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Determination of some trace metals in water of Shatt Al-Arab River during 2007-2008

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Abstract

The present study is an attempt for assessment the aquatic ecosystem of Shatt Al- Arab River by measuring the trace metals (Cd , Co , Ni , Pb , Cu and Fe) in water collected in four locations (Qurmat-Ali , Al-Muftiya , Al-Seba and Rass Al-Besha) which represent different levels and sources of human impact., the results showed that the highest concentration of the trace metals in the Rass Al-Besha location (14.48 , 84.24 , 38.74 , 41.09 , 10.55 , 145.49) µg ⁄ l for trace metals (Cd , Co , Ni , Pb , Cu and Fe) respectively , the highest concentration of the trace metals is Cadmium in all locations , Cobalt was the highest in two locations (Rass Al-Besha and Al- Seba) comparing with the concentrated standard allowed by the system of maintenance of River pollution form No. 25 of 1967 (Service Specifications Iraqi and standards) , and levels in the international determinate of draft drainage from world health organization WHO, 1993 and Japan specification EQS ,2001. While the lowest concentration (4.25 , 39.76 , 11.80) µg ⁄ l for trace metals (Cd , Co , Ni) respectively in the Qurmat-Ali location , (21.60 , 64.44) µg ⁄ l for Pb and Fe respectively Al-Muftiya location , 5.25 µg ⁄ l for Cu in the Al- Seba location . Thus, this study allows to validate the use of trace metals as an indicator for assessment the aquatic ecosystem of Shatt Al-Arab River .

Key words: Shatt Al-Arab, trace metals, pollution.

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Introduction

Trace metals are considered pollutants which cause a disturbance in the environmental system because it cannot removed easily by natural operations like any organic pollutants (Cousins *et al*., 2002). The aquatic environment that is most concerned by human activities and pollutants which includes industrial and domestic sewage , mining and atmospheric distribution (Batley , 1995). In Basrah city the problem of environmental pollution has been worsen because of the large quantities of industrial wastes, waste water, fertilizers and pesticides, which find their way into the side branches and then to the Shatt Al - Arab then up to the different organisms (Abdullah *et al*., 2007 ; Al-Hejuje,1997), pollutants may be enter the aquatic environment through physical processes like, erosion and rainfalls which bring granules like Lead, sediments, or through biological processes, which include up take the metals by organisms and then extracted and decomposition of these organisms , this session called biogeochemical cycle (Bieny *et al*., 1994) , or may be move through currents of the sources of water and deposited to the bottom (Abdullah *et al*., 2007) .The comparison of metals contamination in different aquatic environment is possible by analylsis of water (Manfra and Accomero, 2005). Al-Saad *et al*., (1996) illustrated that the Shatt Al-Arab water polluted by trace metals fall within the acceptable level after compared to similar studies in other regions of the world , Abaychi & DouAbal ,(1985) found that the northern part of the Shatt Al-Arab polluted by the metals Nickel and Vanadium , while Al-Kafaji *et al*.,(1997) showed that the trace metals, within the accepting of the limit with the exception concentration of Iron . Al-Kafaji (2000) pointed in another study on trace metals for a rise in the suspended parts of the water more than the dissolved , while Awad *et al*. (2004) noticed that the trace metals within the accepting limit with the Nickel .

The aim of the present study is the assessment of trace metals pollution in the ecosystem of Shatt Al-Arab River by using trace metals as an indicator. Using standard concentrations in order to know the upper and lower levels of comparison with the accepting limit .

Materials and methods

Seasonal samples collected from four locations (Qurmat-Ali, Al-Muftiya, Al-Seba and Rass Al-Besha) .(Figure1). From October 2007 to September 2008. Utilizing a method (Riley & Taylor ,1968) to extract the trace metals dissolved in the water by passing the water sample volume of 3 liters through the filter paper type GFF (0.45) Micrometer. Residue passed through the ion exchange column 50 cm long and 2.5 cm in diameter, containing the type of resin (Chelex -100) run at speeds of 2 ml per minute in order to capture trace metals by the resin, then wash the resin at about 20 ml of distilled water free of ions. Passing 30 ml of nitric acid concentration of 2 N to dissolve the trace metals conjoined resin and transferred in plastic containers and evaporate the solution to near drought using a water bath, after which the remaining part is dissolved in 1 ml of hydrochloric acid 0.5-N and then complete the sized to 25 ml distilled water free of ions preserving the volume of plastic bottles and closing titely to become a sample ready for analysis. Use of a AAS Flame Atomic Absorption Spectrophotometer with a Cathode Lamp for each particular trace metals.

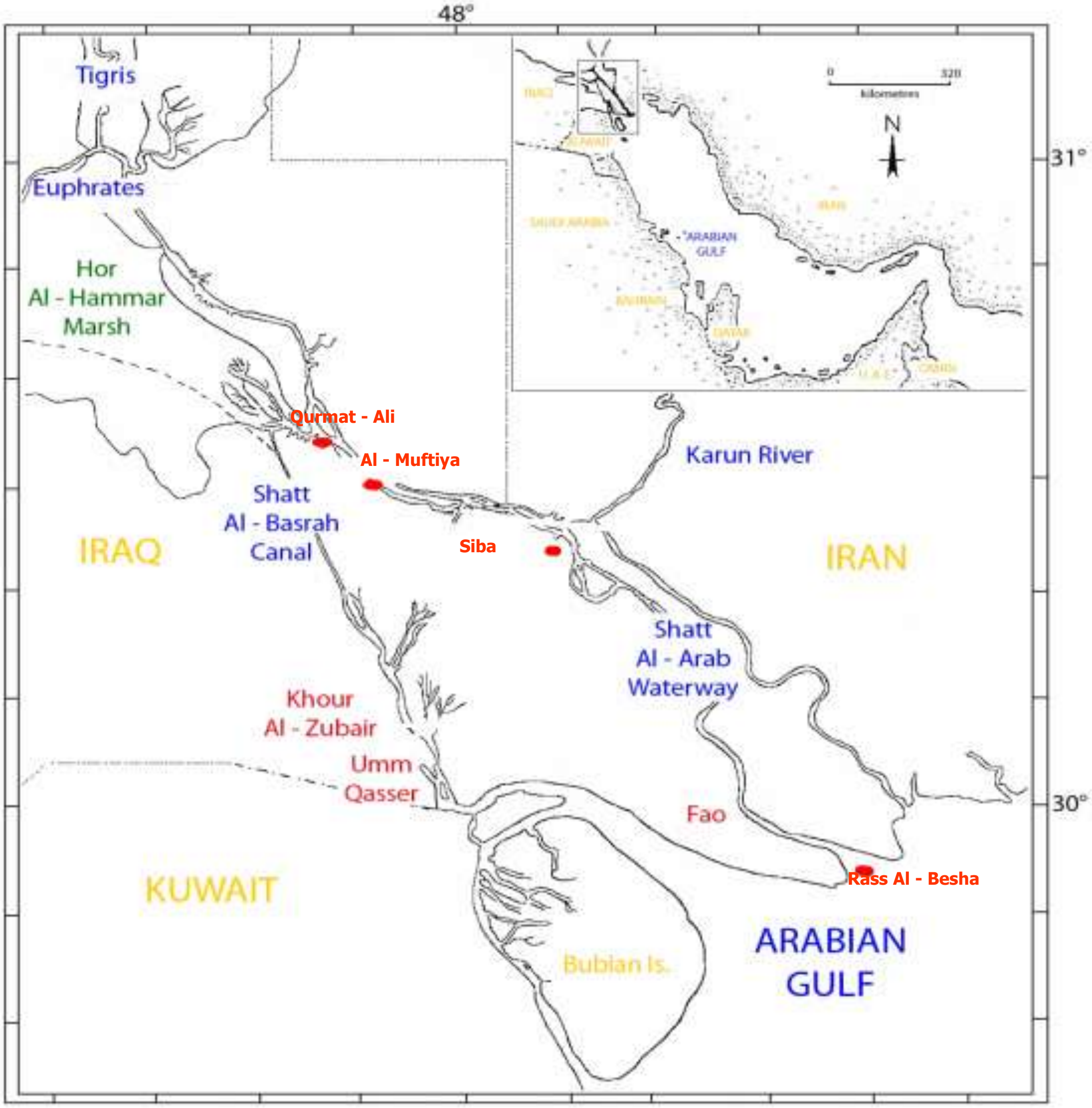

Figure 1. Location map of the study area showing the sampling stations

Results and discussion

Results showed the highest concentration of Cadmium is in the locations ,Rass Al-Besha , Al- Seba and Al-Muftiya . Cobalt is highest in the locations Rass Al-Besha and Al- Seba) comparing with the concentrated Standard allowed by the system of maintenance of River pollution form No. 25 of 1967 (Service Specifications Iraqi and standards). While the lowest concentration of Nickel and Lead compared with the concentrated standard

, but they recorded high concentration than the allowable levels in the international determinate of draft drainage from world and health organization (WHO , 1993) and Japan specification (EQS , 2001) (Table 6). We notice a seasonal variation that increasing in concentrations for these metals during the Summer and decreasing during the Winter , the reason may be increasing of temperature degrees during the Summer will increase the range of evaporation or may be due to the agricultural activates and this is consistent with the Mahmood , (2008) , while decreasing during the Winter season may be due to the rain which causes the dilution and this is consistent with the Al-khafaji (1996) . We notice increasing in concentration during the Spring and Autumn the reason may be due to the domestic sewage, (Table 1 – 4)). The concentrations of Zinc and Iron lower than the allowable levels from prior specification (Table 5). The reason increasing of concentration of Cd and Co was the sewage and the agricultural activates and this is consistent with the (Abaychi & DouAbul 1985 ; Hossain & Khan 2000) . It could cause those metals to the regarded with the crude oil and access to the environment due to oil leakage during transport, loading, and this is consistent with the Al-lmarah, (2001), that waters of the Shatt al-Arab to be affected by the transfer and loading and unloading as well as waste oil, which has thrown the mass transport of water and a source of pollution of trace metals because of the oil was containing certain ratios of these metals (DouAbul *et al*., 1987; Abaychi & Mustafa, 1988). Al-Taein (2006) illustrated that the concentration of trace metals are subject to changes in regular seasonally instance like temperature , water level and rise of water or irregular changes like agricultural wastes , household and industrial waste . There was significant heterogeneity between the concentrated and more dispersed when they are small differences between the values and the standards of a few to give an idea of the averages the extent of homogeneity or variation of these values on the status of any degree of proliferation.

Generally it was not recorded in this study a high concentration of trace metals studied except Cadmium in the stations (Rass Al-Besha , Al- Seba and Al-Muftiya). Cobalt in two locations (Rass Al-Besha and Al- Seba) because of the dilution factor affected by tidal movement of the Shatt al-Arab with the Arabian Gulf , and affected by drainage, especially during the seasons of Autumn and Winter which rains have an important role, as explained by (Al-lmarah, 2001). Increasing water discharge in the end of the Winter and early Spring, leading to the water being released, which leads to a decrease in concentration of proliferation and thus to reduce pollutants and this is consistent with the present study.

conclusion

The finding of this study showed that the trace metals has potential to be used as an indicator for the assessment the environment of Shatt Al-Arab River which could be directly detrimental to the health of the aquatic ecosystem and indirectly to organism, since the River water is used to irrigate a nearby farmland, hence continual assessment is highly essential .

Table 1. Concentration levels of trace metals in water (µg ⁄ l± S.D) from Shatt Al-Arab during autumn 2007.

LOCATIONS	TRACE METALS					
	Cd	Co	Ni	Pb	Cu	Fe
Qurmat-Ali	3.51±0.232	42.90±2.762	14.74±1.176	38.21±1.924	7.93±0.761	99.08±4.564
Muftiya	7.19±0.482	51.32±2.934	21.29±1.986	30.19±1.768	8.05±0.867	55.32±3.453
Al-Seba	4.34±0.424	60.01±3.641	35.15±1.865	29.33±1.215	6.49±0.352	83.11±4.976
RassAl-Besha	16.20±0.127	78.11±3.853	42.91±2.768	35.72±2.537	5.29±0.312	176.45±3.875

* Values are mean of triplicate analysis

Table 2. Concentration levels of trace metals in water (µg ⁄ l± S.D) from Shatt Al- Arab during Winter 2008 .

LOCATIONS	TRACE METALS					
	Cd	C0	Ni	Pb	Cu	Fe
Qurmat-Ali	1.57±0.682	30.72±2.641	6.99±0.978	24.92±1.641	4.92±0.512	86.34±4.298
Muftiya	4.90±0.385	28.89±2.243	4.51±0.582	14.63±0.973	5.77±0.487	40.62±2.769
Al-Seba	5.51±0.131	40.61±3.165	25.58±2.824	18.09±0.432	2.11±0.225	71.55±3.143
RassAl-Besha	8.30±2.634	71.53±4.682	30.07±2.741	30.5±2.8321	7.55±0.694	54.08±2.998

Table 3. Concentration levels of trace metals in water (µg ⁄ l) from Shatt Al-Arab during Spring 2008 .

LOCATIONS	TRACE METALS					
	Cd	Co	Ni	Pb	Cu	Fe
Qurmat-Ali	5.01±0.121	34.85±2.265	8.61±1.412	27.74±1.953	11.11±0.812	105.33±5.676
Muftiya	6.39±1.351	32.31±2.122	16.55±2.632	13.07±0.787	8.90±0.554	60.08±3.885
Al-Seba	12.99±1.987	52.82±2.879	23.11±2.886	28.06±3.112	6.00±0.665	90.91±4.991
RassAl-Besha	11.27±1.321	96.21±4.875	23.52±2.787	38.15±2.885	13.31±1.669	119.39 ±5.99

Table 4. Concentration levels of trace metals in water (μg/l± S.D) from Shatt Al-Arab during Summer 2008 .

LOCATIONS	TRACE METALS					
	Cd	Co	Ni	Pb	Cu	Fe
Qurmat-Ali	6.91±0.223	50.56±2.969	16.86±1.212	42.33±3.123	14.24±1.775	203.39±6.755
Muftiya	9.08±0.839	55.28±2.998	22.05±1.887	28.51±1.832	10.52±0.511	101.73±4.99
Al-Seba	15.24±1.587	73.59±3.984	30.68±2.813	36.12±1.748	6.40±0.665	133.51±5.663
RassAl-Besha	22.15±1.857	91.09±3.993	58.46±3.114	59.98±3.691	16.05±2.712	232.04±6.999

* Values are mean of triplicate analysis

Table 5. Total Concentration levels of trace metals in water (μg/l± S.D) from Shatt Al-Arab during study period and comparison of standard Concentration

LOCATIONS	CD	CO	NI	PB	CU	FE
Qurmat-Ali	4.25±0.223	39.79±2.451	11.80±0.229	33.30±2.889	9.55±0.376	123.54±6.233
Muftiya	6.89±0.665	41.95±3.554	16.16±1.991	21.60±1.785	8.31±0.723	64.44±4.287
Al-Seba	9.52±1.234	56.76±3.996	28.63±2.212	27.90±1.994	5.25±0.451	94.77±5.664
RassAl-Besha	14.84±1.997	84.24±4.887	38.74±2.532	41.09±3.923	10.55±0.899	145.49±6.984

* Values are mean of triplicate analysis

Table 6. comparison of standard concentrations (μg/l).

	CD	CO	NI	PB	CU	FE
RIVERS MAINTAINING SYSTEM 1967	5.00	50.00	100.00	50.00	50.00	300.00
WHO standards 1993	3.00	-	20.00	10.00	-	-
EQS standards 2001	10.00	-	10.00	10.00	40.00	-

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قياس تراكيز بعض العناصر النزرة في مياه شط العرب خلال 2007 – 2008

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الخلاصة

تضمنت الدراسة الحالية تقييم بيئة شط العرب من العناصر النزرة (الكادميوم , الكوبلت , النيكل , الرصاص , النحاس ، الحديد) في مواقع (كرمة علي , المفتية , السيبة , رأس البيشة) . أظهرت النتائج أرتفاعاً للعناصر المدروسة في موقع رأس البيشة اذ بلغت (14.48 ، 84.24 ، 38.74 ، 41.09 ، 10.55 ، 145.49) مايكغم / لتر للعناصر (الكادميوم , الكوبلت , النيكل , الرصاص , النحاس ، الحديد) على التوالي ، وسجل عنصر الكادميوم أرتفاعاً في المواقع المدروسة وعنصر الكوبلت في موقعي رأس البيشة والمفتية عن الحدود المسموح بها في المحددات البيئية لنظام صيانة الأنهار العراقية من التلوث والمحددات الدولية لمياه الشرب من قبل WHO لسنة 1993 والمواصفات اليابانية EQS لسنة 2001 . بلغت اقل معدلات التراكيز (4.25 ، 39.76 ، 11.80) مايكغم / لتر للعناصر (الكادميوم ، الكوبلت ، النيكل) على التوالي في موقع كرمة علي و (21.60 ، 464.4) مايكغم / لتر لعنصري الرصاص والحديد على التوالي في موقع المفتية و(5.25) مايكغم / لتر لعنصر النحاس في محطة السيبة . وتم التقييم على اساس الاختلافات في التراكيز . وعليه فان هذه الدراسة تسمح باستخدام العناصر النزرة كدليل لتقييم بيئة شط العرب .

كلمات مفتاحيه : شط العرب ، العناصر النزرة، التلوث.