

## Toxic Environmental Parameters in Water Samples from some aquatic wetlands southern Iraq.

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### Abstract:

In this study, estimation has done for some toxic elements; Phosphorus(P), Arsenic(As), Cadmium (Cd), Mercury(Hg) and Lead(Pb), as well as pH, conductivity(EC), Total Dissolved Solids (TDS) and Chloride (Cl-) in the waters of 4 sites in Shatt Al-Arab River(1- Ashar, 2-Sehan, 3-Seebah and 4-Fao), in addition to another three sites, 5- Al-Hewaizah Marsh, 6- Water supply for fish lake and 7- Tigris River. All of these sites represent sources for multi uses waters. High value of total phosphorous 0.4 mg/l was recorded in Fao station 4 and 0.5 mg/l in Al-Hewaizah marsh station 5, Mercury ranged between 0.003 mg/l in station 7 and 0.0062 mg/l in station 6. For Arsenic lower value was recorded as 0.002 mg/l in station 7, and higher values as 0.52 mg/l in station 3. For cadmium values recorded were in the same trend as Arsenic, lower values as 0.00003 mg/l in station 5 and higher value as 0.007 mg/l in station 4, while levels of Lead were alternative with lower value of 0.006 mg/l in station 3, and as higher as 0.0216 mg/l in station 7. pH values reported ranged between 7.52 and 7.88 in stations 5 and 6 respectively. Conductivity and TDS as well as chloride were coincide as higher values recorded in the water of Shatt Al-Arab river, stations 1-4 (11860 – 47700  $\mu$ S/cm, 11500 – 40300 mg/l and 5690 – 31670 mg/l) respectively due to the effect of water from Arabian Gulf during high tide as well as station 6 ( 30900  $\mu$ S/cm, 27250 mg/l and 17900 mg/l) respectively and lower values in ( 575  $\mu$ S/cm, 390 mg/l and 97 mg/l) respectively in station 7. Taking in consideration that the permissible levels set by WHO and USEPA for major parameters within this study are 0.06 – 0.12 mg/l for phosphorous, 0.00001 mg/l for arsenic, 0.00025 – 0.002 mg/l for cadmium, 0.00077 – 0.0014 mg/l for mercury and 0.05 mg/l for lead.

### 1-Introduction :

Nearly 3 million people from southern Iraq supply their water for different uses from Shatt Al-Arab River and Southern marshes. These waters are characterized by tens of environmental parameters, trace elements(

As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn, etc), physical(pH, conductivity, salinity etc) and Chemical (dissolved oxygen, carbonates, bicarbonates, silicates, calcium, magnesium, fluoride...etc). Some of the'se parameters such as trace elements Cr, Cu, Ni Zn are essential

for living organisms, others are non essential such as mercury, lead, arsenic, cadmium...etc, while some essential parameters like nitrate and phosphate become toxic when they present in high concentrations. Non essential trace elements have no known biological function but are toxic elements (Viarengo, 1985). It is expected that high tide from the Arabian Gulf will drive saline water toward the northern parts of Shatt Al-Arab River, some time reaching the borders of Al-Hewaizah and Al-Hammar Marshes (Alwash,2009).

## **Materials and Methods**

### **Study area**

Water samples were collected from the subsurface layer from different sites along Al-Hewaizah marsh and Shatt Al-Arab river (as shown in Fig. 1).

### **Analysis**

For the present study, the physico-chemical parameters of water from Shatt Al-

Arab River and Al-Hewaizah Marshland were recorded in one period of time for summer 2009.

pH (unitless) and conductivity ( $\mu\text{S}/\text{cm}$ ) were measured on the spot using multi purpose portable apparatus, TDS (mg/l), chloride(mg/l) and inorganic phosphates(mg/l) were analyzed according to the standard methods given in APAH (1998). For the determination of Total Phosphorous, unfiltered water samples were conserved with chloroform.

Trace elements Cd and Pb (both in mg/l) were determined by Atomic Absorption Spectrophotometer, AAS Pye Unicam model SP9 and using deionized water for the whole analysis. Mercury (Hg in mg/l) was determined by cold vapor Atomic Absorption Spectrophotometric technique, while spectrophotometry was adopted for the determination of arsenic(As in mg/l).

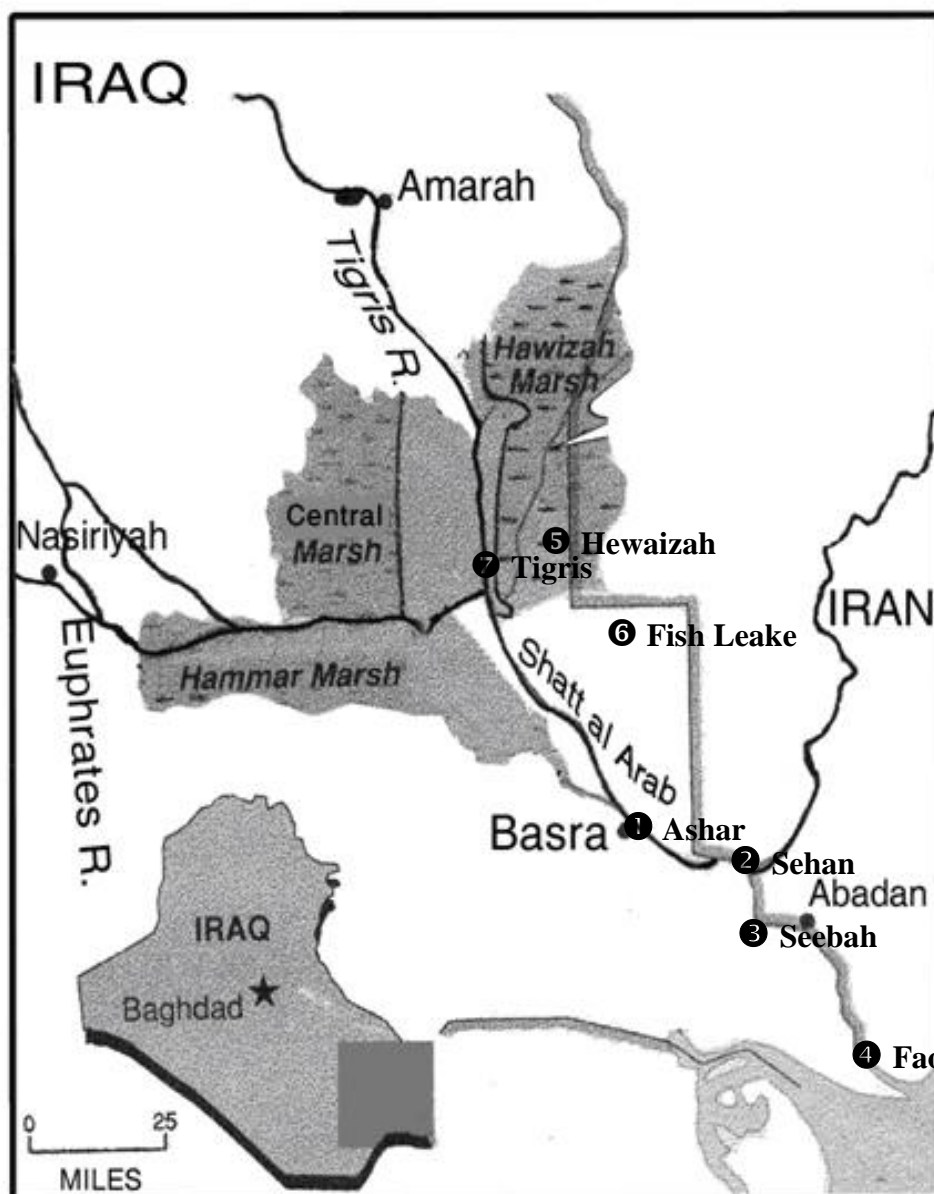


Figure (1) Map of southern Iraq showing positions of sampling sites (1-7)

### Results and Discussion

The major qualitative water parameters were estimated in each site from at least two places, parameters estimated were; pH, EC, TDS, Chloride, Total Phosphorus and trace elements, As, Cd, Hg, and Pb. Table 1 shows the results of investigated water quality .

Changes in the pH of aquatic environment affect fishes by altering the enzyme activities or electrolyte composition of body fluid,

provide severe stress.(Moyle and Cech, 2004).Measured pH in this study (6.9- 7.89) as shown in fig.2) indicating natural-alkaline water which is not harmful to fish. The raising in pH may be due to removal of carbon dioxide from the water by photosynthesis of phytoplankton, and removing of hydrogen ions in response to photosynthesis (Esmaili, 2006).

Phosphorus is available to green plants in the form of phosphate, which is derived under natural conditions from phosphate bearing rocks, and also added to natural waters by human waste.

Total dissolved solids denote mainly the various kinds of mainly presenting the water. In natural waters, dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates, and nitrates of calcium, magnesium, sodium, potassium, iron and manganese etc. In the polluted waters, the concentration of other substances increases depending upon the type of pollution .

In this study it is found that values of TDS in the water of Shatt Al-Arab river are increased from north(Tigris) to south(Fao), as shown in fig.4, which is coincide with the findings of Hussain et al., (2009). This increasing in the salinity of Shatt Al-Arab waters has a great effect upon animal production,(Cattle, Chicken, Birds...etc.) ( Al-Hilfy, 2009).

Conductivity is the numerical expression of the ability of a water sample to carry an electric current and could be a sign of productivity of the water body. Results from this study showed that values of conductivity ranged 575  $\mu\text{S}/\text{cm}$  in Tigris river and 47700  $\mu\text{S}/\text{cm}$  in Fao.

High values reported within this study were in sites 1-5 due to high tide water from Arabian Gulf. In the other sites conductivities reported were due to discharging of sewage in the Shatt Al- Arab with out treatment.

In aquatic ecosystems water contamination by trace metals is one of the main types of pollution and pose serious

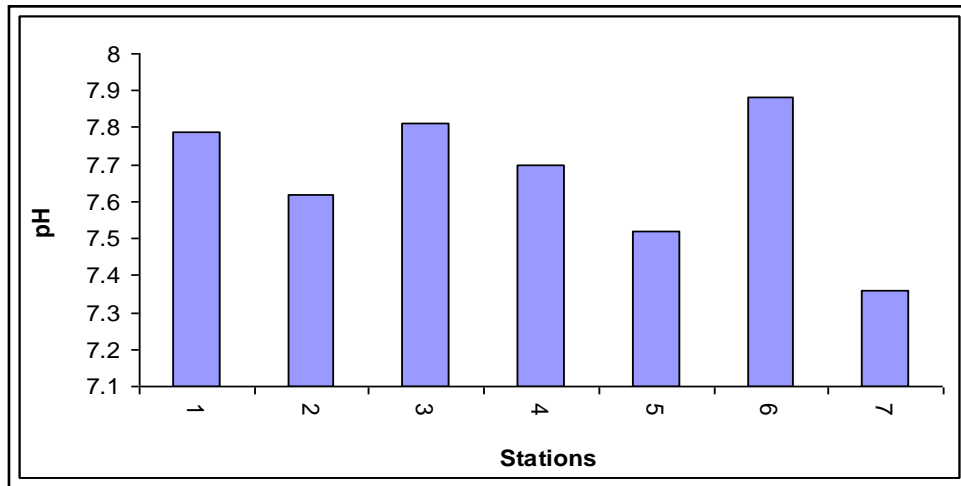
environmental risks (Keskinen, et al., 2004) that may stress the biotic community.

Trace metals recorded in this study represent the total( dissolved and particulate) as water samples were analyzed with out filtration.

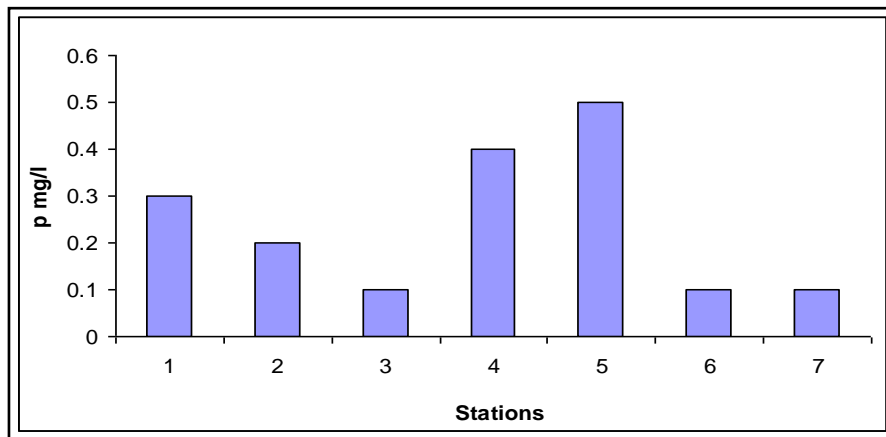
Arsenic is a well-known toxic element that the Environmental Protection Agency (EPA) and the World Health Organization (WHO) list as a known carcinogen. Arsenic is found in a wide variety of chemical forms throughout the environment and can be readily transformed by microbes( Taylor, 2009). Levels of As reported in this study was quite high compared with standard level of 0.0001 mg/l set by WHO and EPUSA. Highest level reported for As in suspended particles was 0.031 mg/l in Yangtze river, China (Müller et al., 2008),while Zhang (1995) reported nil value in Yangtze river for average concentrations from five cruises between 1984 and 1988.

For cadmium, values recorded were in the same trend as arsenic, lower values as 0.00003 mg/l in Al- Hewaizah marsh(station 5) and higher value as 0.007 mg/l in Fao (station 4) within Shatt Al-Arab river as shown in figure 7, while levels of Lead were alternative with lower value of 0.006 mg/l in station 3 within Shatt Al-Arab river, and as higher as 0.0216 mg/l in Tigris river (station 7).

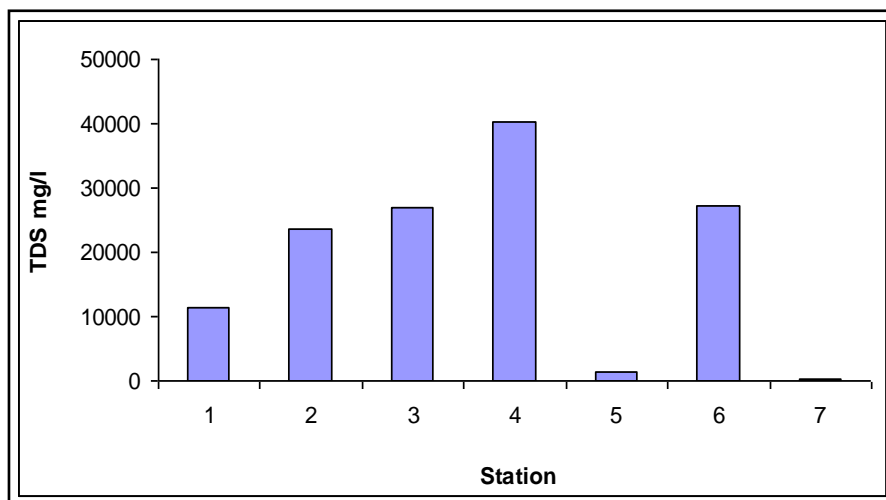
Mercury ranged between 0.003 mg/l in Tigris river and 0.0062 mg/l in water supplied to fish lake ( station 6) as shown in figure 8.



**Fig.2. Variation of pH in the waters of southern Iraq.**



**Fig.3. Variation of Total Phosphorus in the waters of southern Iraq.**



**Fig. 4. Variation of TDS in the waters of southern Iraq.**

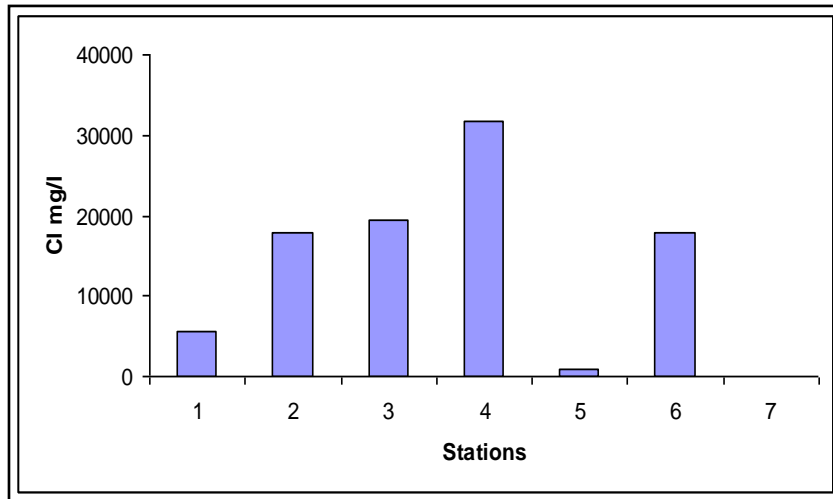


Fig.5. Variation of Chloride in the waters of southern Iraq.

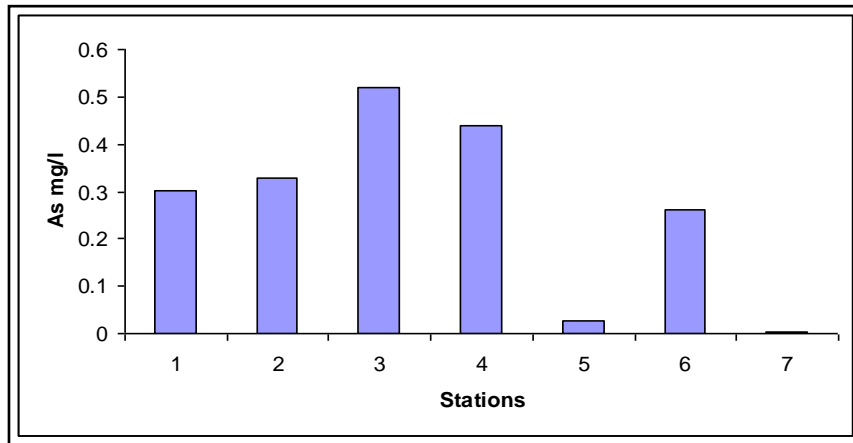


Fig. 6. Variation of Arsenic in the waters of southern Iraq.

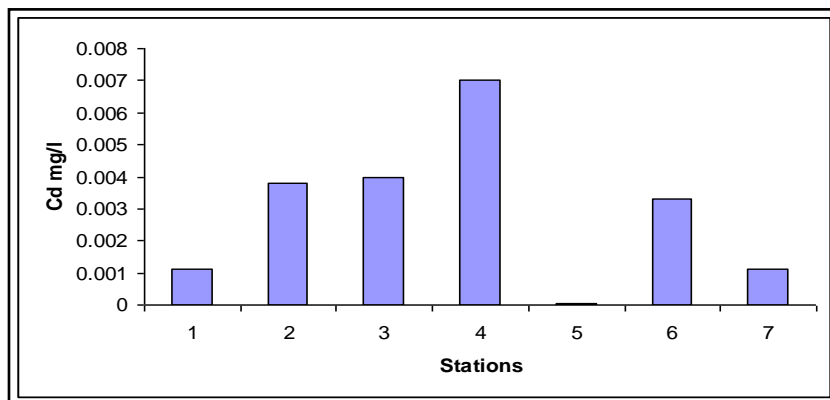
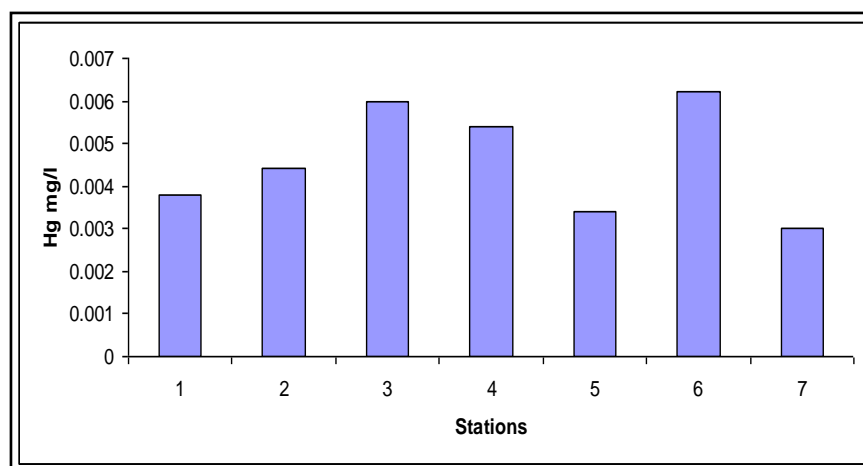


Fig. 7. Variation of Cadmium in the waters of southern Iraq.



**Fig. 8. Variation of Mercury in the waters of southern Iraq.**

The control of emissions to the environment from major polluting point sources has played an important role in improving river water quality over the last couple of decades.

The deterioration in river quality during the summer 2009 is notable. The reasons were shortage in water discharge, resulting in poorer dilution in rivers and the huge amounts of waste water discharging to the rivers, ( Coffey, 2009. [www.clarityauthoring.com](http://www.clarityauthoring.com)). The increasing application of mineral fertilizers in agriculture and municipal wastes from growing population leads to detrimental contamination of surface water

### Conclusion

This study reveals that most water of southern Iraqi wetlands are contaminated with different pollutants among which are the most toxic trace elements; arsenic, mercury, lead and cadmium. In order to identify the levels, sources and health effects, more studies by expert scientists should be conducted to assess their existence and future treatments.

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## الملوثات البيئية الخطرة في مياه بعض المسطحات المائية جنوب العراق

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### الخلاصة:

قدرت قيم بعض المواصفات البيئية الخطرة وهي: الفسفور الكلي والزنك والزرنيخ والكاديوم والرصاص فضلاً عن الاس الهيدروجيني و التوصيلية والمواد الذائبة الكلية والكلوريد في مياه اربعة مواقع في شط العرب وهي (1 العشار ، 2 سيحان، 3السيية و4) مرسى الزوارق عند الفاو و ثلاثة مواقع اخرى وهي (5 هور الحويزة و 6) موقع مغذي بحيرات الاسماك و7) موقع من نهر دجلة. تمثل هذه المواقع مصدر رئيسي لمياه متعددة الاغراض في جنوب العراق. سجلت اعلى القيم للفسفور الكلي بحدود 0.4 ملغم/ لتر في المحطة رقم 4 و بحدود 0.5 ملغم/لتر في المحطة رقم 5 . وتراوحت قيم الزنك بحدود 0.003 ملغم/لتر في المحطة رقم 7 و 0.0062 ملغم/لتر في المحطة رقم 6 . وسجل للزرنيخ قيماً دنياً بحدود 0.0055 ملغم/لتر في المحطة رقم 5 وقيماً اعلى بحدود 0.52 ملغم/لتر في المحطة رقم 3 . كما سجلت قيم للكاديوم بنفس تصرف الزرنينخ اذ كانت القيم الدنيا بحدود 0.00003 ملغم/ لتر في المحطة رقم 5 و قيم اعلى بحدود 0.007 ملغم/لتر في المحطة رقم 4 بينما تفاوتت قيم الرصاص بين مواقع الدراسة حيث سجلت ادناها بحدود 0.002 ملغم/لتر في المحطة رقم 3 واعلاها بحدود 0.0216 في المحطة رقم 7. اما الاس الهيدروجيني فقد تراوحت قيمه بين 7.52 – 7.88 في المحطتين 5 و 6 على التوالي. وتوافقت التوصيلية (11860 – 47700 مايكروسيمنس/سم) والمواد الذائبة الكلية ( 11500 – 40300 ملغم/لتر) والكلوريد ( 5690 – 31670 ملغم/لتر) باعلى القيم في كل مواقع شط العرب(المحطات 1-4) والذي يعزى الى مياه الخليج العربي ذات الملوحة العالية وكذلك في المحطة رقم 6 ( 30900 مايكروسيمنس/سم و 27250 ملغم/لتر و 17900 ملغم/لتر على التوالي). اما ادنى القيم في هذه المواصفات كانت في المحطة رقم 6 ( 575 مايكروسيمنس/سم و 390 ملغم/سم و 97 ملغم/لتر على التوالي). علماً بان الحدود المسموح بها دولياً للمتغيرات الرئيسية في هذه الدراسة هي : 0.06 – 0.12 ملغم/لتر للفسفور و 0.00001 ملغم/ لتر للزرنيخ و 0.00025 – 0.002 ملغم /لتر للكاديوم و 0.00077 – 0.0014 ملغم/لتر للزنك و 0.05 ملغم/لتر للرصاص .

كلمات دالة: تلوث عناصر نزررة، مياه، شط العرب، هور الحويزة.