Al-Qadisiyah Journal of Pure Science

Volume 25 | Number 2 Article 16

4-7-2020

Heavy Metals Concentrations In Sediments Of Al-Delmaj Marsh, Al-Qadisiya /Wasit Governorates/ Southern Iraq

Faris Nasir Murad
College of Science. Department of Geology, University of Kufa –Iraq

Abbas Hameed
College of Science. Department of Geology, University of Basrah –Iraq

Hamid Taleb Al-Saad
College of Marine Science, University of Basrah –Iraq

Recommended Citation

Murad, Faris Nasir; Hameed, Abbas; and Al-Saad, Hamid Taleb (2020) "Heavy Metals Concentrations In Sediments Of Al-Delmaj Marsh, Al-Qadisiya /Wasit Governorates/ Southern Iraq," *Al-Qadisiyah Journal of Pure Science*: Vol. 25: No. 2, Article 16.
DOI: 10.29350/2411-3514.1205
Available at: https://qjps.researchcommons.org/home/vol25/iss2/16

Al-Qadisiyah Journal of Pure Science
ISSN(Printed): 1997-2490 ISSN(Online): 2411-3514
DOI: /10.29350/jops.
http://qu.edu.iq/journalsc/index.php/JOPS

Heavy metals concentrations in Sediments of Al-Delmaj Marsh, Al-Qadisiya /Wasit Governorates/ Southern Iraq

Authors Names
a. Faris Nasir Murad
b. Abbas Hameed
c. Hamid Taleb Al-Saad

Article History
Received on: 02/03/2020
Revised on: 13/03/2020
Accepted on: 12/04/2020
Keywords:
Heavy metals, Sediments, Al-Delmaj Marsh.
DOI: https://doi.org/10.29350/jops.2020.25. 2.176

ABSTRACT

The seasonal study of heavy metals were taken during February 2018 to November 2018. The concentration of heavy metals were determined(Cd, Cr, Cu, Zn, Ni, Pb, Fe), by using Flame Atomic Absorption Spectrophotometer (FAAS) for sediment sample at Ten stations along Al-Delmaj Marsh they are (St.1, St.2 before water recharge, St.2 after water recharge, St.3, St.4, St.5 before water discharge, St.5 after water discharge, St.6, St.7, St.8), the stations were selected to cover all the marsh area. The Total Organic Carbon (TOC%) were analyzed. The results obtained for the sediment samples were low except for Fe and Pb which were relatively high. Which were followed the order : (Fe >Pb>Zn> Ni>Cr>Cu> Cd).Whereas the highest mean also the lowest mean concentration in some stations because of the fewness sources of pollution in this region whereas the highest mean concentration in other stations because of there are a lot of pollution sources such as: (sewage pollutants, municipal waste, and fertilizer waste). there is a variation in the concentrations of studied elements they were ranged as follows: Cd: (0.222 - 0.283 µg/g), Cr: (1.472 - 1.685 µg/g), Cu: (0.305 - 0.362 µg/g), Zn:(1.947 - 2.826 µg/g), Ni: (1.738 - 2.206 µg/g), Pb: (3.696 - 4.921 µg/g), and Fe: (10.95 - 13.247 µg/g), The concentrations of heavy metals are very importance to know the locations of pollution, its percentage and causes, sources and methods of treating pollution to preserve public health. The rate of Total Organic Carbon in the studied area were ranged (0.55- 0.97), and this indicates the influence of sediments in the presence of a source of organic materials, due to the degradation process that occurs in the area sediments.

1. Introduction

Heavy metals include (Ni, pb, Cd, Cu, Fe, Cr,..etc). Their presence and properties in the soils generally depends on the parent rock derived from them. Measuring the concentrations of these elements can lead to identification the source of pollution in water systems and soils [6,3].

These elements are one of the most dangerous of inorganic pollutants, which had spreaded in the environment since the beginning of the industrial revolution, and their significantly accumulation lead to the transformation of more toxic complex compounds to remain for a long time in the environment were causing imbalance in the natural balance of the ecosystem, as well as, increasing their rates were damaged the soil characteristics and the destruction the biological diversity in the environment. Heavy metals pollution became a major environmental problem, due to their toxicity, non-degradable and

[a] College of Science. Department of Geology, University of Kufa – Iraq
[b] College of Science. Department of Geology, University of Basrah – Iraq
[c] College of Marine Science, University of Basrah – Iraq

constant nature. This leads to their aggregation in plants, microorganisms and other aquatic organisms, that are transmitted to humans through the food chain, this leads to multiple health problems [15]. In naturally aquatic environments, the elements are ordinarily at the concentrations differing from nanogram to microgram in a liter. These elements are essential and necessary to sustain the life of living organisms such as copper, zinc, and iron which play main roles in the functioning of enzyme systems. On the other hand, at higher concentrations become toxic. The other group of elements are non-essentially, it contains elements that pollute the environment and harm its revival even when it exists at high levels.

2. Materials and Methods

Sediment samples were collected seasonally, for the period from February 2018 to November 2018, from ten sampling stations for analysis and estimation the concentration of some heavy metals (Cd, Cr, Cu, Zn, Ni, Pb and Fe) as shown in Fig. (1). (sta.1, sta.2 before water recharge, sta.2 after water recharge, sta.3, sta.4, sta. 5 before water discharge, sta.5 after water discharge, sta. 6, sta.7, sta.8) in the Al-Delmaj marsh, the samples sites were selected based on field surveys. Sediment samples were taken seasonally from each stations by using (a Van veen grab sampler), the water was allowed to drain off, using polyethylene bags then the samples were placed in an ice box until reaching the laboratory. The heavy metals were extracted according to the method of [11]. Sediment samples heavy elements were measured by using Flame Atomic Absorption Spectrophotometer (FAAS). The Total Organic Carbon content in the sediment samples was determined according to the burning method [14].

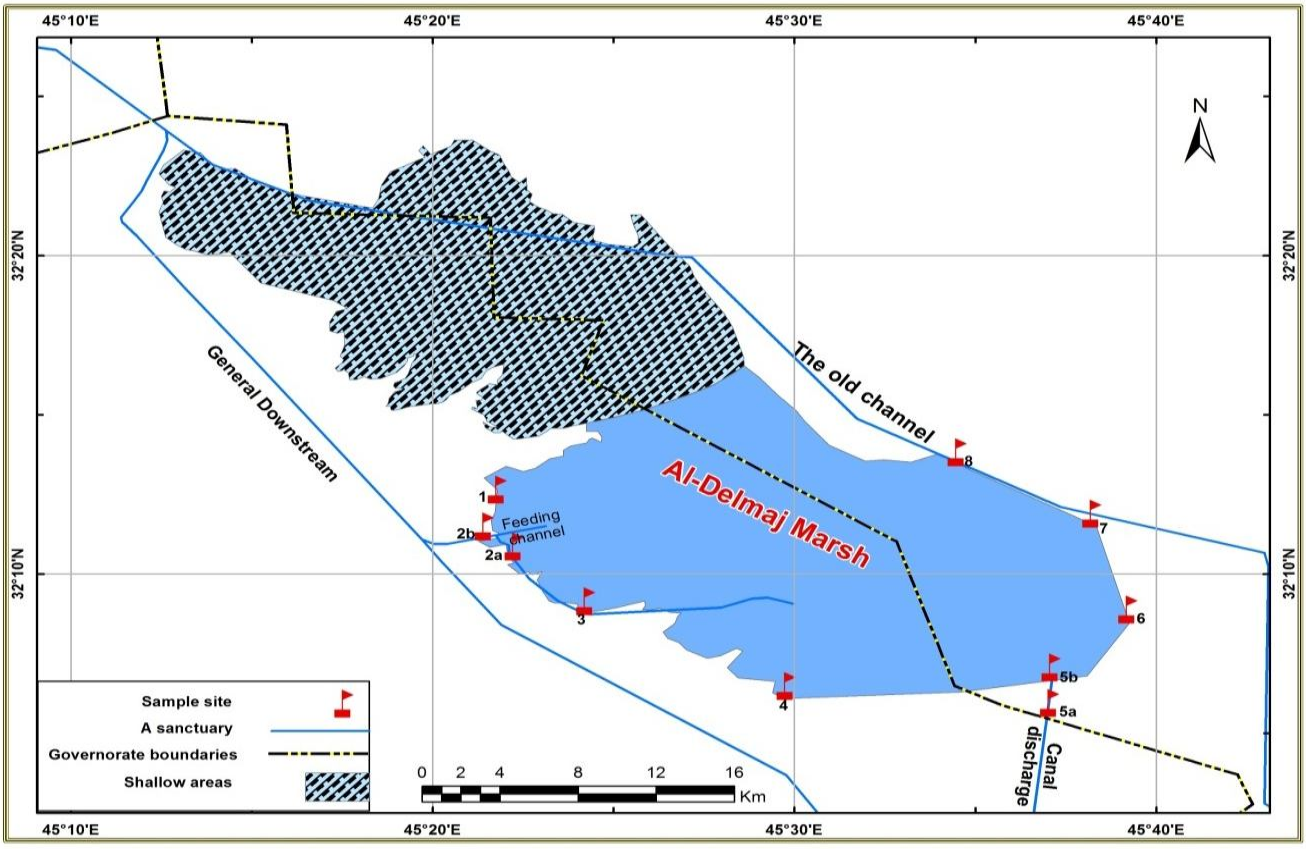

Figure (1) : Map of Al-Dalmaj Marsh showing sampling locations

3.Results and Discussion:

Results of the present study are shown in (Table 1), The concentration of Cd in the sediment samples during summer was (0.311µg/g) in station (1), the lowest concentration reached (0.153µg/g) in station (2) before water recharge and at average (0.222 µg/g) for all stations. In autumn season the concentration reached the highest concentration (0.429 µg/g) in station (2) after water recharge, and its lowest concentration (0,202 µg/g) in station (8) and at mean (0.283 µg/g)for all stations, while in winter season concentration report the highest concentration to (0.346 µg/g) in station (1) and its lowest concentration (0.175 µg/g) in station (2) before recharge and at average (0.241 µg/g) for all stations. In the spring season, reached its highest concentration to (o.321 µg/g) in station (1), and its lowest concentration (0.167 µg/g) in station (2) before water recharge and at mean (0.223 µg/g) for all station. When comparing the results, the highest concentrations of this element were in the autumn season reached (0.429 µg/g) in station (2) after water recharge and lowest concentrations in the winter season reached (0,175 µg/g) in station (2) before water recharge. The increasing of Cd in the autumn season may due to increased human activities and continuous release of pollutants by soil washing process without treatment [13]. The concentration of Cr in the summer season (Table 1) equal to (2.453 µg/g) in station (1), and the lowest concentration (0.685 µg/g) in station (7) and at mean (1.472 µg/g) for all stations. In the autumn season the concentration reached the highest concentration (2.544 µg/g) in station (1), and the lowest concentration equal to (0.971 µg/g) in station (8) and at mean (1.677 µg/g) for all stations. In winter season, the highest concentration in the sediment sample was (2.829 µg/g) in station (1), and the lowest concentration (0.944 µg/g) in station (7), at mean (1.685 µg/g) for all stations. In the spring season sediment sample reached the highest concentration was (2.653 µg/g) in station (1), and the lowest concentration (0.855 µg/g) in station (7), at mean (1.587 µg/g) for all stations. the concentrations of the element in the sediment sample among the seasons are very small, the highest concentrations for the element were found in station (1) because of sewage pollution and using of fertilizers in the surrounding area, the lowest concentrations at station (7) reached (0.685 µg/g) in the summer season sediment sample.

Table (1): Seasonal variations concentrations of (Cd and Cr) µg/g from the study stations

Stations	Cd (µg/g)				Cr (µg/g)			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1	0.311	0.336	0.436	0.321	2.453	2.544	2.829	2.653
2 before	0.153	0.317	0.175	0.167	2.002	2.233	2.032	2.003
2 after	0.179	0.429	0.194	0.186	2.091	2.322	1.495	2.102
3	0.201	0.256	0.187	0.175	1.232	1.527	1.426	1.311
4	0.213	0.219	0.216	0.204	1.544	1.611	1.828	1.766
5 before	0.239	0.237	0.248	0.222	1.424	1.721	1.625	1.586
5 after	0.255	0.332	0.286	0.246	1.038	1.811	1.744	1.099
6	0.214	0.296	0.228	0.23	1.127	1.022	1.202	1.201
7	0.248	0.211	0.285	0.266	0.685	1.013	0.944	0.855
8	0.210	0.202	0.247	0.214	1.124	0.971	1.327	1.296
Mean	0.222	0.283	0.241	0.223	1.472	1.677	1.685	1.587

The concentration of Cu (Table 2) during summer season equal to(0.381 µg/g) in station (2) after water recharge which represented the highest concentration, the lowest concentration was reached (0.241 µg/g) in station (8) and at mean (0.305 µg/g) for all stations. In the autumn season (Cu), the highest concentration was reached (0.527 µg/g) in station (5) before water discharge, the lowest concentration (0.264 µg/g) in station (1) and at mean (0.362 µg/g) for all stations. While in the sediment samples of the winter season, the highest concentration reached (0.427 µg/g) in station (2) before water recharge, the lowest concentration was (0.306 µg/g) in station (6) and at mean (0.361 µg/g) for all stations. In the spring season, the highest concentration was reached (0.411 µg/g) in station (2) after water recharge, the lowest concentration (0.298 µg/g) in station(6) and at mean (0.345 µg/g) for all station. The convergence in large concentrations of sediment samples which appeared in the autumn season reached (0.527 µg/g) in station (5) before water discharge, the lowest concentration appeared among the seasons in the summer season (0.241 µg/g) in station (8). The fluctuation in Cu concentrations is mainly due to the different source of pollution such as the discharge of industrial wastes, sewage pollution. The concentration of Ni (Table 2), the highest concentration appeared in the sediment samples of the summer season reached (2.744 µg/g) in station (2) before water recharge, and the lowest concentration was (1.296 µg/g) in station (8) and at mean (1.738 µg/g) for all stations, while in the autumn season the highest concentration reached (3.023 µg/g) in station (4), and the lowest concentration (1.544 µg/g) in station (5) before water discharge and at mean (2.206 µg/g) for all stations, whereas in the winter season the highest concentration reached (3.208 µg/g) in station (2) before water recharge, the lowest concentration (1.434 µg/g) in station (8) and at mean (2.122 µg/g) for all stations.

Table (2) Seasonal variations concentrations of (Cu and Ni) µg/g from the study stations

Stations	Cu (µg/g)				Ni (µg/g)			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1	0.312	0.264	0.36	0.354	1.753	1.73	1.937	1.854
2 before	0.356	0.366	0.427	0.398	2.744	2.627	3.208	2.938
2 after	0.381	0.454	0.405	0.411	2.002	2.122	2.135	2.022
3	0.313	0.369	0.422	0.386	1.347	2.032	1.626	1.428
4	0.318	0.395	0.364	0.339	1.950	3.023	3.032	2.022
5 before	0.294	0.527	0.361	0.343	1.326	1.544	1.624	1.427
5 after	0.267	0.342	0.327	0.312	1.544	1.594	1.746	1.629
6	0.299	0.313	0.306	0.298	2.121	2.744	3.032	2.316
7	0.274	0.295	0.317	0.302	1.296	2.543	1.455	1.329
8	0.241	0.303	0.329	0.314	2.299	2.103	1.434	1.359
Mean	0.305	0.362	0.361	0.345	1.738	2.206	2.122	1.832

In the spring season appeared the highest concentration (2.938 µg/g) in station (2) before water recharge, the lowest concentration reached (1.329 µg/g) in station (7) and at mean (1.832 µg/g) for all stations. There are variations in nickel concentrations among the seasons and stations. The highest concentration appeared in the winter season sediment samples in station (2) before water recharge reached (3.208 µg/g), while the lowest concentration appeared in the

summer season sediment sample in station (7) reached (1.296 µg/g). Also the fluctuation in Ni concentrations among the stations and seasons due to the different source of pollution such as sewage wastes, and using of fertilizers. The concentration of Pb. (Table 3), the summer season sediment samples, was the highest concentration reached (4.436 µg/g) in station (2) after water recharge, the lowest concentration was (3.112 µg/g) in station (8) and at mean (3.696 µg/g) for all stations, while in the autumn season sediment samples were the highest concentration reached (6.233 µg/g) in station (2) after water recharge, the lowest concentration was (2.853 µg/g) in station (5) after water discharge and at mean (3.997 µg/g) for all stations, whereas in the winter season, the highest concentration reached (6.252 µg/g) in station (2) before water recharge, the lowest concentration was (4.034 µg/g) in station (8) and at mean (4.921 µg/g) for all stations, In the spring season, the highest concentration reached (5.643 µg/g) in station (2) after water recharge, the lowest concentration was (3.618 µg/g) in station (7) and at mean (4.361 µg/g) for all stations. The concentrations of the element in the sediment samples in winter and spring seasons are more than in summer and autumn seasons, the highest concentration appeared in the winter season reached (6.252 µg/g) in station (2) before water recharge, while the lowest concentration appeared in the autumn season reached (2.853 µg/g) in station (5) after water discharge. Due to high rainfall then increasing the washing process, also increasing sewage pollutants.

The concentration of Zn. (Table 3), in the summer season sediment samples, the highest concentration was reached (2.534 µg/g) in station (2) after water recharge, the lowest concentration was (1.035 µg/g) in station (1) and at mean (1.947 µg/g) for all station, while in the autumn season sediment sample, the highest concentration reached (3.643 µg/g) in station (2) after water recharge, the lowest concentration was (1.126 µg/g) in station (1) and at mean (2.165 µg/g) for all station. Whereas in the winter season, the highest concentration reached was (4.315 µg/g) in station (8), the lowest concentration was (1.244 µg/g) in station (1) and at mean (2.826 µg/g) for all stations. In the spring season, the highest concentration reached (3.616 µg/g) in station (2) after water recharge, the lowest concentration was (1.112 µg/g) in station (1) and at mean (2.409 µg/g) for all stations.

Table (3) Seasonal variations concentrations of (Pb and Zn) µg/g from the study stations

Stations	Pb (µg/g)				Zn (µg/g)			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1	3.465	3.63	4.633	3.659	1.035	1.126	1.244	1.112
2 before	4.254	5.643	6.252	5.428	2.416	2.433	4.308	3.528
2 after	4.436	6.233	5.344	5.643	2.534	3.643	3.126	3.616
3	4.416	4.231	5.683	5.42	2.330	1.253	3.753	3.416
4	3.628	3.102	4.035	4.011	1.426	2.643	1.746	1.544
5 before	3.726	2.972	4.527	4.123	1.547	1.767	1.889	1.684
5 after	3.264	2.853	5.034	4.024	1.852	1.655	2.033	1.942
6	3.543	3.641	4.75	3.868	2.002	2.544	3.167	2.011
7	3.125	4.262	4.924	3.618	2.021	2.232	2.686	2.122
8	3.112	3.412	4.034	3.816	2.316	2.361	4.315	3.118
Mean	3.696	3.997	4.921	4.361	1.947	2.165	2.826	2.409

The variations in the concentrations of the element in the sediment sample between the seasons and studied stations, the highest concentration in the winter season in station (1) for all stations. The lowest concentration in effects of interior rivers discharge and sewage pollutants. The lowest concentration in the summer season was (1.035 µg/g) in station (1).

The concentration of Iron (Table 4), the highest concentration of the summer season sediment samples reached was (19.831 µg/g) in station (2) after water recharge, the lowest concentration was (4.723 µg/g) in station (6) and at mean (10.95 µg/g) for all stations, In the autumn season, the highest concentrations was reached to (19.842 µg/g) in station (2) after water recharge, the lower concentration reached was (4.252 µg/g) in station (8) and at mean (11.175 µg/g) for all stations, while in the winter season, it concentration rate of sediments are high as it was the highest concentration reached (21.546 µg/g) in station (2) after water recharge, the lowest concentration reached (6.421 µg/g) in station (6) and at mean (13.247 µg/g) for all stations. Also in the spring season, the highest concentration (20.013 µg/g) in station (2) after water recharge, the lowest concentration reached (5.852 µg/g) in station (6) and at mean (11.970 µg/g) for all stations. The highest concentration appeared in the winter season at station (2) after water recharge reached (21.546 µg/g), whereas the lowest concentration appeared in the autumn season in station (8) reached (4.252 µg/g). This fluctuation in concentration of Fe due to the seasonal changes and weather conditions of heat, light, wind speed, erosion and sedimentation processes which affect the sedimentation of Iron as a result of oxidation and reduction processes.

Table (4) Seasonal variations concentrations of (Fe µg/g) from the study stations

Stations	Summer	Autumn	Winter	Spring
1	14.544	13.622	16.33	15.645
2 before	17.341	17.721	20.426	18.832
2 after	19.831	19.842	21.546	20.013
3	12.543	14.683	15.427	13.686
4	13.686	13.721	16.469	14.714
5 before	7.645	7.891	9.423	8.654
5 after	8.429	7.831	9.949	8.943
6	4.723	6.731	6.421	5.852
7	5.430	5.462	8.541	6.874
8	5.328	4.252	7.943	6.493
Mean	10.95	11.175	13.247	11.970

TOC concentration (Table 5), the highest concentration of TOC% was (0.976 µg/g) at station (8) in the winter season, the lowest concentration at the station (5 before water discharge) reached was (0.729 µg/g). In the Summer season, the high concentration reached (0.723 µg/g) at station (7), the lowest concentration reached (0.557 µg/g) at station (5 before water discharge). The highest mean concentration (0.9019 µg/g), in the winter season, and the lowest mean concentration (0.6613 µg/g) in the summer season. The increase in TOC concentrations in winter season is due to increased water level, and decreased temperature. the absence of a gradient in

the TOC% values for all study stations and different stations, due to the amount of organic matter included in the sediment, the lack of TOC% concentrations in sediments, due to the sediments are Homogeneous in the ratios an grains size, so, have a difference a few of concentrations, while, the high concentrations of the TOC%, because the sediments are heterogeneous in their proportions and the size of the granules. Many previous research papers and studies [2,10,7,8,4,1,5,9,12].

Table (5)Mean concentrations of (TOC %) in stations of different seasons

Stations	Winter	Autumn	Spring	Summer
1	0.925	0.847	0.764	0.675
2 before	0.904	0.858	0.764	0.694
2 after	0.937	0.842	0.776	0.687
3	0.947	0.885	0.795	0.626
4	0.854	0.792	0.702	0.614
5 before	0.729	0.685	0.617	0.557
5 after	0.915	0.812	0.722	0.674
6	0.877	0.823	0.742	0.663
7	0.955	0.9	0.816	0.723
8	0.976	0.883	0.798	0.7
Mean	0.9019	0.8327	0.7496	0.6613

4.Conclusions

1. Heavy elements, when entering the aquatic environment, tend to be dispersed and distributed in living components, so the methods used to monitor the elements in the aquatic environment, by determining their concentrations in water and sediments.

2. Seven elements, are concentrated in sediments, and the elements are : (Cd, Cr, Cu, Ni, Zn, Pb, Fe).

3.In the sediments, the proportions of the metals appeared as follows :

21.546 >	6.252 >	4.315 >	3.208 >	2.829 >	0.527 >	0.429
Fe	Pb	Zn	Ni	Cr	Cu	Cd
Winter	Winter	Winter	Winter	Winter	Autumn	Autumn
2 after	2 before	8 St.	2 before	1 St.	5 before	2 after

4. Analysis (TOC%), showed that the values were (0.55- 0.9), during the different seasons, Winter values > Autumn values > Spring values > Summer values. The absence of a gradient with values (TOC%), due to the difference in the amount of organic matter included in the sediments.

References

[1]Agah, H., Hastroudi, M.S. and Baeyens, W. (2012). Trace Metals and Major Elements in Sediments of the Northern Persian Gulf Journal of the Persian Gulf (Marine Science) / Vol. 3 Wo. 7.

[2]Al-Hashimi, A.H., and H.H. Salman, 1985,"Trace Metals in the Sediments of the North-Western Coast of the Arabian Gulf", Mar.Poll.Bull., 16:pp. 118-120 .

[3]Al-Hejuje, M.M. (2015). Application of water quality and pollution indices to evaluate the water and sediments status in the middle part of Shatt Al-Arab River. Ph.D. Thesis, Biology Department, College of Science, University of Basra, 239 pp.

[4]Al-Imarah, F.J.M and Basim D. Al-Khafaji, 1997,"Effect of Industrial Effluent upon the Level of Trace Metals in Water and Sediments of Shatt Al-Arab", Proceedings of the Second National Symposium on Iraqi Environment, Basra, for 25-26 March 1997.

[5] Al-Khafaji ,B.Y. (1996)." Trace metals in water , sediments and fishes from Shatt Al-Arab Estuary North-West Arabian Gulf ". Ph.D. Thesis , Biology Dep. , College of Education , Univ. Basrah . 131 pp.

[6]Al-Khuzaie, D.K. (2015). Assessment of Sediment Quality Collected from Shatt Al-Arab River, Basrah, Southern Iraq, J. of international Acad. Res. For.Multidisc., 3(6):17pp.

[7]Al-Muddafr, N., T. Jassim, and I.N. Omer, 1992,"Distribution of Trace Metals in Sediments and Biota from Shatt Al-Arab", Mar. Mesop., 7 (1), pp. 49-61.

[8]Al-Saad, H.T., B.Y. Al-Kafaji, and A.A. Sultan,1996,"Distribution of Trace Metals in Water, Sediments and Biota Samples from Shatt Al-Arab Estuary", Mar. Mesop., 11 (1), pp. 63-77 .

[9] Al-Saad, H.T.; Al-Taein, S.M.; Al-Hello, M.A.R. and Dou Abul, A.A.Z.(2009). Hydrocarbons and Trace elements in water and sediments of the marsh land of Southern Iraq. Mesopotamian Journal of Marine Science, 24(2): 126- 139.

[10] Al-Sabah, B.J.,2007, Study of Physiochemical Behavior of Polluted Mineral Elements for Water and Sediments of Shatt AL-Arab, Ph.D. Thesis, College of Agriculture, University of Basra, 217p.

[11]Chester , R. & Voutsinou, F.G.(1981)." The initial Assessment of Trace Metal Pollution in Coastal Sediments". Mar. Poll. Bull. ,12(3):84-91.

[12]Jaagumagi, R., (1990). Draft development of the Ontario Provincial Sediment Quality Guidelines for Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel and Zinc, Water Resources Branch, Ontario Ministry of Environment. 10 pp.

[13]Krajnc, E.I., (1987). Integrated criteria document. Cadmium Effect Appendix Bilthoven, Netherlands " National Institute of Public Health and Environmental Protection, (Report No. 758476004).

[14] Sparks, D.L.; Page, A. I.; Helmke, D. A.; Loeppert, R. H.; Soltanppour, P. N.; Tabatabai, M. A.; Johnston, C. T. and Sumner, M. E. (1996). Methods of Soil Analysis .Part 3. Chemical methods. S.S.S. of Am., Inc. Madison Wisconsin. USA.

[15] Varol, M.; and Sen, B. (2012). Assessment of Nutrient and Heavy Metal Contamination in Surface Water and Sediments of the Upper Tigris River, Turkey, Catena, 92: 1-10.