



Seasonal Variations of the Total Petroleum Hydrocarbons in Water and Sediments of Southern Iraqi Marshlands after Rehabilitation 2003.

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Abstract

For the period Jan. – Oct. 2004, water and sediments samples were collected from different sites of Iraqi marshland; El-Hewizeh, Central, and Al-Hammar Marshlands. Analysis was done for the determination of Total Petroleum Hydrocarbons (TPH) in the water and sediment samples by adopting the spectrofluorometric method according to standard procedures and comparison with standard solutions of Iraqi crude oil. Concentrations of TPH recorded in water from Iraqi marshlands were in the range of 0.6 – 46.82 , 20.48 – 39.87 , 14.28 – 26.16 and 11.64 – 17.427 $\mu\text{g/ml}$ during winter 04, spring 04, summer 04 and autumn 04 respectively. For sediments range recorded were 29.12 – 103.80 , 23.84 – 93.51 , 15.17 – 61.89 and 14.37 – 48.14 $\mu\text{g/g}$ dry weight during the same period of time respectively. Reported values indicate that Al-Hammar marshland is rich in petroleum hydrocarbons compared with other sites of study area except some alteration due to human activities such as in site no. 1 (El-Tarabah) in Al-Hawizeh marsh as fishing is the main source for living. Range of %TOC recorded in the sediments of marshlands were 0.284 – 1.032 being the highest in Al-Hammar marshes during winter 2003/2004 and showed alternative values during the whole period of study.

1.Introduction

The pressure of increase population and rising fishing as well as services developments in the marshlands, after rehabilitation 2003, are likely to result in increasing pollutants among

which are the petroleum hydrocarbons. Pathways of petroleum hydrocarbons into water bodies of marshlands could be biogenic by production of certain plants or anthropogenic

from different sources (Al-Saad and Al-Timari, 1993).

Organic matter is present in water as a dissolved or particulate forms, in particulates it occur as individual or adsorbed matter on organic or inorganic particles. Hence, in the aquatic environment they are mainly associated with suspended and bottom sediments in which their partitioning is controlled by different factors including the various sediment characterizations such as grain size distribution, mineral composition and organic contents (Khalaf et al., 1986).

Hydrocarbons in the water body could be associated with sediments and accumulated in 0-20 cm layer in the bottom soil along the water body. The degree of petroleum hydrocarbons pollution in southern Iraqi marshlands were very low and mainly from Tigris –Euphrates rivers.

2. Methods and analysis

Subsurface water samples were collected by means of water sampler in glass bottles of 4-5 liter volume from eight sites chosen for this study covering all marshlands of southern Iraq: 1-Al-Tarabah, 2-Umm Al-Ward in Al-Hawizeh marshes, 3- El-Harasheen, 4-Al-Fartoos, 5- El-Saddah along Al-Izz river in the Central marshes, 6- Al-Duboon, 7- Al-Nagarah and 8- Al Barghah in Al-Hammar marshes, figure 1.

Sediment samples as bottom surface sediments were collected from the same sites

Fractions of petroleum hydrocarbons as a pollutants in the southern Iraq marshland area were given little attention during the period before desiccation 1980-1990 in which n-alkanes were detected in water and sediments from Al-Hammar marshes (Al-Saad and Al-Timari, 1994) and polycyclic aromatic hydrocarbons, as a class of carcinogenic compounds, were studied in sediments from the same area (Al-Saad and Al-Timari, 1989). For these studies Capillary Gas Chromatography was adopted. Total petroleum hydrocarbons (TPH) were detected in Aquatic plants from Al-Hammar marsh by means of spectrofluorometry (Al-Saad, 1994). The present study is aimed at investigation of distribution and variations of petroleum hydrocarbons in the environments of southern Iraqi marshlands after rehabilitation 2003.

by means of van Veen grab sampler, and sediment samples were put in polyethylene bags.

Flourescence intensities for each sample were measured at emission wavelength 360 nm after excitation at 310 nm. For comparison, Basrah crude oil was used as an arbitrary standard. Total organic carbon (TOC) was determined following the procedure of El-Wakeel and Riley (1957).

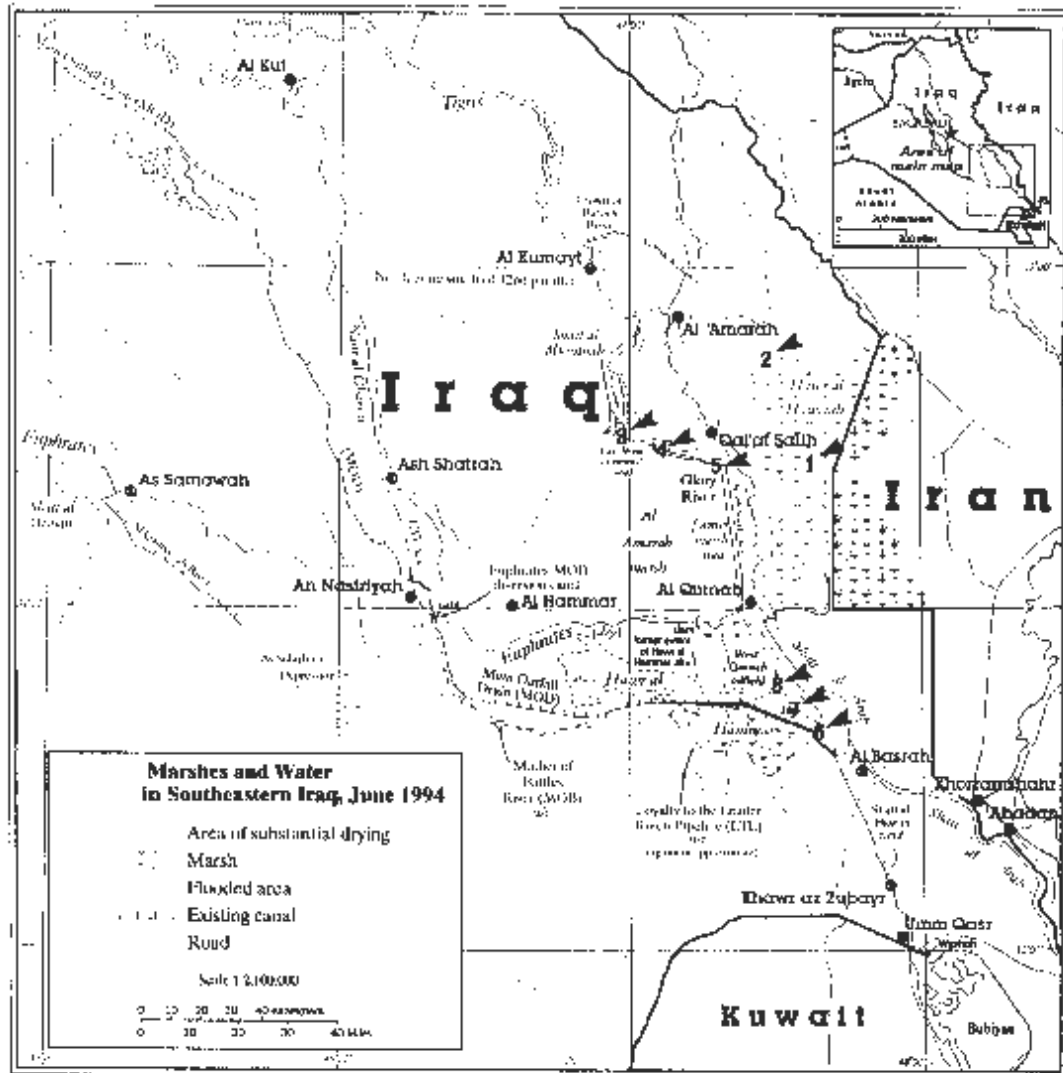


Fig. 1 . Map of southern Iraqi marshes showing the position of sampling stations 1-8.

3.Results and Discussion

Concentrations of TPH's and % TOC at each sampling site during the four seasons of 2004 are presented in tables 1-4.

Table 1.

Levels of total petroleum hydrocarbons in water ($\mu\text{g/l}$) and sediments ($\mu\text{g/g}$ dry weight) samples from Iraqi marshlands together with %TOC during Winter 2004.

| Position | Total Petroleum Hydrocarbon's | | % TOC |
|--------------|-------------------------------|-----------|-------|
| | Water | Sediments | |
| El-Tarabah | 0.60 | 29.16 | 0.481 |
| Umm El-Ward | 2.70 | 103.80 | 0.433 |
| Al-Herasheen | 6.96 | 91.60 | 0.364 |
| Al-Fartoos | 42.06 | 66.25 | - |
| El-Saddah | - | - | - |
| Al-Doboos | 46.82 | - | 0.994 |
| Al-Nagharah | 28.03 | - | 1.032 |
| Al-Barghah | 16.07 | - | 0.739 |

- = Non sampled.

Table 2.

Levels of total petroleum hydrocarbons in water ($\mu\text{g/l}$) and sediments ($\mu\text{g/g}$ dry weight) samples from Iraqi marshlands together with %TOC during Spring 2004.

| Position | Total Petroleum Hydrocarbon's | | % TOC |
|--------------|-------------------------------|-----------|-------|
| | Water | Sediments | |
| El-Tarabah | 20.48 | 93.51 | - |
| Umm El-Ward | - | - | - |
| Al-Herasheen | 39.87 | 23.84 | - |
| Al-Fartoos | 22.32 | 48.22 | - |
| El-Saddah | 32.70 | 31.81 | - |
| Al-Doboos | - | - | - |
| Al-Nagharah | - | - | - |
| Al-Barghah | - | - | - |

- = Non sampled.

Table 3.

Levels of total petroleum hydrocarbons in water ($\mu\text{g/l}$) and sediments ($\mu\text{g/g}$) samples from Iraqi marshlands together with %TOC during Summer 2004.

| Position | Total Petroleum Hydrocarbon's | | % TOC |
|--------------|-------------------------------|-----------|-------|
| | Water | Sediments | |
| El-Tarabah | 14.28 | 41.95 | 0.865 |
| Umm El-Ward | 22.32 | 44.19 | 0.547 |
| Al-Herasheen | 19.16 | 61.89 | - |
| Al-Fartoos | - | - | - |
| El-Saddah | 21.60 | 15.17 | 0.720 |
| Al-Doboos | 20.36 | 34.56 | 0.582 |
| Al-Nagharah | 26.16 | 22.85 | 0.505 |
| Al-Barghah | 22.68 | 41.40 | 0.368 |

- = Non sampled

Table 4.

Levels of total petroleum hydrocarbons in water ($\mu\text{g/l}$) and sediments ($\mu\text{g/g}$) samples from Iraqi marshlands together with %TOC during Autumn 2004.

| Position | Total Petroleum Hydrocarbon's | | % TOC |
|--------------|-------------------------------|-----------|-------|
| | Water | Sediments | |
| El-Tarabah | 17.417 | 28.093 | 0.774 |
| Umm El-Ward | 12.573 | 32.147 | 0.785 |
| Al-Herasheen | 13.616 | 30.531 | 0.284 |
| Al-Fartoos | 11.877 | 14.378 | 0.533 |
| El-Saddah | - | - | |
| Al-Doboos | 11.647 | 15.573 | 0.418 |
| Al-Nagharah | 13.802 | 48.147 | 0.477 |
| Al-Barghah | 11.786 | 18.154 | 0.319 |

- = Non sampled.

From these tables, concentrations of TPH recorded in water from Iraqi marshlands were in the range of 0.6 – 46.82 , 20.48 – 39.87 , 14.28 – 26.16 and 11.78 – 17.45 $\mu\text{g/ml}$ during winter , spring , summer and autumn of the year 2004 respectively. For sediments range recorded were 29.12 – 103.80 , 23.84 – 43.51 , 15.17 – 61.89 and 14.37 – 48.14 $\mu\text{g/g}$ dry weight during the same period of time respectively. The highest levels were during winter for both water and sediment samples. During winter 2004 and through the early stages of flushing water into the marshlands, levels of TPH's were lower in station 1 (Al-Tarabah within Al-Hawiezah marshes) which recorded 0.6 $\mu\text{g/ml}$ and 29.12 $\mu\text{g/g}$ dry weight in water and sediments respectively. In station 2 (Umm Al-Ward) which located in the entrance of Al-Hawiezah marshland recorded the highest level of TPH's. This marsh receives water from Tigris river who carry tremendous amounts of suspended particulate matter to which organic

matter are sorbed. These materials are mostly deposited in the entrance of the marsh as water current drops appreciably (Al-Saad and Al-Timari,1989). The situation is change in the same station during Spring 2004, in which high levels were recorded upto 20.48 $\mu\text{g/ml}$ and 93.51 $\mu\text{g/g}$ dry weight in water and sediments respectively. These alteration is explained on the basis of spreading of pollutants due to climate conditions (wind, current, rain...etc) (Abo-Samrah et al.,1990). During the period of time afterwards, the area received petroleum hydrocarbons in a certain fixed trend which could be classified as from biogenic source as aquatic plants increase in number and quantity (Al-Saad,1994).

Although, different TPH's were recorded in different sites during the period of study, variations levels among different sites do not show any seasonal trend, most of the values were in the range of acceptable limits despite of the high concentrations in some sites and

periods in which TPH's were higher than previously measured levels in the same or comparable area(Al-Saad and Al-Timari,1993). The general situation corresponds to a rather low levels of pollution, plants growth massively water test is good, fishes are increased and grow and showed a biodiversity... etc.

There are two phenomenon which are affecting the variation of petroleum hydrocarbons in water of southern Iraqi marshlands, temperature and water flow. Seasonal variation of temperature in southern Iraq is low in the range of 11-15 ° C during Winter and high in the range 30-35°C during Summer (Arndt and Al-Saadi,1975). On the other hand, water flow in the marshland was facilitated the increase of water column from early 2004 (winter) until its end (Autumn). From the results in this study its seemed that the phenomena of water flow is the more effective factor governing the random variation of petroleum hydrocarbons in southern Iraqi marshlands (DouAbul and Al-Saad,1985), despite the relatively high effects of temperature (Gearing and Gearing,1982) which facilitate the processes of bacterial degradation

(Mulkins-Philips and Stewart,1974) and photo oxidation of petroleum hydrocarbons (Lee,1980).

The TOC values found to have fluctuated distribution which ranged from 0.284% in Central marsh during Autumn 2004 to 1.032% in Al-Hammar marsh during Winter 2003/2004, being higher in Hor Al-Hammar than other marshlands.

The levels reported in the study area are comparable to those reported earlier in the sediments from Iraqi marshlands, Al-Saad and Al-Timari (1989) reported %TOC ranged 0.45-3.62 in surface sediments and 0.33- 2.12 in sub surface sediments from Hor Al-Hammar, Al-Timari *et.al.*, (1997) reported values of %TOC ranged 1.13 - 2.66 in surface and 0.15 – 1.95 in sub surface sediments from Hor Al-Hammar, as well as in nearby areas, Al-Saad (1987) reported values of %TOC ranged 0.20 – 1.0 in surface sediments from Shatt Al-Arab river, Evans(1966) recorded values in the range 0.83 – 1.51 % TOC in the sediments of northeast Arabian Gulf, Al-Ghadban (1980) found that the average TOC in the sediments from southern Kuwait was 0.67%.

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التغيرات الموسمية لمحتوى الهيدروكربونات النفطية الكلية في مياه ورواسب اهوار العراق الجنوبية بعد التأهيل 2003

فارس جاسم محمد الامارة و عباس عادل حنتوش و علي مهدي ناصر و سامي طالب لفتة الياسري
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الخلاصة

للفترة من كانون الاول 2003 لغاية تشرين الثاني 2004 تم جمع عينات مياه ورواسب من مواقع مختلفة في اهوار العراق الجنوبية : الحويزة والوسطي والحمار. اجري لهذه العينات تحليل كيميائي لتقدير المحتوى الكلي من الهيدروكربونات النفطية باستخدام طريقة التفلور اعتماداً على الطرق القياسية والمقارنة مع محاليل قياسية لعينات من نفط خام عراقي. كانت مديات تراكيز الهيدروكربونات النفطية الكلية المسجلة في مياه الاهوار كما يلي: 0,6 – 46,82 و 20,48 – 39,87 و 14,28 – 26,16 و 11,64 – 17,41 مايكروغرام/لتر خلال شتاء 2003 و ربيع 2004 و صيف 2004 و خريف 2004 على التوالي. وفي الرواسب كانت القيم المسجلة كما يلي: 29,12 – 103,80 و 23,48 – 93,51 و 15,17 – 61,89 و 14,37 – 48,14 مايكروغرام/غرام وزن جاف خلال نفس فترات الدراسة على التوالي. تشير التراكيز المسجلة ان هور الحمار غني بالهيدروكربونات النفطية مقارنة بمواقع الدراسة الاخرى عدا بعض الاختلافات في محطة الدراسة رقم 1 وهي الترابية ضمن هور الحويزة حيث يزداد الصيد كمصدر للمعيشة. وكانت نسبة الكاربون العضوي الكلي بحدود 0.284- 1.032 % حيث كانت اعلى القيم في هور الحمار خلال شتاء 2003/2004 و اظهرت قيماً متبادلة خلال فترة الدراسة.