewage plant in the city, so it is exposed to many sources of wastewater or home use in addition to the high temperatures of summer, which has a role in increasing the concentration of this metals and concentration of Zn in *B. bengalensis* is higher than that in *P.euphraticus*. The concentration of Mn in the *P.euphraticus* was higher than in *B. bengalensis*, and the concentrations of Cd for both species were close to each other, while the Pb concentration outperformed in *P.euphraticus* over its concentration in the *B. bengalensis*, as many factors affect the transition of metals to biology including high organic content in addition to the solubility of the metals in the water, there are also factors related to the degree of complexity and development of the organism (Al-Khafji & Hussein, 2015).

The accumulation and toxicity of heavy metals depend heavily on the general environmental situation, and this may explain the variation and differences in the values recorded in this study for the concentrations of the metals studied in both species of organisms in the stations studied and during the different seasons compared with other studies (Al-Qarooni, 2012; Waykar & Petare, 2013; Al-Mamoory, 2013)

Conclusion

The results proved high concentrations of Pb, Cd, Cu, Zn, Mn and Fe in Euphrates river. Increasing level of toxic and harmful metals in water, sediments and molluscs, refers to the importance of pollution in the aquatic environment which requires taking the possible actions to save the Euphrates river from pollution risks.

References

Akbar, M.M.; Ghazali, A.M. (2012). Estimating the concentration of some heavy elements in the water, sediments of Al Gharraf river–Thi Qar. Thi Qar Science Journal, 3(3):

Al-salman, I.M.A.; Truesdale, V. and Elzwai, A.A. (2013). Catfish (Clariaslazera) as bio-indicator to estimate the levels of heavy metals in lentic Aquatic Ecosystem in Sebha Man- Made Lake- South Libya. IJST. vol.(8) No.(4).

Aldwila, N.M.; Al-Wasabi, M.; Nagi, H. and Alshwafi, N. (2018). Assessment of heavy metal pollution in the surface, sediments of Hadrhamout coastal, Yemen. Adv. Clin. Toxicol. 3(1): 1-15.

Al-Haidarey, M.J. Salih. (2009). Assessment and Sources of some Heavy Metals in Mesoptamian Marshes. Phd. thesis college of Science, University of Al-Kuffa, 155p.

Al-Khafaji, B.Y. and Hussain, H.M. (2015). Concentrations of some trace elements in water, sediments, and reed in the Diwaniyah River. Thi-Qar Science Journal, 5(2): 42-53.

Al-Kanani, Hassanein Ali Abdel-Ali (2015). Qualitative Characteristics of the Theses of the Woolen Textile Factory and Its Impact on the Water of Euphrates river at the Center of the City of Nasiriyah in Southern Iraq. Master Thesis, College of Science, Thi-Qar University. 143 pp.

Al-Mamoori, A.M. Juber (2013). Environmental Biomarkers in Selected Molluscs as a Tool for Biomonitoring of Pollution by Heavy Metals. University of Babylon, College of Sciences, 15(2):114-118.

Al-Qarooni, I.H. (2011). Estimation of some heavy metals concentration in water, sediment and bioaccumulation in some invertebrates of Shatt Al-Arab River and Shatt Al-Basrah canal southern of Iraq. Ph.D. Thesis, College of Education, Basrah University, 243pp.

Al-Qarooni, I.H.; Akbar, M.M. and Al-Saad, H.T. (2012). Snail *Bellamya bengalensis* as bioindicator for pollution by trace elements in Shatt al-Arab. Basrah Journal of Science, 30(2):139-150.

Al-Saad, H.T. (2000). Oil spill in oil refinery – case study – (Notes). Marsh Mesopotamia, 15(2): 453- 458.

Al-Saadi, H.A. (2006). The Aquatic Environment, Yazurdy Scientific House for Publishing and Distribution, Amman, Jordan, 308 pp.

APHA (American Public Helth Association) (1995). Standard methods for examination of water and wastewater, Washington, DC. 1193P.

Bai, L.; Liu, X. and Hu, J. (2018). Heavy metal accumulation in common aquatic plants in rivers and lake in the Taihu basin. Int. Res. Public, 15(2875): 1-12.

Caeiro, S.; Costa, M.H.; Ramos, T.B.; Fernandes, F.; Silveira, N.; Coimbra, A. and Painho, M. (2005). Assessing heavy metal contamination in Sado Estuary sediment: an index analysis approach. Ecological indicators, 5(2): 151-169.

Eze, O.C.; Tukura, B.W.; Atolaiye B.O. and Opaluwa, O.D. (2018). Pollution Assessment of Heavy Metals in Water and Sediment from Mpape River in FCT, Abuja, Nigeria Chemistry Research Journal, 3(2): 66-77.

FAO (1994). Review of pollution in the African aquatic environment CIFATechnical paper No. 25: 118.

Farhood, A.T. (2017). Using the *Typha domengensis* aquatic plant as a vital guide for the accumulation of some heavy elements in Hur Abi Zark in southern Iraq. Thi Qar Science Journal, 6(2): 35-42.

Hussein, N.A. (2014). Iraqi marsh environments. Dar Al-Fikr for publication and distribution. Iraq, Basrah. 214 pp.

Irabii, D.S. (2001). Mercury pollution by industrial waste and sediment the south of Iraq. Ph. D. thesis, University of Basrah, Iraq, 132.

Jamil, K. (2001). Bioindicator and Biomarker of Environmen tal Pollution and Risk Assessment. Science Publishers, I nc. Enfied (NH), USA Printed in India, 204 pp.

Jazza, S.H. (2015). The Status of Hydrocarbon Compounds Pollution of Water, Sediments and Some Aquatic Biota in Al-Kahlaa River Missan Province / Iraq. Ph.D, Thesis. College science. university of Basrah: 137pp.

Juned, S.; Nagargoje, B.N.; Bhosle, A.B. and Yannawar, V.B. (2018). Monitoring of Heavy Metals and Physico-Chemical Parameters of Soil, Near Sudha Dam Bhokar, Maharashtra. Journal of American Science, 14(5):1-7.

Kabala, C. and Singh, B.R. (2001). Fractionation and mobility of copper, lead, and zinc in soil profiles in the vicinity of a copper smelter. Journal of Environmental Quality, 30(2): 485-492.

Kazar, I. Abdul Amir. (2009). Concentration of some trace minerals in an environment and some footsteps in the eastern donkey. Master Thesis. College of Science - University of Basrah, 121 pp.

Keenan, H.; Dyer, M.; Songsasen; A.; Bangkedphol, S. and Homchan, U. (2006). Environmental Monitoring of the Sediment Pollution along the Thai: Laos. Journal of ASTM International, 3(7):32- 40.

Khairallah, N.K. (2017). Seasonal and site changes in the concentrations of some trace elements in the sediments, water and aquatic plant of the Champlain in the Euphrates River at the Souq Al-Shuyukh district in southern Iraq. Master Thesis, College of Science, Dhi Qar University, 123 pp.

Khan, M.I.; Khisroon, M.; Khan, A.; Gulfam, N.; Siraj, M.; Zaidi, F. and Qadir, F. (2018). Bioaccumulation of heavy metals in water, sediments, and tissues and their histopathological effects on Anodonta cygnea (Linea, 1876) in Kabul River, Khyber Pakhtunkhwa, Pakistan. BioMed research international, 2018.

Mahmood, A.A. (2008). Concentrations of pollutants in water, sediments and aquatic plants in some wetlands in south of Iraq, Ph.D. thesis, College of Science, University of Basrah.165pp.

Morillo, J.; Usero, J. and Gracia, I. (2004). Heavy metal distribution in marine sediments from the southwest coast of Spain. Chemosphere, 55(3): 431-442.

Naaz, S. and Pandy, S.N. (2010). Effect of industrial wastewater on heavy metal accumulation, growth and biochemical responses of lettuce (*Lactuca sativa* L.) J. of Environ. Biol., 31 : 273-276.

Nazeer, S.; Hashim, M.Z. and Malik, R.N. (2015). Heavy metals distribution, risk assessments and water Quality characterization by water quality index of the River Soan, Pakistan. Ecol. Indic., 43: 262-270.

Ndome, C.B.; Ekaluo, U.B and Asuquo, F.E. (2010). Comparative bioaccumulation of heavy metals (Fe, Mn, Zn, Cu, Cd, and Cr) by some edible aquatic Mollusca from the Atlantic coastline of south eastern Nigeria. World J. of fish and marine sciences, 2(4): 317-321.

Pueyo, M.; Sastre, J.; Hernandez, E.; Vidal, M.; Lopez-Sanchez, J.F. and Rauret, G. (2003). Prediction of trace element mobility in contaminated soils by sequential extraction. Journal of Environmental Quality, 32(6): 2054-2066.

ROPME (Regional Organization For the Protection of the Marine Environment) (2002). Manual of oceanographic observation and pollutants analysis methods. ROPME, P.O. Box 26388, AL – Safat, Kuwait.

Salman, J.M. (2006). Environmental study of pollution on Euphrates River Between Al–Hindia Dam and Al- Kufa city–Iraq. Ph. D. Thesis. Univ. of Babylon. 125pp.

Salman, J. M. (2011). The Clam *Pseudodontopsis euphraticus* (Bourguignat,1852) as a Bioaccumulation Indicator Organism of Heavy Metals in Euphrates River-Iraq. Babylon, 3(19): 116-125.

Salvado, V.; Quintana, X.D. and Hidalgo, M. (2006). Monitoring of nutrients, pesticides, and metals in waters, sediments, and fish of a wetland. Arch. Environ. Contam. Toxicol. 51: 377-386.

Schweitek, M.; Rugner, H.; Schera. U. and others (2017). Aparsimonians approach to sestimate PAHs Concentration in river sediments of anthropogenic ally impacted water sheds .Science of the Total Environment, 60(2): 636:645.

Sharhan, S.B. (2018). Evaluation of organic and bacterial contamination in the deposits of Al-Ghurat River at the center of Nasiriyah city - southern Iraq. Master Thesis, College of Science, Thi Qar University, 118 pp.

Shariati, S.; Pourbabaee, A.A.; Alikhani, H.A. and Rezaei, K.A. (2019). Investigation of heavy metal contamination in the surface sediments of Anazial wetland in North of Iran. Pollution, 5(1): 211-224.

Waykar, B. and Petare, R. (2013) Bioaccumlation of Heavy metals in freshwater Snails *Bellamya bengalensis* and *Lymnea accuminata* from Dhule District (Mahrashatra) India. The Bioscan, 8(3): 1043-1047.

Yi, L.; Hong, Y.; Wang, D. and Zhu, Y. (2007). Determination of free heavy metal ion concentration in soil around a cadmium rich zinc depose. Geochemical J., 41:235-24