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Evaluation and monitoring the impact environmental pollution in water and soil south of Baghdad.

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ABSTRACT

Set of water and soil samples were collected from different locations in Tigris River and agriculture fields' south Baghdad- Iraq. Both water and soil samples were collected during January, February and March 2017. The presented results revealed different values for physical, and chemical parameters for both water and soil samples studied. The chromatographic results for evaluation of polyaromatic hydrocarbons (PAHs) using HPLC method, revealed high values in some station in the range between 0.22-52.51 ng/ml for water and 0.21-30.2 ng/ml for soil, which indicated that predominate PAH were Fluoranthene, Pyrene, naphthalene, Benzo (b) fluranthene and Benzo (k) fluranthene derivative in these samples, which were may be diffused from neighboring oil resources. In some polluted soil samples there is a highly elevated in heavy metals and the concentration of nitrate and nitrates ions which might be came from the residue of explosive material during the last war (2003) in Iraq. Soil samples were investigated for its heavy metals content. Samples of soil were analyzed for their content after digestion with nitric acid using atomic absorption spectrometers AAS. The results refer to increase in most of these elements. The aim of this work is to renew data base for the environmental parameters which are very important to study the medical problems which were recently elevated in these regions (cancer incidents, cardiovascular diseases, digestion disease, genetic mutation in new born children and allergy disease) compared with the international criteria for evaluation these types of diseases status.

Keywords: Polyaromatic hydrocarbons; Heavy metals; Environment pollution; Water analysis; Soil analysis; Iraq environmental.

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INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) represent a wide spread class of environmental chemical pollutants and are ubiquitous contaminants with two or more fused aromatic rings in marine environments. PAHs' solubility in water decreases, while correspondingly their boiling and melting point increases, with increasing molecular weight [1]. PAHs are lipophilic compounds with very low water solubility and therefore, their concentration in water is very low [2, 3]. As a consequence of their hydrophobic nature, PAHs in aquatic environments rapidly tend to become associated to the particulate matter ending in sedimentation. Therefore, sediments represent the most important reservoir of PAHs in the marine environment. For that reason, PAHs accumulation in coastal sediments is both due to anthropogenic and natural emissions.

The release of massive amounts of oil combustion related pollutants are common in oilfields and around refineries in Iraq. There are many persistent and less biodegradable compounds in petroleum that could easily enter the food chain. Petroleum-derived compounds, such as saturated hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) are widespread environmental contaminants and many of them are known as potent carcinogens. Zare-maivan demonstrated chromosome aberration in lima beans exposed to petroleum in vitro [4]. Saeed demonstrated presence of PAHs as a result of Iraq-Kuwait war in the atmosphere of Kuwaiti towns with potential health hazards [5]. Since, PAHs are persistent in the environment and plants, as primary producers of the ecosystem can absorb PAHs, plant parts of two prominent species of halophytes.

Accumulation of metals in plants is highly dependent on their availability in soil. Partitioning of metals over the solid phases and soil solution is affected by soil characteristics of which pH are the most important. Environmental pollution and exposure to toxic material is an increasingly serious problem the world over. The unscientific use of hazardous materials in agriculture and industries and its dumping has created a great risk for human life, plants and animals. Similarly the heavy metals are assimilated in the environment from vehicle exhaust, from the smoke of industries or the spreading of industrial effluents through water in soil [6, 7].

Tigris River is the most important river in Iraq, runs from north to south through the Baghdad city, which provides for agriculture irrigation and drinking water stations. This ecosystem during the years, due to its closeness to the town and to the richness of human activities (e.g. industrial, aquaculture and urban activities) have accumulated in sediments both high PAHs and organic matter levels, so the goal of this work is to study the concentrations distribution of the sixteen PAHs in twelve sectors in Tigris River south of Baghdad.

MARTIAL AND METHODS

Water samples were collected during the period from 7th of January till the end of February 2017, from four locations from Tigris river (40-50 Km) south of Baghdad; while soil samples were collected from the agriculture fields near by the river. Water samples were collected in glass bottles, covered with screw caps, while the soil samples (1 kg/sample) were collected in glass packaging, all samples were immediately transported to the laboratory for analysis.

Our samples were collected, transported in a cool box to the analysis laboratory, and then stored at 20^{o}C before analysis. High performance liquid chromatography (Shimadzu LC-10 AVP HPLC) technique used to analyze PAHs. The other water parameters were analyzed by using the following instruments: pH meter (WTW), Conductivity meter (WTW), Colony counter, Microscope (Olympus), Turbidity meter (WTW), Shimadzu UV-vis 1700, Ion selective meter (WTW) and Atomic absorption spectroscopy Shimadzu 3600 (AAS). De-ionized water was used in the preparation of all solutions.

RESULTS AND DISCUSSION

The laboratory results of water and soil samples were carried out for determine the concentration ratios of PAHs. The results were listed in Tables (1 and 2) for both water and soil samples, while Figs (1 and 2) showed the distribution of Total L. PAHs and Total H. PAHs within the research area along 10 km with the river. It was showing that the PAHs concentration in ng/l significantly increased from the 1st point to the 4th point, due to the polluted sources from (Al Dora refinery, the previous Iraqi nuclear stores and relating buildings, Al Rustameah swage water station, different factories and plants for produce leathers, chemicals, dyes, rubbers, plastics, textiles, power stations and hospitals for transmitted disease.

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Table 3 illustrated the laboratory analysis results for soil samples, which show a clear rise in the rates of heavy metals, nitrates and nitrites, which refer to clear pollution. The elevated results confirm that these areas are considered to be oil producing regions and busiest in cars traffic. Therefore, it necessary to highly confirm the need for baseline data to reveal the background levels, and the chronic oil pollution in such vital areas from industrial and other anthropogenic sources, which is described in some literature as "acute oil pollution". The observation we did in this area gave us a good indications for the increasing the cancer incidents and new diseases which appeared in these locations.

Table 1: PAHs (ng/L) in Tigris river (surface water)

Compound	Site 1	Site 2	Site 3	Site 4
Naphthalene	8.50	8.41	11.22	16.37
Acenaphthylene	5.90	6.27	12.15	13.51
Acenaphthene	5.85	11.24	15.01	10.37
Fluorene	4.24	6.21	8.17	7.93
Phenenthrene	3.88	6.00	6.19	5.92
Anthracene	5.18	6.42	7.82	12.35
Total L. PAH	33.55	44.55	60.56	66,45
Fluoranthene	20.18	24.20	52.51	76.71
Pyrene	10.96	12.39	22.35	35.66
Benzo (a) anthracene	8.44	16.53	31.25	35.91
Chrysene	5.89	10.30	19.50	24.08
Benzo (b) fluranthene	3.87	4.98	6.04	20.18
Benzo (k) fluranthene	1.31	1.66	2.41	16.69
Benzo (a) pyrene	2.11	3.56	4.20	13.22
Dibenzo(a,h) anthracene	4.23	4.61	6.77	9.72
Benzo(g,h,i) perylene	5.18	3.98	6.92	10.00
Indeno(1,2,3-cd) pyrene	1.10	0.99	0.22	1.21
Total H. PAH	63.27	83.2	152.17	243.38

Table 2: PAHs (ng/l) in soil agriculture samples near Tigris river sampling

Compound	Site 1	Site 2	Site 3	Site 4
Naphthalene	7.9	10.5	12.4	25.9
Acenaphthylene	5.2	8.7	15.5	20.8
Acenaphthene	9.5	17.4	22.1	30.7
Fluorene	2.9	5.6	10.7	16.3
Phenenthrene	5.2	11.2	18.9	30.2
Anthracene	4.1	7.2	25.2	33.7
Total L. PAH	34.8	60.6	104.8	157.6
Fluoranthene	0.88	1.23	2.81	6.1
Pyrene	0.63	0.99	2.98	5.4
Benzo (a) anthracene	1.01	1.23	3.14	5.1
Chrysene	0.69	2.81	4.00	4.8
Benzo (b) fluranthene	0.99	1.68	3.24	4.43
Benzo (k) fluranthene	1.12	0.57	1.61	1.59
Benzo (a) pyrene	1.40	0.46	2.78	3.88
Dibenzo(a,h) anthracene	0.43	0.52	0.99	1.52
Benzo(g,h,i) perylene	0.28	0.87	2.02	3.11
Indeno(1,2,3-cd) pyrene	1.21	0.21	0.74	0.88
Total H. PAH	8.64	12.57	24.31	36.81

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Table 3: Soil analysis in four sites in research area

Analysis	Site 1	Site 2	Site 3	Site 4
Arsenic (ppm)	0.15	0.15	0.29	0.29
Aluminium (ppm)	0.012	0.012	0.016	0.016
Barium(ppm)	12.65	12.65	18.92	18.92
Calcium (ppm)	128.3	128.3	152.5	152.5
Cadmium (ppm)	0.321	0.321	0.398	0.398
Copper (ppm)	35.2	35.2	15.64	15.64
Iron (ppm)	23000	23000	21000	21000
Lead (ppm)	0.521	0.521	0.652	0.652
Mercury (ppm)	0.22	0.22	0.35	0.35
Magnesium (ppm)	10900	10900	9800	9800
Manganese (ppm)	600	600	620	620
Sodium (ppm)	33600	33600	15600	15600
Selenium (ppm)	0.607	0.607	0.702	0.702
Zinc (ppm)	76.8	76.8	62.5	62.5
pH	6.58	6.58	7.02	7.02
NO_2 (ppm)	1.23	1.23	3.98	3.98
NO_3 (ppm)	2.56	2.56	7.25	7.25

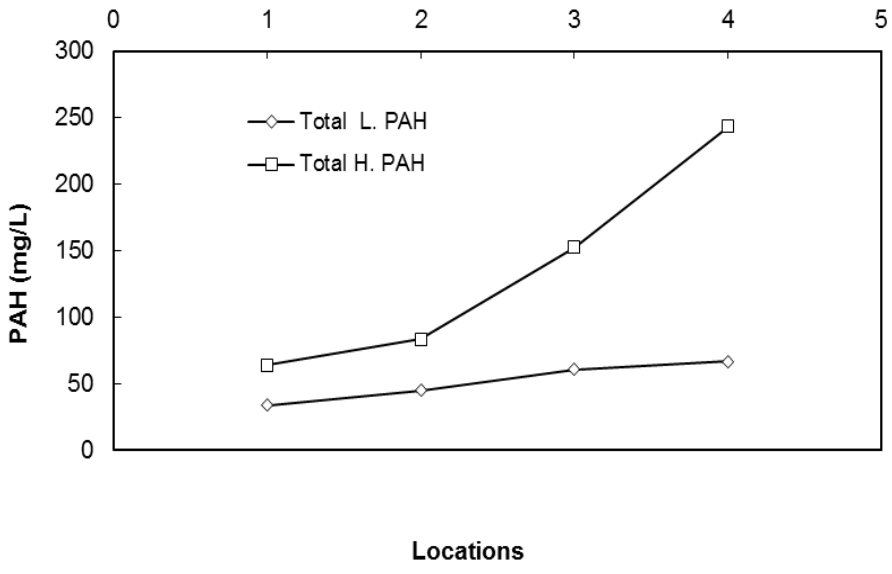

Figure 1: Total L.PAHs Total H. PAHs distribution for water samples

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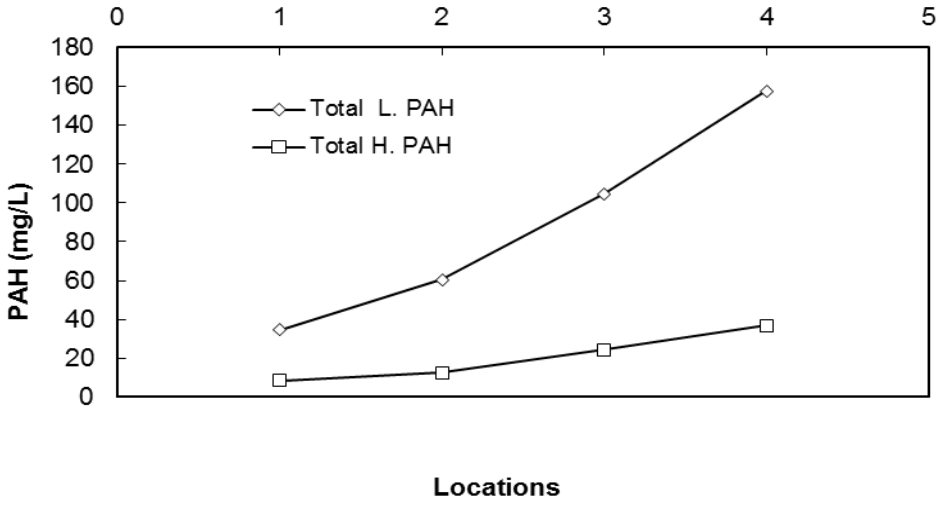

Figure 2: Total L.PAHs Total H. PAHs distribution for soil samples

CONCLUSION

Results obtained with the present study provided useful information in order to evaluate PAHs contamination in Tigris river water and agriculture soil samples in the same area. In water samples, Total L. PAHs and Total H. PAHs refer to increasing from the frist location to the final one. The chromatographic results for (PAHs) indicated that predominate were Fluoranthene, Pyrene, naphthalene, Benzo (b) fluranthene and Benzo (k) fluranthene derivative in these samples.

The study showed that these locations south of Baghdad grown in contaminated areas have high risk of having heavy metal concentrations beyond the permissible limit for each of them as compared to the less contaminated areas.

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