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LEVELS OF TRACE METALS IN SHATT Al-ARAB BRANCHES DURING SPRING AND SUMMER SEASONS, 2006.

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ABSTRACT

The levels of trace metals Co, Cu, Ni and Zn in both dissolved and particulate phases of water from six branches of Shatt Al-Arab River have been investigated during two seasons, spring and summer 2006 by means of Atomic Absorption Spectrophotometry. Levels recorded in µg/ml were: Co (0.019-0.078), Cu(0.163 - 0.240), Ni(0.035 – 0.094) and Zn (0.130–0.215) in dissolved phase during both seasons compared to particulate phase in which levels recorded in µg/g were Co (11.10 – 26.468), Cu(76.340- 376.543), Ni (7.778 – 150.676) and Zn (222.546 – 654.128). These levels were higher than most previous studies at the same sites. It is appeared that all studied branches are highly polluted and water appears highly turbid, viscose and greenish in color due to the expected abundance of phytoplanktons.

Key Words: Trace Metals, Shatt Al-Arab Branches, Atomic Absorption, Dissolved, Particulates.

INTRODUCTION

There are mainly a different sources of pollutants in aquatic environment, such as, organic materials, major ions and trace metals. They contribute to different sources as natural or anthropogenic. Some natural sources include storm dust-fall, erosion or crustal weathering as well as dead and decomposed biota in water, whereas the anthropogenic sources include sewage, industrial, agricultural and automobile waste in addition to shipwrecks and dumping of war materials (Lioyd, 1992; FAO, 1994; Al-Saad, 1995).

As a result of direct discharges of wastes containing different pollutants to the aquatic environment among which are the trace metals, their levels will increase in water column, moreover, sedimentation could happened in which sediments acts as archive for many pollutants (Förestner and Wittman,1979).

Shatt Al-Arab river is originates from the confluence of Tigris and Euphrates rivers at Qurnah town Northern Basrah city. Starting from its beginning, Shatt Al-Arab River receives and discharges water through hundreds of canals on both sides. Within Basrah city there are tens of these canals in which six of them represented the greatest running through the city carrying huge amounts of untreated domestic sewage (Al-Hejuje, 1997). Among these canals which are located from south to north and known as creeks are the following: Al-Khorah, Al-Ashar, Al-Khandak, Al-Rubat, Al-Jubaylah and Shatt Al-Turek.

Pollution studies of these canals were very few and mostly focused upon separate canals such as for Al-Khandak (Al-Hejuje, 1997) and Al-Jubaylah (Al-Khafaji, 2000; Al-Imarah *et al*, 2006), in addition to comprehensive studies for Shatt Al-Arab river and its branches such as: Al-Saadi and Antoine,(1981); Al-Issa,(1981); Saad and Antoine, (1982); DouAbul *et al*, (1987) and Al-Aarajy, *et al*., (1992).

The aim of this study was to evaluate the extent of pollution by trace metals in Shatt Al-Arab river branches within Basrah city .

STUDY AREA

Water quality for pollution by trace metals in Shatt Al-Arab branches, as shown in figure 1 was investigated in the main six: Al-Khorah, Al-Ashar, Al-Khandaque, Al-Rubat Al-Jubaylah and Shatt A-Turek. All of them are passing through a region of highly populated density which carries huge amounts of domestic, industrial or agricultural wastes towards Shatt Al-Arab River. They are affecting by law and high tides of Shatt Al-Arab River.

MATERIALS AND METHODS

One site from the midway of each of Shatt Al-Arab branches: Al-Khorah, Al-Ashare, Al-Khandak, Al-Rubat, Al-Jubaylah and Shatt Al-Turek canals, were selected in this study. Acid washed polyethylene bottles were used for sampling water which collected from each site a way from shore by 3-5 m during the two seasons Spring and Summer along the year 2006, few drops of concentrated nitric acid were added to each container as a preservative agent for trace metals analysis (Korkish and Sorio, 1975).

Water samples were transferred to the laboratory and stored in refrigerator prior to trace metals analysis, then water samples were filtered through pre-washed 0.45 μm Millipore membrane filters. Materials passing through the filters were considered as dissolved while those retained as particulate.

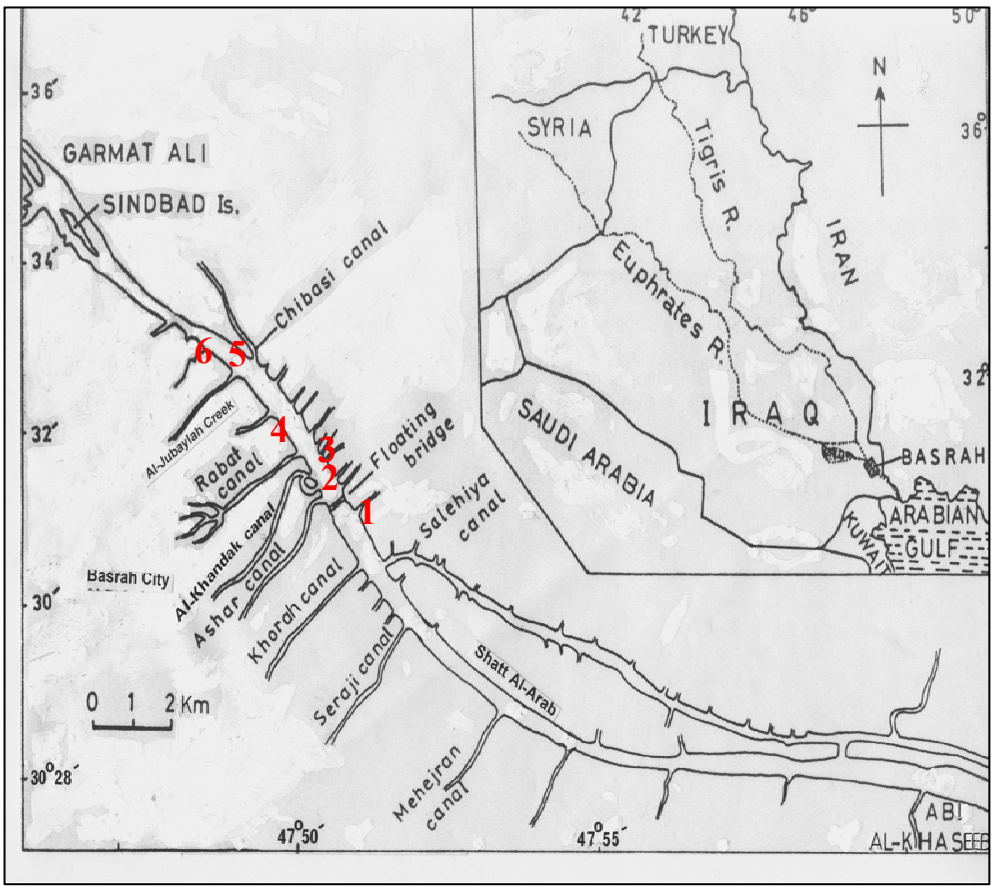

Fig. 1. Branches of Shatt Al-Arab River penetrating Basrah city.

The dissolved trace metals were concentrated by using chelex-100 resin following a modified procedure for that described by Riely and Taylor (1968).

Trace metals as particulate phase of water were analyzed following the procedure described by Sturgeon et al. (1982).

Trace metals in both phases of water, dissolved and particulate, were determined by Flame Atomic Absorption spectrophotometer Model SP 9, and deionised water was used throughout the analysis.

RESULTS and DISCUSSION

The concentrations of the present study in both phases , dissolved and particulate forms during the two seasons are listed in tables 1 and 2 respectively.

Table 1. Concentrations of trace metals in water samples from Shatt Al-Arab branches during Spring 2006.

Trace metals►► Canals ▼	Co	Cu	Ni	Zn
	Dissolve phase (μg/ml)			
1-Al-Khorah	0.046	0.190	0.039	0.160
2-Al-Ashar	0.06	0.220	0.040	0.130
3-Al-Khandak	0.075	0.240	0.090	0.220
4-Al-Rubat	0.078	0.235	0.094	0.215
5-Al-Jubaylah	0.045	0.214	0.063	0.360
6-Shatt Al-Turek	0.049	0.198	0.072	0.146
	Particulate phase (μg/g)			
1-Al-Khorah	11.10	156.444	126.650	509.234
2-Al-Ashar	20.876	245.672	124.546	634.654
3-Al-Khandak	24.543	376.543	139.765	743.765
4-Al-Rubat	24.342	345.873	150.676	654.128
5-Al-Jubaylah	12.650	298.534	140.980	324.290
6-Shatt Al-Turek	14. 450	81. 340	124.762	222.546

Table 2. Concentrations of trace metals in water samples from Shatt Al-Arab branches during Summer 2006.

Trace metals►► Canals ▼	Co	Cu	Ni	Zn
	Dissolve phase (μg/ml)			
1-Al-Khorah	0.019	0.175	0.038	0.140
2-Al-Ashar	0.024	0.163	0.042	0.110
3-Al-Khandak	0.029	0.205	0.039	0.190
4-Al-Rubat	0.098	0.202	0.040	0.200
5-Al-Jubaylah	0.086	0.196	0.036	0.185
6-Shatt Al-Turek	0.049	0.201	0.035	0.130
	Particulate phase (μg/g)			
1-Al-Khorah	18.145	78.068	7.778	223.546
2-Al-Ashar	19.425	86.668	8.546	209.654
3-Al-Khandak	26.468	92.765	12.820	256.987
4-Al-Rubat	20.432	88.876	12.068	323.168
5-Al-Jubaylah	19.874	81.34	9.987	333.512
6-Shatt Al-Turek	14.450	76. 340	6.946	243.765

DISCUSSION

Trace metals are distributed in the aquatic environment in different phases and states. They exist as dissolved in water, adsorbed on particulate or in sediment, or incorporated within the inner Skelton. In general the levels of trace metals in dissolved phase were lower than those in

particulate matter in both season in six stations of this study. The particulate matter play a great role in the distribution of trace metals between dissolved phase in water and precipitation in sediments (Al-Khafaji, 1996). Moreover, the concentrations of studied trace metals in the selected stations were higher than those reported during the last decade (Al-Hejuje, 1997; Al-Khafaji, 2000; Al-Imarah *et al*., 2006), as well as those reported in nearby areas (Al-Imarah *et al.*, 1998: Ali, 2004) which is explained on the basis of increase domestic waste discharges to these branches without treatment, which is in accordance with the findings of Al-Saadi et al. (1995) during their study for Al-Razazah leak, they explained the increase in trace metals due to the presence of huge amounts of organic matter in the discharging waste in which these organic matter undergo decomposition leading to increase carbon dioxide in these canals and in turn decrease the pH which lead to liberate and release trace metals from organic matter and finally their concentrations will increase in the water (Parry and Hayward, 1973). Furthermore, the levels of trace metals in both dissolved and particulate phases of water from studied branches are different from branch to another due to the effect of water flow within each branch as well as the effect of tides from Shatt Al-Arab river it self. During period of study water flow was high in Al-Khorah, Al-Ashar branches and Shatt Al-Turek showed water flow in a certain level as well, while water flow in Al-Khandak and Al-Rubat branches were very rare in which they reported the highest levels of trace metals which is accompanied by highly abundance of phytoplankton's and highly colored waters(Maulood, *et al*., 1979; Al-Aaraji, 1996). In addition to that, levels of trace metals are changed according to type and density of phytoplankton in each study station (Kessler, 1986; Patterson, 1983).

Seasonally it is shown that most levels of trace metals in dissolved and particulate phases of water were changed in which higher levels were reported during spring, while during summer levels were low which could be explained due to the effect of temperature and water flushing following the increase activity of human being.

In comparison with results for studies in nearby stations it is found that there is a relative increase in the levels of trace metals in this study compared with past studies, as shown in table 3 for dissolved trace metals and table 4 for particulate matter. Even though levels are still lower than or within the levels according to Iraqi standards for inner waters (Al-Ani, 1987).

Table 3. comparison between concentrations of trace metals (in µg/l)in the dissolved phase of water from different locations.

Location	Co	Cu	Ni	Zn	Reference
Shatt Al-Arab River	-	-	1.202	1.364	Al-Imarah,2001
Shatt Al-Basrah canal	0.05	2.64	0.26	5.86	Al-Imarah et al., 2000
Shatt Al-Arab estuary	0.37	0.47	2.85	0.82	Al-Imarah *et al*., 1998
Al-Jubaylah canal	-	0.56	-	4.3	Al- Khafaji, 2000
Al-Jubaylah canal	-	0.84	0.42	1.05	Al-Imarah et al., 2006
Al-Khandak & Al-Ashar canals	-	2.14	-	13.25	Al-Hejuje, 1997
Southern wetlands, Iraq	265.23	23.02	154.30	118.51	Al-Imarah et al., 2007
Maximum limits	100	3000	1000	15000	Al-Ani, 1978
Basrah Branches	55.05	225.35	62.08	250.85	Present study

Table 4. comparison between concentrations of trace metals (in µg/g) in the particulate phase of water from different locations.

Location	Co	Cu	Ni	Zn	Reference
Shatt Al-Arab River	-	489.04	19.56	161.30	Mustafa,1985
Shatt Al-Arab River	-	77	-	77	Abaychi and DouAbul, 1985
Shatt Al-Arab estuary	6.07	35.55	493.65	46.23	Al-Khafaji, 1996
Al-Jubaylah canal	-	56	-	6589.3	Al- Khafaji, 2000
Al-Ashar and Al-Khandak canals	-	108.39	-	15951.55	Al-Hejuje, 1997
Basrah Branches	55.05	225.35	62.08	250.85	Present study

Conclusion

There is an increase in the levels of trace metals Co, Cu, Ni and Zn in these locations as a result of untreated sewage disposal.

Despite the tidal phenomenon, Basrah branches do not get flushed properly by the water of the Shatt Al-Arab River on account of insufficient penetration of water during high tides.

To overcome the pollution situation of Basrah branches, suggestions are:

1 - Rehabilitate the construction of the sewerage system for the City of Basrah.

2 - Using a pumps in the near ends of branches to Shatt Al-Arab River to flush the polluted water and flow of fresh water from Shatt Al-Arab River to achieve the required renewal of water.

3 - Creation of loops by connecting the far ends of each two or more branches.

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مستويات المعادن النزرة في الانهر الفرعية لشط العرب خلال فصلي الربيع والصيف 2006.

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الخلاصة

تم تقييم مستويات المعادن النزرة هي الكوبلـت والنحـاس والنيكـل والخارصين في الجزئين الذائب والعالق في مياه ستة انهار فرعية من شـط العرب وذلك خلال موسمي الربيع والصيف من عـام 2006. واسـتخدمت تقنية الامتصاص الذري في القياسات. وكانت المستويات المسجلة في الجـزء الذائب من المياه وبوحدات مايكروغرام/ مللي لتر بحدود كوبلت (0.049 - 0.078) ونحاس (0.163-0.240) و نيكل (0.035 – 0.094) و خارصين (0.130 – 0.215) خلال موسمي الدرا سة، وفي الجزء العالق فـي الميـاه كانت المستويات وبوحدات مايكروغرام/غـرام بحـدود كوبلـت (11.10– 26.468) ونحاس (76.340- 376.543) و نيكـل (7.778 – 150.676) وخارصين (222.546 – 654.128). و هـذه المـستويات ا اعلـى مـن المستويات المسجلة في دراسات سابقة لنفس المنطقة، و يتـضح فـي هـذه الدراسة ان جميع القنوات الفرعية المدروسة من شط العرب كانـت عاليـة التلوث والتي تتميز بالعكورة واللازوجة العاليتين وبلون مائل الـى الخـضرة بسبب وفرة الهائمات النباتية.