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PETROLEUM HYDROCARBON CONCENTRATIONS IN FISHES FROM SHATT AL-ARAB RIVER

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ABSTRACT

Seven fish species were collected from Shatt Al-Arab River. The fishes were extracted and the concentration of petroleum hydrocarbons (PHC) were determined Spectrofluorometrically , in order to provide information on the background values of oil generally present in these fishes . Total hydrocarbon concentrations of these fishes ranged from 29.6 µg / g in Aspius vorax to 45.9 µg / g in Barbus xanthopterus expressed in terms of Kuwait crude oil equivalents . A positive correlation between PHC and fat content (r = 0.55) have been observed . From the result of gas chromatographic analysis it was possible to determine that PHC present in these fishes were biogenic and anthro-biogenic.

INTRODUCTION

The use of petroleum hydrocarbons (PHC) has increased with the energy requirements of the world and unavoidably a proportion of these compounds is lost to the environment . On the whole, these hydrocarbons are relatively stable to chemical and biological attack and thus it is probable that their concentrations in the environment are increasing.Since it is known that organisms in the aquatic environment can acquire hydrocarbons from their surroundings. It is reasonable to suppose that the amount present in these organisms are also increasing. If the hydrocarbons are not readily metabolized or rejected by the various organisms in the food chain then the conditions are present for an accumulation to occur in the higher lived members of the food chain. This could have undesirable consequence not just to aquatic life

but also to those who are dependent on fish as a food or livehood (Mackie et al., 1974).

The water of Shatt Al-Arab River is liable to small oil spills of varying magnitudes. The major source for the input of petroleum in this river are oil refinery effluents,sewage discharge , and losses during loading operations (Al-Saad, 1983). Petroleum hydrocarbons present in the Shatt Al-Arab River have been implicated in situations where biological damages has been reported (Al-Daham et al., 1981).

In Shatt Al-Arab fishes are mostly widely distributed . So the present study shows the result of the survey undertaken to obtain preliminary data on the existing levels of petroleum hydrocarbon contamination in these fishes.

This study is the first of its kind for the region and may provide valuable information for forthcoming researchs.

MATERIALS AND METHODS

Samples representing the seven fisf species studied were collected from Shatt Al-Arab River (Figure 1).

The scientific name of these species are listed in Table (1). Each species were represented by at least 25 uniform size of adult individuals.

The muscles of which were pooled together to form one composite subsample. Sixty grams of fish muscle from each subsample were freeze-dried, ground and sieved through 1 mm metal sieve.

The extraction and fractionation procedure employed in the present study was based upon that of Risebrough et al. (1983). Fat content determined by weighting.

The determination of aromatic hydrocarbons was carried out using Shimadzu RF 540 Spectroflurometer.Emission spectra (exciatation 310 nm) were recorded for each sample , and fluorescence intensities were measured at 360 nm. Blank determination were achieved for each sample.Kuwait crude oil, chosen as an arbitary standard for comparison , was supplied, by American Petroleum Institute (API). Chrysen standard were employed to calibrate the spectrofluorometer and check the quantification of the analytical result.

The alphatic hydrocarbons (n-alkanes) were analysed by gas chromatography a Perkin-Elmer model sigma 300 capillary gas chromatograph equipped with flame ionization detector (FID) and a split/splitless injection port. A wall coated open tubular (WCOT) fused silica capillary column (30 m x 0.25 mm I.d) with 0.22 u film thickness coated with sp 2100 was used. Operation temperatures for the detector and injector were 320 ^{o}C respectively , while the column was

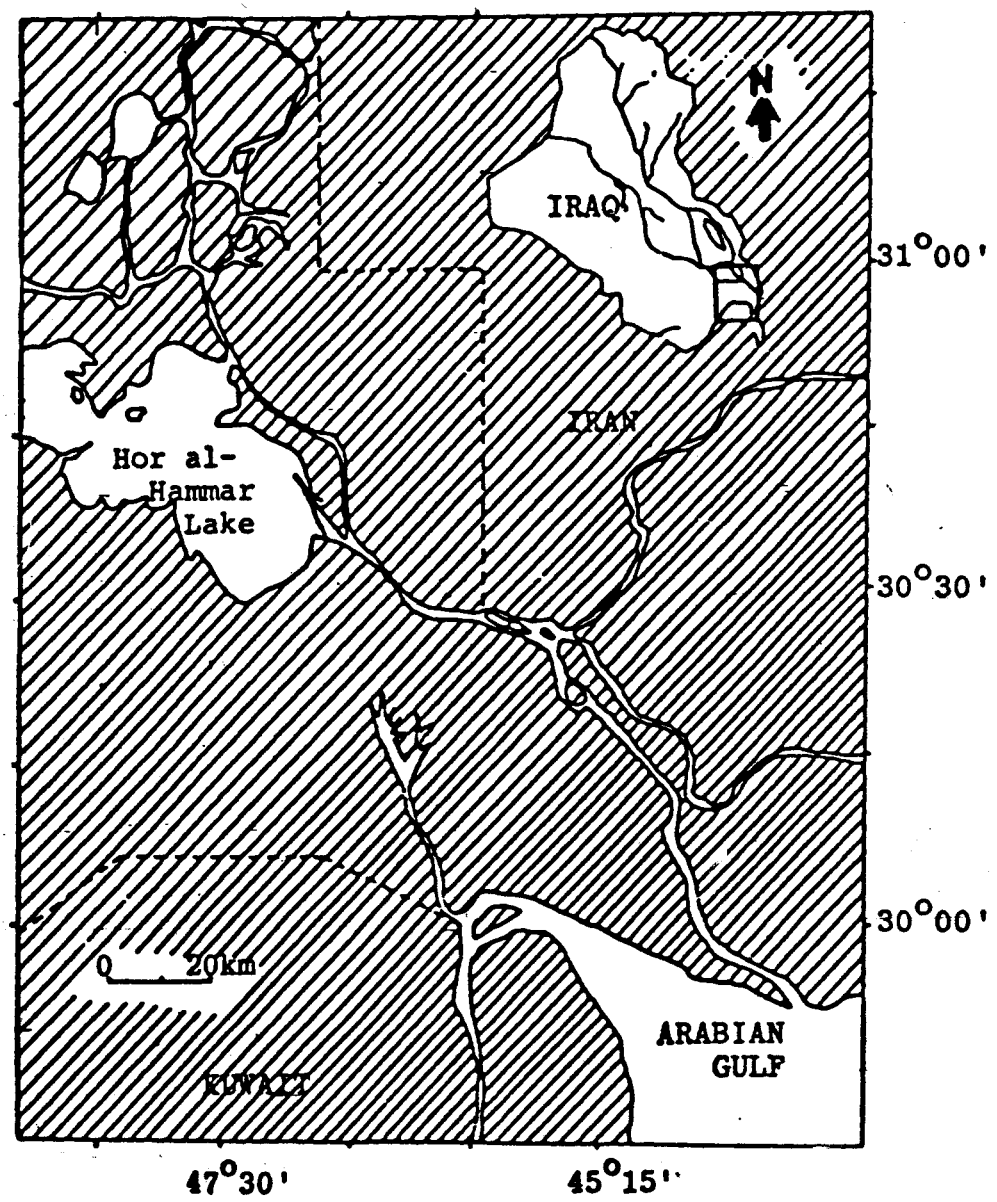

Figure (1) : Sample locations.

operated under a temperature programme conditions (4 C/min) from 60°C to 280°C with isothermal period (30 min) at the end.

RESULTS AND DISCUSSION

The distribution of n-alkanes in fish studies are summerized in Table (1). While the total petroleum hydrocarbons (PHC) and fat percentage are presented in Table (2). The amount of PHC in fishes sample ranged from 29.6 ug/g in Aspius vorax to 45.9 ug/g in Barbus xanthopterus. From this result it is evident that all fish species are contaminated to some extent with PHC.

On the basis of differing hydrocarbon concentrations observed in fishes along Shatt Al-Arab River, we observed a positive relationship between PHC and fat content (r=.55), some studies conducted with fish indicated that PHC were increased with increase of the fat content(Sabo et al.,1975; Stegeman & Sabo, 1976 and Cravedi & Tulliez, 1982).

However, consideration should be made to the fact that different species of fish have different abilities to accumulate or eleminate certain pollutants from the environment (Cravedi & Tulliez, 1982). This may explain the rather high concentration of PHC in Barbus xanthopterus despite its low fat content in comparison with other species studied.

Hydrocarbons can enter fish through the water or from their food. Entrance from the water is primarily through the gills,but some oil,including tar particles, can enter during drinking or feeding (Payne et al., 1970). A microscopic examination of the gut content of these fishes has shown the presence of phytoplankton, zooplankton, animals detritus, fecell palletes and some aquatic plant.

A number of parameters generated from gas chromatographic analysis have been used to characterize the source (s) of hydrocarbons extracted from the tissues of aquatic organisms (Payne et al., 1985). Typical distribution chromatograms for the n-alkane with the blank are shown in Figure (2) and Table (2). They range from about C10 to C32 with usually an odd carbon number precominance, such as (n-C15, C17, C19, C21, C25, C27 and C29) which come only from natural sources (Phytoplankton,Zooplankton, Bacteria, Fungi, Algae & Plant) because these organisms can synthesis such alkanes (Mazurek & Simoneit, 1984) and fishes are feed on such food, that mean their presence are a biogenic origins.

Carbon preference index (CPI) is a definitive measure of biologically synthesized compound. For n-alkane an odd :

Table (1) : Distribution of n-alkanes from Shatt Al-Arab River during October 1985. Concentration in um/g dry weight.

n - alkanes	Barbus xenthopterus	Hilsa ilisha	Barbus sharpeyi	Barbus grypus	Barbus subquincunciatus	Cyprinus carpio	Aspius vorex
C 10	0.2	0.1	0.2	0.1	0.1	0.1	-
C 11	0.1	0.2	0.2	0.3	0.2	0.3	0.1
C 12	0.3	0.4	0.1	0.2	0.5	0.2	0.2
C 13	2.4	0.3	0.3	0.1	0.4	0.4	0.3
C 14	2.1	1.4	0.4	0.5	0.6	0.5	0.4
C 15	2.0	1.9	1.8	1.3	2.0	1.9	0.9
C 16	2.3	1.8	0.6	0.7	0.5	0.6	0.3
C 17	2.3	1.9	2.7	2.3	2.1	1.6	2.4
C 18	1.8	1.8	0.9	0.6	0.3	0.6	0.6
C 19	0.7	2.0	2.8	2.6	2.9	0.9	0.9
C 20	0.4	1.5	1.9	0.9	1.2	0.2	0.5
C 21	0.5	1.9	2.4	3.2	2.3	1.9	2.1
C 22	0.3	1.1	0.8	0.3	0.6	0.5	0.6
C 23	0.2	0.6	0.5	0.4	0.3	0.6	0.7
C 24	0.2	0.5	0.4	0.5	0.9	0.9	0.6
C 25	0.2	0.6	1.6	2.7	1.8	1.3	0.9
C 26	0.1	0.5	0.3	0.6	0.5	0.7	0.9
C 27	2.4	0.6	2.7	2.3	2.5	2.1	3.1
C 28	0.4	0.7	0.2	0.4	0.6	0.9	0.7
C 29	0.3	0.3	0.4	0.9	1.2	0.9	0.6
C 30	0.2	0.2	0.2	0.4	0.3	0.6	0.5
C 31	0.1	0.1	0.3	0.5	0.7	-	0.4
C 32	0.1	-	0.1	0.3	0.1	-	0.3
Total	19.6	20.4	21.8	22.1	22.6	17.7	18.0
Pristane	0.7	1.7	1.5	1.8	0.8	0.3	1.3
Phytane	0.6	1.9	1.3	1.6	0.5	0.2	0.3
C P I	1.3	1.0	2.5	3.0	2.6	2.0	2.2

Table (2) : Alphatic, aromatic and total petroleum hydrocarbons content (THC) in ug/g and fat % in fishes from Shatt Al-Arab River.

S p e c i e s	Alphatic (ug g^{-1})	Aromatic (ug g^{-1})	THC ug g^{-1}	Fat %
Barbus xanthopterus	19.6	26.3	45.9	3.1
Hilsa ilisha	20.4	20.2	40.6	6.2
Barbus sharpeyi	21.8	18.4	40.2	5.1
Barbus grypus	22.1	15.1	37.2	3.4
Barbus subquincunciatus	22.6	13.2	35.8	3.3
Cyprinus carpio	17.7	12.3	30.0	2.5
Aspius vorax	18.0	11.6	29.6	2.2

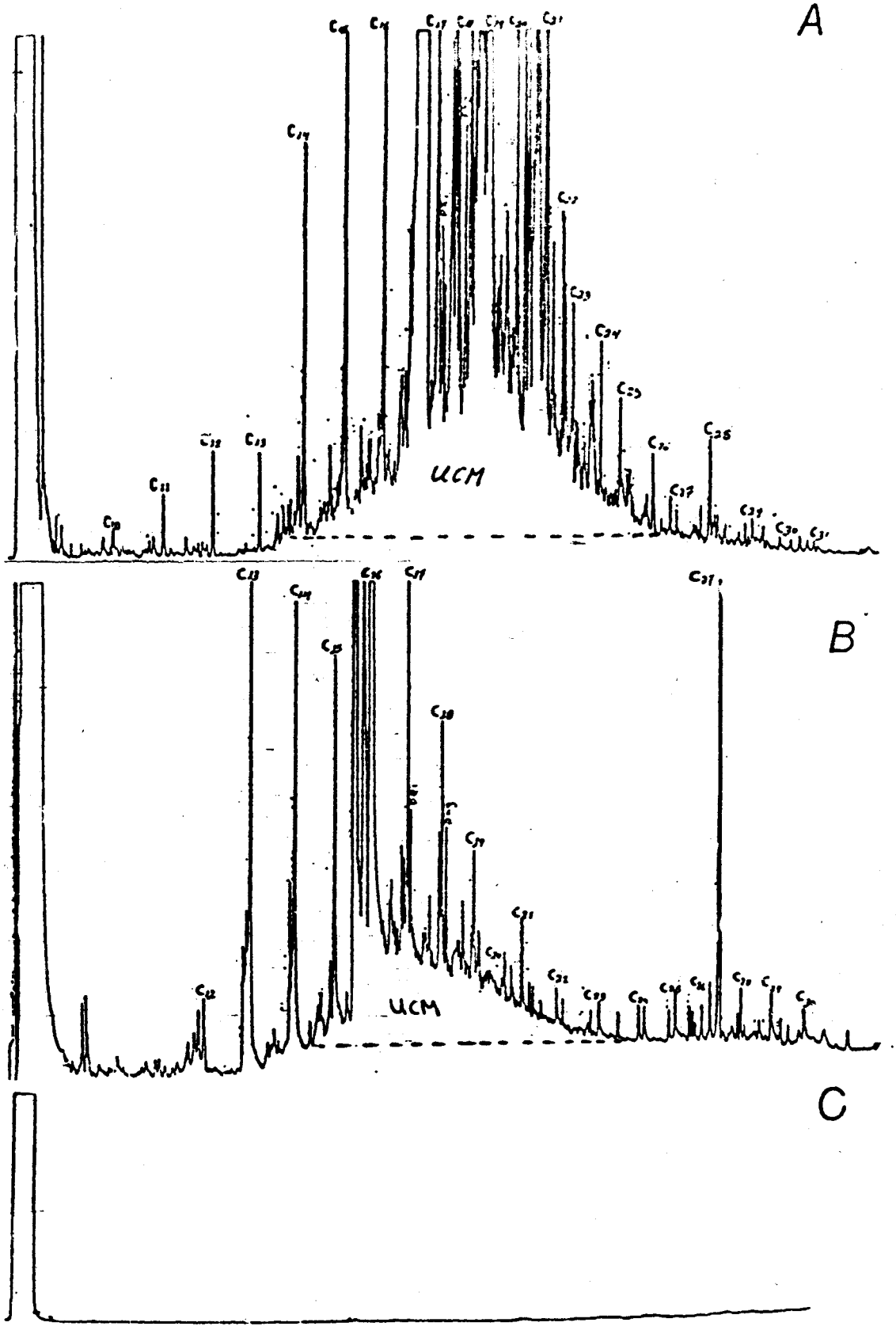

Figure (2) : Chromatograms of n-alkanes extract of fishes from Shatt Al-Arab River. A: Hilsa ilisha ; b: Barbus grypus ; c: blank.

even carbon number predominance is observed over a given carbon range (Mazurek & Simoneit,1984). From Table (1) since the CPI 1, it is believed that PHC in these fishes derived from a biogenic origin ; however Table (1) , Figure (2) , pristane and phytane are diagenetic products of phytol and are not primary constituent of most aquatic organism , their presence in these hydrocarbon fractions coupled with the presence of a broad unresolved complex mixture (hump) indicate petroleum residue contamination , and that because of oil polluted area (DouAbul & Al-Saad, 1985).

Our analysis in gas chromatography for aromatic fractions have confirmed residues of napthalene and acenapthalene only in these fishes. This is undoubtly due to the fact that napthalene is present in No. 2 fuel oil used extensively in the region (DouAbul et al.,1987), furthermore napthalene is some what more water soluble and low particulate affinity that the larger molecular weight aromatic hydrocarbon that accumulate to highest concentration by aquatic organism (Neff et al., 1976).

The concentrations of PHC obtained in the present study are comparable with those reported in Das (1976) , which indicate no direct danger on human health. Much higher concentration were shown in (Mackie et al.,1974 and Cravedi & Tulliez, 1982) which reflect a serious case of pollution.

The major conclusion that can be drawn from the present study that,these fish contain certain amount of PHC and the main source of these PHC are biogenic and anthrobiogenic.

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تركيز الهايدروكاربونات النفطية في اسماك من نهر شط العرب

المستخلص

تم جمع 7 انواع من الاسماك من نهر شط العرب، وقد استخلص من هذه العينات كمية الهايدروكاربونات النفطية وتم قياسها بواسطة جهاز اللصف لغرض توفر معلومات حول القيم المرجعية للنفط المتواجد في هذه العينات. تراوحت تراكيز الهايدروكاربونات النفطية في هذه العينات من 29.6 مايكروغرام/غرام في السلك Aspius vorax الى 45.9 مايكروغرام/غرام في الكطان Barbus xanthopterus كوزن مكافي الى نفط خام الكويت.

تبين من الدراسة وجود علاقة خطية بين كمية الهايدروكاربونات النفطية ونسبة الدهن حيث بلغت قيمة المكافي الخطي (٢ = 0.55).

بينت نتائج تحليل العينات بجهاز الكروموتوغرافي الى ان مصادر هذه الهايدروكاربونات النفطية هي من الفعاليات البايولوجية (الطبيعية) والتلوث بالنفط الخام ومشتقاته.