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Evaluation some Polycyclic Aromatic Hydrocarbons (PAHs) in *Eucalyptus Camaldulensis* and *Phragmites Australis* Plants Around the Diyala-Baghdad Bridge

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ABSTRACT

The concentrations and sources of the Polycyclic Aromatic Hydrocarbons were determined in two leaf plants species *Eucalyptus camaldulensis and phragmites australis* at three stations in the areas around the Diyala-Baghdad Bridge Baghdad / Iraq from one time only January 2020. The results showed the highest mean concentration of PAHs in leaf plants species at A was 3.93 ng/g in *E. camaldulensis* and the lowest in B was 2.16 ng/g at *phragmites australis*. According to PAHs indices the Pyrene Ratio, Fluoranthene, Phenanthrene /Anthracene ratio, LMW/HMW ratio, Ant/(Ant/Phen) ratio, BaA/(BaA/Chry) ratio and InP/(InP+BghiP) ratio. These results indicate the possibility of introducing PAH sources in these types of plants from species of the leakage of pollutants to the area through which the main passed of the river Diyala River.

KEYWORDS: Polycyclic Aromatic Hydrocarbons; leaf Plants.

الخلاصة

حُددت تراكيز المصادر الهيدروكربونات العطرية المتعددة الحلقات في نوعين من النباتات *Eucalyptus camaldulensis* & *phragmites australis* المحيطة بجسر ديالى - بغداد / العراق خلال فترة كانون الثاني 2020. أظهرت النتائج أن أعلى متوسط لتركيز للهيدروكربونات العطرية متعددة الحلقات في أنواع نباتات الأوراق عند المنطقة الاولى وبلغ 3.93 نانوغرام / غرام بالوزن الجاف في اوراق نبات *E. camaldulensis* وأقل تركيز في المنطقة الثانية كان 2.16 نانوغرام / غرام بالوزن الجاف في اوراق نبات *phragmites australis* وفقًا لمؤشرات الهيدروكربونات العطرية متعددة الحلقات في الدراسة كانت هناك نسبة من مركبات البيرين ، والفلورانثين ، الفينانثرين، الأنثراسين ، وهناك تباين بين الوزن الجزيئي المنخفض والوزن الجزيئي المرتفع تشير هذه النتائج إلى إمكانية إدخال مصادر الهيدروكربونات العطرية متعددة الحلقات في هذه الأنواع من النباتات من الانواع من تسرب الملوثات للمنطقة التي مر بها النهر الرئيسي نهر ديالى.

INTRODUCTION

The polycyclic aromatic hydrocarbons (PAHs) can exist in the environment and a distributed in the both of the aquatic and the terrestrial of environments in biogenic and the anthropogenic origin. PAHs are very dangerous substances because of their cariogenic properties. It is transport and accumulation in the soils and of the plants, especially on agricultural lands. It includes the monocyclic aromatics in structure has at least one the ring structure such as benzene, toluene, xylenes and a polycyclic hydrocarbon released to the environment (4). It can a transport of over long distances in the atmosphere and may be a deposit in a faraway these areas, so that are can found in the environment (5,6). It can form by a several the pathways include a pyrogenic biosynthesis according to (1). Petrogenic PAHs are a relatively of derived from the fossil fuel containing a PAHs. The digenetic PAHs can refer to the formation from a biogenic of the precursors, like the plant terpenes, leading to the formation of a compounds such as the retune of the “methyl isopropyl phenanthrene” or “1-methyl-7-isopropyl phenanthrene C18H18” and a derivatives of the phenanthrene and then chrysene, However, this the source is not a significant of, the presence in all the environment compartments result from both natural processes include volcanic activity and forest fires or predominantly anthropogenic activities such as the waste incineration, burning

wood, coal or garbage according to (2,3). There is large number of PAH compounds in ecosystem about sixteen compounds include anthracene, fluoranthene, benzo "pyrene, perylene, dibenzo and anthracene pyrene. The physical and chemical, with toxicological properties of all compounds are a different. The long terms of exposure to all compounds could bring about different in life according to Al-Hejuje *et al*., 2015 (7). Because the Diyala Bridge area has many pollutants on a daily basis, therefore the study aimed to measure PAH concentrations in some plants dominant to assess. The observed PAH concentrations have at the biological levels by using the species that an inhabit of these areas to study spatial the sources and the routes by a which PAHs reach the leaf of plants.

MATERIAL AND METHODOLOGY

The areas around the Diyala-Baghdad Bridge are sub-district located to the southeast of Baghdad and at the confluence of the Diyala River as showing in Figure 1. It is about 17 kilometers from the center of Baghdad. The coordinates of the area are 33°13′N 44°32′E. Two species of plants were choosing *Eucalyptus camaldulensis* and *Phragmites australis* leaves. Plants samples were collected from three randomly stations A, B and C one time in January 2020. The plant samples were washed with distilled water, dried in an air temperature, grinded finely in an electrical mortar, stored in a glass of containers until it analysis. Each of 5 grams grinded plants were placed separated in soxhlet of extracted using intermittent extraction according to (7), using separator funnel to extract the saponification matter with 40 ml n-hexane. The upper saponification matter with hexane (hydrocarbons) was took and passed by a chromatographic column were provided with glass a wool in bottom then layer of the "silica gel" and layer of alumina, in the top placed layer of anhydrous sodium sulfate then added 25 ml of n-hexane to isolated the aliphatic fraction after that add 40 ml of benzene to isolate the aromatic fraction. HPLC type Shimadzu LC injected by Standard polynucleic aromatic hydrocarbons compounds (PAHs) that were utilized to determine the qualities and quantities of PAHs compound in plants samples.

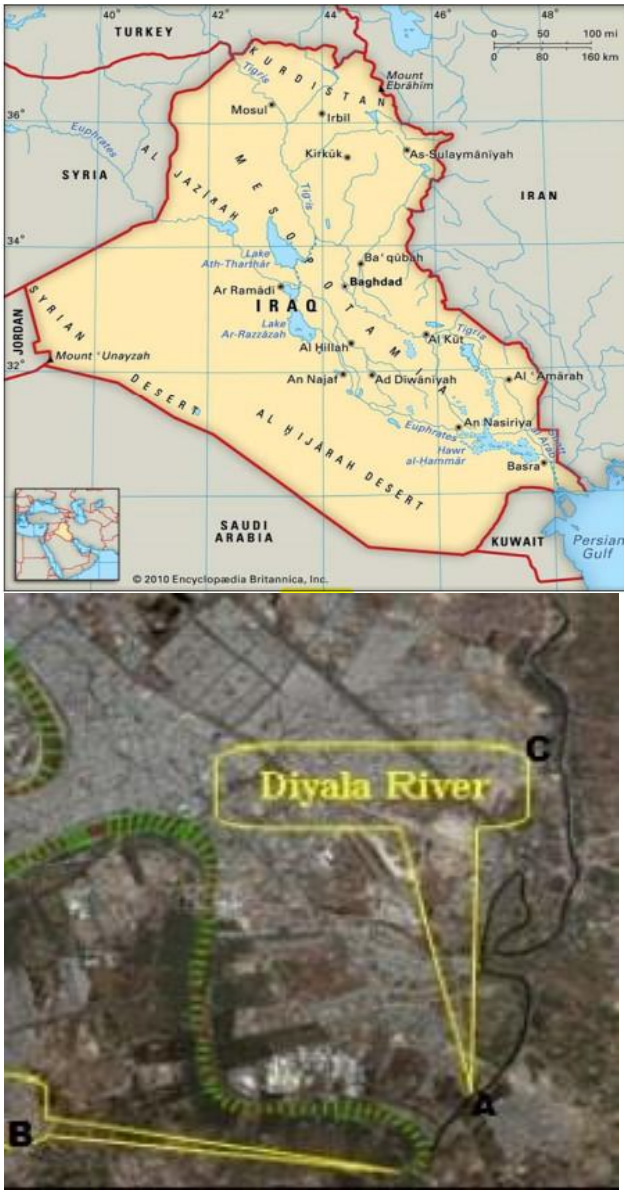

Figure 1. Maps of Iraq showing the Diyala-Baghdad Bridge Rivers with three areas sampling.

RESULTS AND DISCUSSION

PAHs in leaf plant samples

The high concentrations of total PAHs in *Eucalyptus camaldulensis* are recorded at A station 3.93 ng/g dry weight while the low mean concentrations 2.16 ng/g at C station (Table 1 and 2), a significant difference in P value 0.001 were found among locations. Non-significant differences P≥0.031 were found among. The high mean a concentration of total PAHs in *Phragmites australis* are recorded at A 2.194 ng/g dry weight, while the lowest mean concentrations 1.92 are recorded at C (Table 3 and 4), non-signification differences P≥0.003 were found among sites. These variations of total PAHs are

observed in this study and signification differences P≥0.008 were found among sites.

Table 1. The concentrations of PAH (ng/g) in *Eucalyptus camaldulensis* plants

	Eucalyptus camaldulensis		
PAHs comp	A	B	C
Naphthalene	0.111	0.056	0.096
Acenaphthylene	0.231	0.205	0.213
Acenaphene	0.097	0.035	0.086
Fluorene	0.191	0.054	0.104
Phenanthrene	0.164	0.129	0.139
Anthracene	0.126	0.115	0.164
Fluoranthene	0.362	0.236	0.32
Pyrene	0.201	0.252	0.209
Benzo(a) anthracene	0.357	0.063	0.164
Chrysene	0.124	0.131	0.012
Benzo(b) fluoranthene	0.123	0.083	0.145
Benzo(k) fluoranthene	0.121	0.341	0.03
Benzo(a) pyrene	0.271	0.241	0.069
Indo(1,2,3-cd) pyrene	0.312	0.46	0.146
Dibenzo anthracene	0.142	0.326	0.076
Benzo(g,h,i) perylene	0.217	0.053	0.124
Total	**3.93**	**2.44**	**1.99**

Table 2. The concentrations of PAH (ng/g) in *phragmites australis* plants

	phragmites australis		
PAHs comp	A	B	C
Naphthalene	0.117	0.007	0.198
Acenaphthylene	0.174	0.182	0.184
Acenaphene	0.092	0.193	0.067
Fluorene	0.187	0.085	0.192
Phenanthrene	0.148	0.114	0.192
Anthracene	0.244	0.104	0.182
Fluoranthene	0.226	0.218	0.362
Pyrene	0.191	0.247	0.194
Benzo(a) anthracene	0.341	0.041	0.013
Chrysene	0.115	0.124	0.015
Benzo(b) fluoranthene	0.113	0.018	0.172
Benzo(k) fluoranthene	0.116	0.29	0.035
Benzo(a) pyrene	0.255	0.201	0.061
Indo(1,2,3-cd) pyrene	0.289	0.377	0.148
Dibenzo anthracene	0.133	0.311	0.074
Benzo(g,h,i) perylene	0.189	0.034	0.133
Total	**2.16**	**2.06**	**1.92**

Table 3. Mean concentrations of PAH (ng/g) in *E. camaldulensis* plants

Sites	***E. camaldulensis***	***±SD***
A	3.93	0.38
B	2.93	0.23
C	2.04	0.29
Mean	**2.73**	**0.29**

Table 4. Mean concentrations of PAH (ng/g) in *P. australis* plants

Sites	***P. australis***	***±SD***
A	2.944	0.92
B	2.160	0.19
C	2.380	0.17
Mean	**2.302**	**0.32**

PAHs indices in leaf plants: Phenanthrene / Anthracene Ratio

Phenanthrene/Anthracene ratio ranged from 0.164 at A in *E. camaldulensis* to 0.198 at C in *P. australis* (Table 5).

Fluoranthene / Pyrene Ratio

The Fluoranthene / Pyrene ratio ranged from 0.191 at A in *E. camaldulensis* to 0.192 in C. *P. australis* (Table 5).

LMW/HMW Ratio

Ratio LMW/HMW was between 0.221 at A in *E. camaldulensis* to 0.260 at C in *P. australis* (Table 5).

Ratio of Ant / (Ant+Phen)

Ratio of Ant / (Ant+Phen) was between 0.24I at A in *E. camaldulensis* to 0.673 at C. *P. australis* (Table 5).

Benzo (A) Anthracene / Benzo (A) Anthracene+ Chrysene Ratio

BaA / (BaA+Chry) ratio ranged from 0.126 at A in *P. australis* to 0.931 at C in *E. camaldulensis* (Table 5).

Plants are the important components of an ecosystem because they are a main source of the energy, on the land, marine or the fresh water. Plants an accumulate the chemical compounds such as the hydrocarbons, so they are used as bio- indicators to identify the environmental changes in the area this is agree with (8,9).

The predominant lights of PAHs compounds are include: Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene and an anthracene. The dominant metal of PAHs compounds is Floranthene, Pyrene, Benzo, Pyrene, Benzo, anthracene, Benzo, flouranthene, Benzo and an anthracene benzo. They are of the effective and were found in our results, this is referred by Patel *et al.*, 2015 (10).

The highest levels of PAHs compounds in plants were recorded variations might be due to consider as a growth period for these plants because of high nutrition in January season, moderate period of solar radiation and the abundance nutrients compared, this will lead to increase photosynthesis processes and absorption the PAHs compounds this is agree with (11). Differences in concentration of the PAHs compounds plants could be seen. These variations might be attributed to the lipid rings of each a plant species, nature of a growth substrate for each all plants, the tolerance of each species in other conditions, and of the surface area, which might affect the rate of accumulation of plants (3). To determine the origin of PAHs according to ratios, the results of this study revealed that LMW-PAHs/HMW-PAHs ratio was less than one, which indicate the sources of the PAHs in species were the pyrogenic a finding was in the agreement with (12,13). The higher ratio was indicate the origins of PAHs in all species were the pyrogenic and a petrogenic, while a Phenanthrene and Anthracene ratio in all species were less than ten number which indicated the origin of PAHs compounds were pyrogenic this was in agreement with Sander *et al.*, 2002 (14).

From the results, the source of PAHs compounds in the studied plants may be mixed of the petrogenic and the pyrogenic. According to the ratio of Ant/(Ant+Phen), BaA/ (BaA+Chry) and InP/ (InP+BghiP), the study area categorized as lightly of the ecological adverse effect between $0.1 < PELq = 0.24 < 0.5$. This might lead to the organic of compounds finding their way into the food chain, because the industrialized and polluted regions, and very high possibility that locals have been exposed to levels of the PAHs concentration in two types of plants in study areas.

Table 5. PAHs as pollution indices of values origin source descriptions in plant samples.

Sites	*Fl-Py*	*Description*	*Phen-An*	*Description*	*LMW -HMW*	*Description*
A *	0.868	Petrogenic	0.730	Pyrogenic	0.615	Pyrogenic
B *	1.347	Pyrogenic	1.073	Pyrogenic	0.760	Pyrogenic
C *	0.767	Petrogenic	0.751	Pyrogenic	0.528	Pyrogenic
A **	1.286	Pyrogenic	0.790	Pyrogenic	0.518	Pyrogenic
B **	1.010	Pyrogenic	1.084	Pyrogenic	0.480	Pyrogenic
C **	1.480	Pyrogenic	0.914	Pyrogenic	0.416	Pyrogenic

* *E. camaldulensis* ** *P. australis*

CONCLUSIONS

The study concluded the environmental conditions in the types plants surrounding a Diyala river-Baghdad Bridge were at a higher level of PAHs. However, the further pollutants discharge the river on dominated by low the molecular of weight and high the molecular of weight PAHs in a water and the source of PAHs was indicated from emission the various wastes that are thrown into the river, which cause a pollution to the parts a surrounding of the plants.

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