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Studying the Effect of Some Environmental Factor on the Participation of Organochlorine Pesticides in the Surface Sediments of the Shatt Al-Arab

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Abstract - Six stations (Qurna, Al-Diyar, Karma Ali, Al-Ashar, Abu Al-Khasib, and Al-Fao) were chosen along the Shatt Al-Arab, and sediment samples were collected from them on a quarterly basis for the period extending from August 2020 to March 2021 to determine the concentrations of pesticides. Some physical and chemical variables (air and Water temperature, pH, dissolved oxygen, and electrical conductivity (in the water), and the total organic carbon (TOC%) of sediments and sediment texture were determined. The results showed that the range of variables for Shatt al-Arab water is: air temperature 18-43 °C, water temperature 14-34 °C, pH 7.00- 8.52, electrical conductivity 1.29-2.82 mS/cm, Dissolved oxygen3.9- 11 mg/L and total organic carbon in sediments 6.17- 22.55%. Thirteen compounds representing pesticides were identified, and their concentrations ranged between 0 - 9.6 µg/kg. The highest concentration was due to the Endrin compound, and the lowest concentration due to the Endosulfan compound. In general, the concentrations of pesticides were within the internationally permissible limits.

دراسة تأثير بعض العوامل البيئية على توزيع المبيدات الكلورينية العضوية في الرسوبيات السطحية لشط العرب

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المستخلص- اختيرت ست محطات (القرنة، الدير، كرمة علي، العشار، ابي الخصيب، الفاو) على امتداد شط العرب وجمعت منها عينات الرسوبيات بصورة فصلية للفترة الممتدة من آب 2020 ولغاية اذار 2021 لتحديد تراكيز المبيدات فيها وتم قياس بعض المتغيرات الفيزيائية والكيميائية (درجة حرارة الهواء والمياه والاس الهيدروجيني والاوكسجين المذاب والتوصيلية الكهربائية) في المياه ، كما تم تحديد الكاربون العضوي الكلي(TOC%) للرسوبيات ونسجه الرسوبيات . اظهرت النتائج ان مدى المتغيرات لمياه شط العرب هي: درجة حرارة الهواء18-43 م°، درجة حرارة المياه14-34 م°، الاس الهيدروجيني 7.00-8.52 ، التوصيلية الكهربائية 1.29-2.82 ملي سيمنز/سنتيمتر ، الاوكسجين المذاب 3.9- 11 ملغم/لتر والكاربون العضوي الكلي في الرسوبيات6.17-22.55 %. وتم تشخيص ثلاثة عشر مركبا تمثل المبيدات وتراوحت تراكيزها ما بين 0-9.6 مايكروغرام/كيلوغرام وكان اعلى تركيز يعود الى مركب Endrin وأدنى تركيز يعود الى مركب Endosulfan وبصورة عامة كانت التراكيز للمبيدات ضمن الحدود المسموح بها عالميا.

الكلمات المفتاحية: مبيدات كلورينية عضوية، رواسب سطحية، متغيرات المياه، شط العرب.

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Introduction

Environmental pollution is one of the most serious problems facing the modern world. Pollution problems increased in the twentieth century as a result of development and modern industrial technology. The increase in the world's population at high rates over a hundred years has led to an increase in the demand for food, water, clothing, and many other commodities, and these requirements are practiced. The use of pesticides to manage weeds in bodies of water has the potential to cause pesticide accumulation in the water as well as in the sediments (Yadav *et al*., 2022).

When these pollutants are introduced into water bodies, they have an impact on aquatic. (Singh *et al*., 2023). It is necessary to know the danger of the pesticides to aquatic life, it is essential to screen them in sediments.

Great pressure and depletion of natural and environmental resources are contributed significantly a large amount of waste in the surface water as a result of human activities (Al-Hejuje, 2014), as a large number of waste and debris are disposed of into the environment. Also, emission produced from distinctive vehicles introduce chemicals into surface water (Karishma and Hari, 2015; Helal and Abo -Seoud, 2014). Among those chemicals are chemical pesticides. Pesticides have been used for thousands of years when the Sumerians, Greeks, and Romans used various compounds such as sulfur, mercury, copper, and arsenic to kill or reduce the effect of pests (Cui, *et al*., 2020).

The conversion of canals or branches connected to the Shatt al-Arab, such as: Al-Jubaila , Al-Rabat, Al-Khandaq ,Al-Ashar, Al-Khora, and Al-Saraji, into channels for discharging wastewater, after they were previously used as canals for irrigating palm trees, led to an increase in the percentage of pollution in the waters of the Shatt Al-Arab. The Shatt al-Arab was also exposed to major pollution during the Iran-Iraq war due to military accessories and equipment many ships are sunk in the Shatt al-Arab (Kurt, 2015; Al-Saad *et al*., 2021). The use of pesticides in agricultural areas on both sides of the Shatt Al-Arab has led to their reaching to the water and then being deposited at the bottom and the extent of this's impact on living organisms, because organochlorine pesticides are deposited in the fatty tissue of living organisms.

Due to the lack of studies related to organic pesticide residues in the sediments of the Shatt al-Arab. The current study came to determine the concentrations of these compounds in the sediments of the Shatt al-Arab and to study the effect of some physical and chemical water factors on the concentrations of pollutants and the amount of total organic carbon.

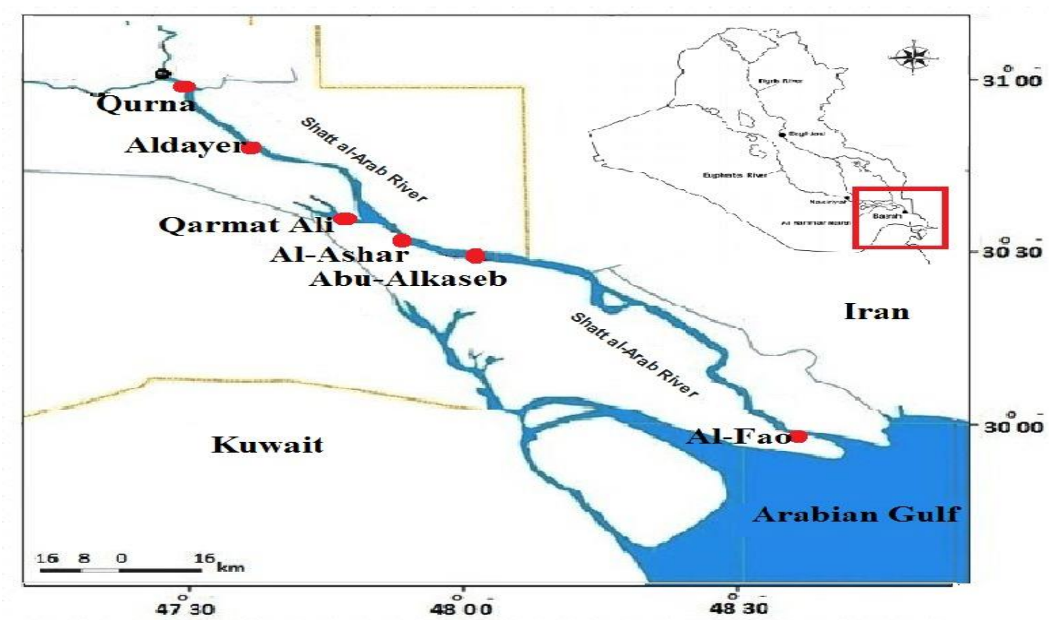
Materials and Methods

Study Area

Shatt Al-Arab river is located in the south east of Iraq and extends from of Al-Qurna city North of Basrah governorate to flow into the Arabian Gulf South of Al- Fao. Shatt al-Arab depends on its water for irrigation and selective fishing, and it is the main source of water drinking in Basra Governorate, also has great importance in tourism and entertainment and is considered a place for migratory birds in the spring (Al- Mahmoud, 2020). The length of the Shatt Al-Arab from al-Qurna to Fao is approximately 204 km, with width in some areas about two km. Six stations were chosen along Shatt Al-Arab, namely Al-Qurna, Al-Diyar, Karmat Ali, Al-Ashar, Abu Al-Khasib and Al-Fao to collect sediments samples seasonally for the period from August. 2020 – March 2021 as show in Table 1. The locations of these stations were determined by means of a GPS device (Geological Positioning System), as show in Figure 1.

(Table 1) Show the GPS of study area.

stations	Name	GPS
1	Al-Qurna	N:3053 `03.62‟,E:47º 31`10.18‟
2	Al-Diyar	N:30º 48`13.01‟,E:47º 34`48.50‟
3	Karmat Ali	N:30º 34` 33.32‟, E:47º 44` 46.29‟
4	Al-Ashar	N:30º 31` 14.59‟, E:47º 50`52.46‟
5	AbuAl-Khasib	N:30º 27` 57.82‟, E:47º 56`32.62
6	Al-Fao	N:29º 59`10.27‟, E:48º 28` 03.70



(Figure 1) Map of the Shatt Al-Arab river and the sampling stations.

Sample Collection

Surface sediment 5-10 cm was collected from the six study stations using the Vanven Grab Sampler, and then stored in ice box after being wrapped in aluminum foil until reaching the laboratory.

The air and water samples were also measured using a simple graduated mercury thermometer 0-100. Water samples were also collected from the six stations using Winkler bottles for measuring the dissolved oxygen using a Winkler Modification Method (APHA,2005)
pH and electrical conductivity of the water was measured using a pH-meter and EC electrical conductivity device respectively.

Sediments samples were air dried, grinded and sieved pore < 63µm. Twenty-five of sieved sample was hot extracted for 24 hrs by using dichloromethane solvent. samples were evaporated to near dryness. process of removing fat was carried out by adding 25 ml of acetonitrile and 25 ml of hexane according to the method described in (Al-Ali, 2012).

Pesticides were purified and separated by passing the sample on a separation column consisting of a layer of sodium sulfate, then fluorosil, then a layer of sodium sulfate (EPA, 2007; Al-Ali, 2012). The quality and quantity of residues were determined using a GC-MS device with an AGILENT-type electron-Ionization-Detector of the SIM type. The volume of the injector is 3 microliters and the carrier gas is Helium gas, with a flow rate of 1 ml/min, and a column temperature of 290°C. A Capillary column was used, 30 meters long, 0.25 mm in diameter, and 0.25 µm thick.

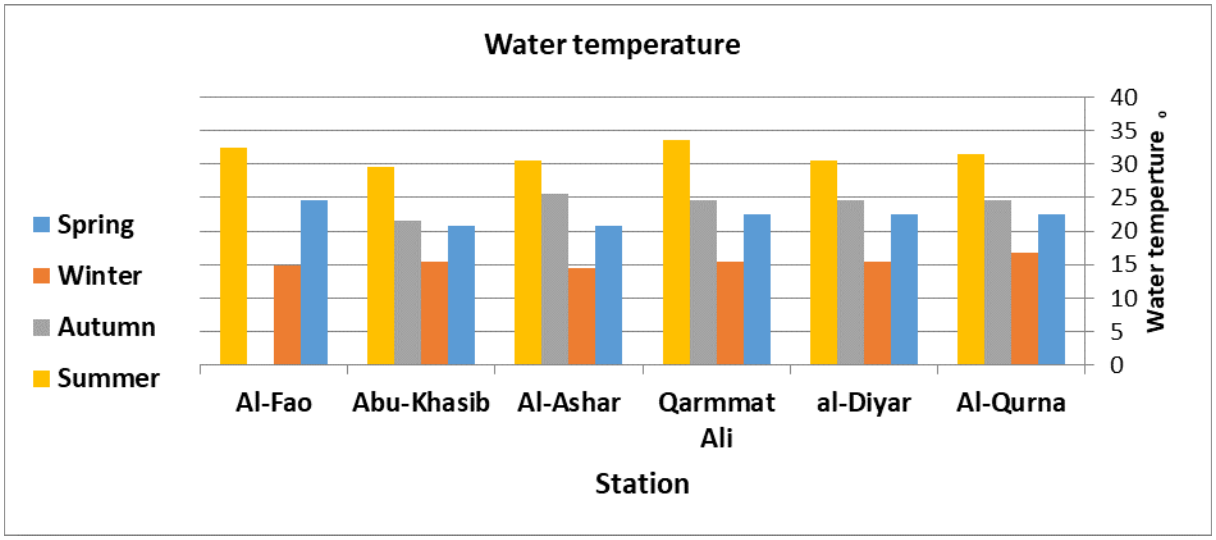
Results and Discussion

Physical and Chemical Properties

Water Temperature

The water temperature was recorded at 34°C at Karmat Ali station during the summer, while the lowest value was recorded at 14°C at Al-Ashar station during the winter, as in Figure 2. The results of the statistical analysis showed that there were no significant differences ($p \geq 0.05$) between the stations in temperature. This water is due to the proximity of the stations to each other and also the fact that it was collected quickly closely within one day. The highest rate was recorded at 24.4 ^{o}C at the Qurna station, and the lowest rate was 20.65 ^{o}C at the Abu Al-Khasib station.

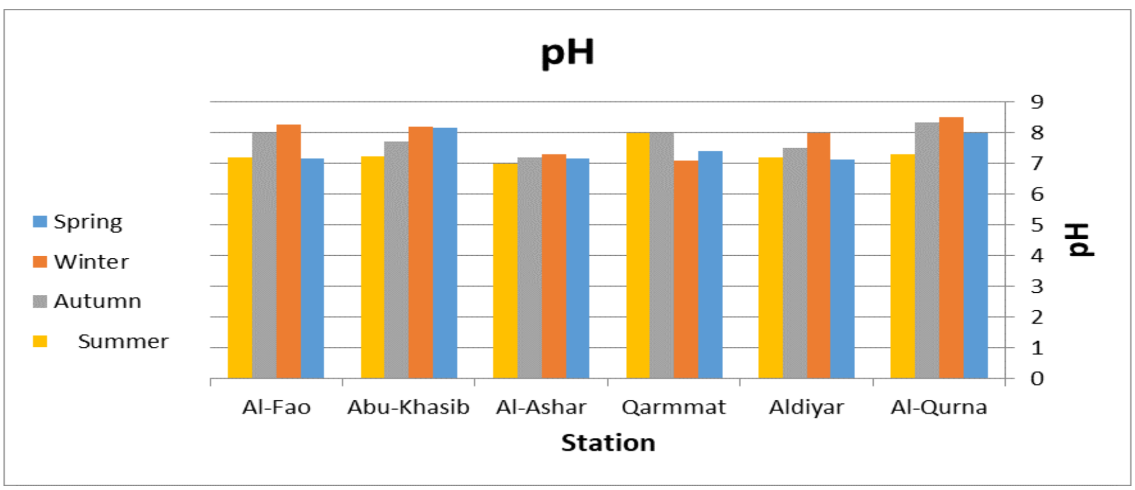
The results of the statistical analysis showed the presence of significant seasonal differences ($p \leq 0.05$) and the highest average water temperature in the summer was 31.58 ^{o}C. The lowest rate in winter is 15.24 m. The reason for the variation in water temperatures is attributed to the nature of Iraq's climate in general, as it is characterized by thermal extremes, being hot and dry in the summer and cold and rainy in the winter (Muslim, 2020). This is due to the intensity of solar radiation and the length of the daylight period in the summer. It has been found that there is an inverse correlation between water temperature and total pesticide rate r = -0.158



(Figure 2) The Seasonal changes in water temperature in the study streams from August-September 2020-March 2021.

pH

The highest pH value 8.52 was recorded at the Qurna station in the winter, while the lowest pH value was 7 at the Ashar station in the summer, as in Figure 3. The results of the statistical analysis showed that there were no significant differences ($p \geq 0.05$) between the stations. The highest rate was 8.04 at the Qurna station and the lowest rate 7.17 was at the Ashar station. The results of the statistical analysis showed that there were no significant seasonal differences ($p \geq 0.05$). The highest pH rate was 7.90 in the winter and the lowest rate was 7.32 in the summer. Significantly high or low pH values in both the aquatic ecosystem are undesirable (Mohammad *et al*., 2021) (This is because the majority of aquatic organisms have a certain range of pH and are therefore very sensitive to its changes because of its significant impact on activities. The vitality of living organisms (Al-Asadi, 2019).



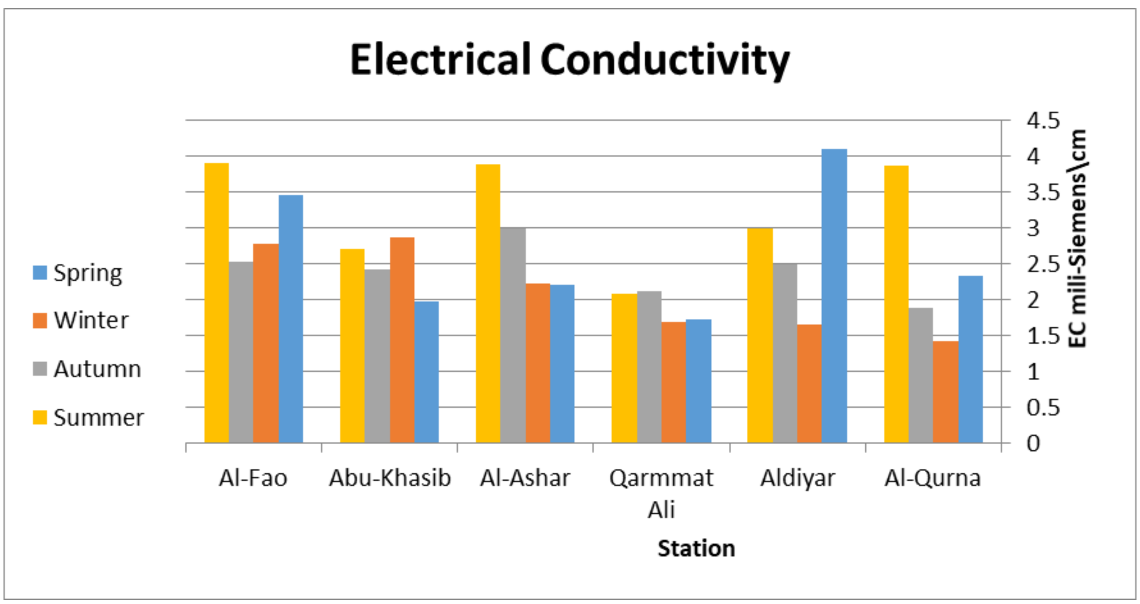
(Figure 3) Seasonal changes in pH values at the study stations for the period from August-September 2020-March 2021.

pH is closely related to dissolved oxygen, and this is confirmed by the positive significant correlation between pH and dissolved oxygen in water (r = 0.497). There is an inverse significant correlation between pH and temperature of water (r = - 0.381). There is a positive significant correlation between pH and the total rate of pesticides (r = 0.426).

Electrical Conductivity

The highest value of electrical conductivity was recorded at 4.2 mili-Siemens/cm at the Diyar station in the spring, and the lowest value was 1.43 mili-Siemens/cm at the Qurna station in the winter, as in Figure 4. The results of the statistical analysis showed that there were no significant differences p ≥ 0.05 between the stations in conductivity. The highest rate was recorded at 3.166 mili-Siemens/cm in Al-Fao station and the lowest rate was 1.900 mili-Siemens/cm in Qarmmat Ali station. The results of the statistical analysis showed that there were no significant differences ≥ 0.05. p) Quarterly.

The highest rate of electrical conductivity was 3.237 mili-Siemens/cm in the summer and the lowest was 2.1058 mili-Siemens/cm in the winter. Electrical conductivity is a measure of the ability of an aqueous solution to carry electric current, depending on the valence and concentration of ions (Kumar, 2015). Electrical conductivity is an important physical indicator, as its values are low in a low-pollution environment, while its values rise when salts, acids, and bases increase, and this indicates that the environment Polluted, that is, used to evaluate the quality of environmental systems (Zaghoul *et al*.,2019).

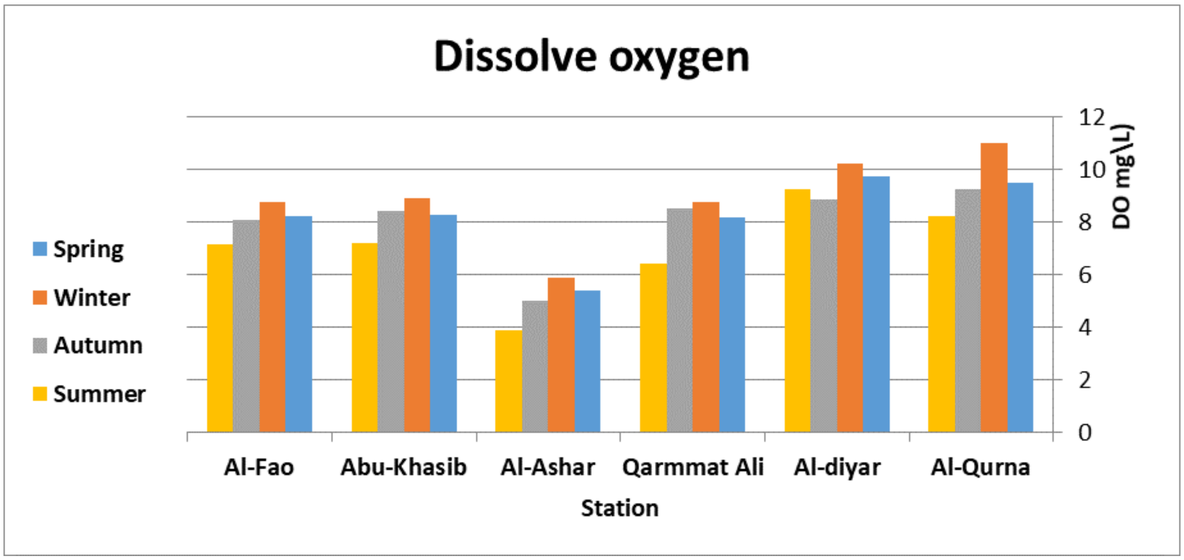


(Figure 4) Seasonal changes in EC values at the study stations from August 2020 - March 2021.

Dissolved Oxygen (DO)

The highest value of dissolved oxygen in water was recorded at 11 mg/L at the Qurna station in the winter, and the lowest value was 3.9 mg/L at the Al-Ashar station in the summer, as in Figure 5. The results of the statistical analysis showed that there were significant differences (p ≤ 0.005) between the stations studied. The highest rate was 10.238 mg/L in the Qurna station and the lowest rate was 4.263 mg/L in the Al-Ashar station. The results of the statistical analysis showed that there were no significant seasonal differences ($p \geq 0.05$), as The highest rate was 8.567 mg/liter in the winter and the lowest rate was 7.458 mg/liter in the summer.

The reason for the decrease in DO values at Al-Ashar station in the summer may be attributed to the proximity of this station to the city center, and thus the amount of waste excreted increases as it is a densely populated area. The rise in temperatures also increases the metabolic activity of bacteria decomposing organic waste (Qzar *et al*.,2021), as well as the increase in biological activity that leads to an increase in consumption of dissolved oxygen and this is consistent with (Al-Awady *et al*., 2015; Al-Hemidawi *et al*., 2021; Qu *et al*.,2022) dissolved oxygen is positively related to the total rate of pesticides r = 0.224.



(Figure 5) Seasonal changes in dissolved oxygen (DO) values at the study stations for the period from August 2020 - March 2021

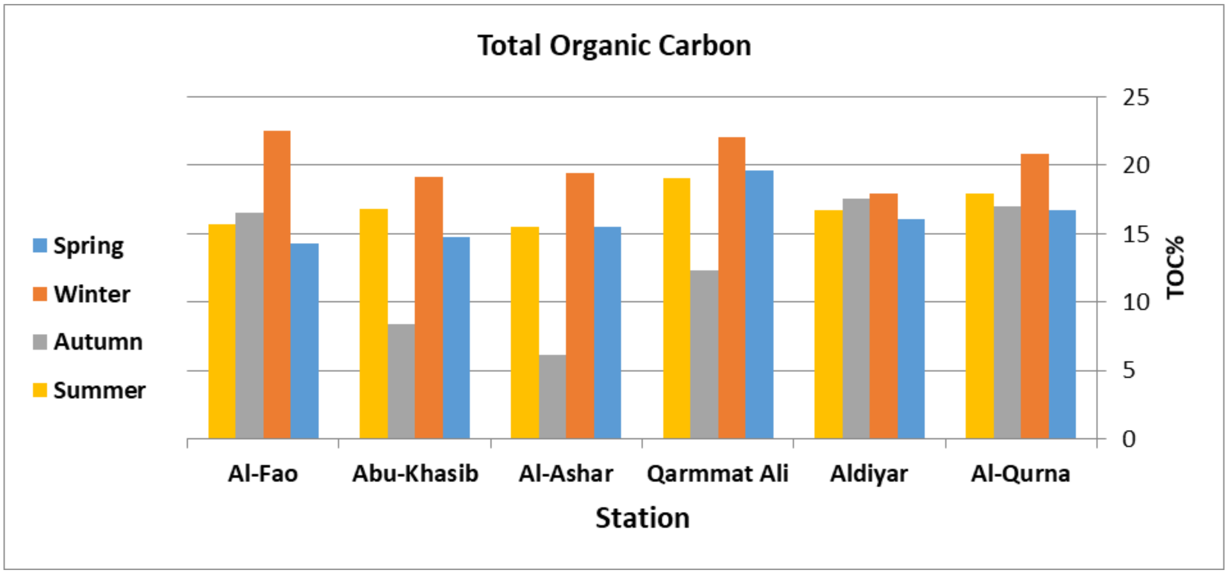
Total Organic Carbon in Sediments (TOC%)

Organic carbon is produced from various sources, including weathering processes of rocks and dead remains of living organisms (Al-Hejaj, 2019; AL-Zabad, 2021; AL-Assad *et al*., 2021), as well as human and animal waste, which plays an important role. In increasing the organic carbon content in sediments, the chemical and biological processes that occur in sediments greatly affect the percentage of total organic carbon (Al-Hejuje *et al*., 2015).

The highest value of the total organic carbon content (TOC) % 22.55 was recorded at Al-Fao station in the winter season, and the lowest value 6.17 was recorded at Al-Ashar station in the fall season, as in Figure 6.

The results of the statistical analysis showed that there were no significant differences ($p \geq 0.05$) between the stations studied. The highest rate was18.27 at Qarmmat Ali station and the lowest rate 14.16 was at Al-Ashar station. The results of the statistical analysis also showed the presence of significant differences ($p \leq 0.05$) in the quarterly and recorded The highest rate is

20.32 in the winter and the lowest rate is 13.02 in the fall. It was observed that there was a correlation r = 0.196 between the percentages of organic carbon content and the percentages of sediment components, where the higher the percentage of clay and silt, the higher the TOC% value. Also, the percentages of organic carbon content are positively and significantly related to Dissolved oxygen r = 0.35, and an inverse significant correlation as observed between TOC% and temperature r = 0.32, and the percentages of organic carbon w content also have a positive significant correlation r = 0.30 with the total rate of pesticides.



(Figure 6) Seasonal changes in the values of the total organic carbon content (TOC%) at the study stations for the period from August 2020 - March 2021.

The current study showed that there is a local and seasonal variation in the total concentrations of pesticides. The results showed that the highest rate of the pesticide Alpha-lindane was 8.99 micrograms/kg in Al-Fao station. This is due to the fact that the station has many farms and leads to leaching of pesticides from agricultural lands.

To the rivers and thus reaching the Shatt al-Arab stream. Fishing is also frequent at the Al-Fao station, and it is often illegal fishing in which pesticides are used. It may be the result of sedimentation of suspended materials that carry pesticides, as organochlorine pesticides are poorly soluble in water and have a high tendency to bind to sediments, in particular Clay and silty clay are characteristic of this region. The lowest rate is 0.1 micrograms - kilograms in Al-Qurna, Abu Al-Khasib, Qarmmat Ali and Al-Diyar stations. As for the Delta-lindane pesticide, the highest rate was recorded 0.4 micrograms\ kg in both Qarmmat Ali and Diyar stations, while the lowest rate was 0 micrograms \kg in both Al-Ashar and Al-Diyar stations. The highest rate of Lindane pesticide was recorded 0.9 micrograms \kg in Al-Fao station, the lowest rate recorded in Diyar and Al- Ashar stations.

(Table 2) Showing the rate of chlorine pesticides, the highest value and the lowest value**.**

	Station					
Name of the pesticides	S1Q Mean±SD Range(Mini-Max)	S2D Mean±SD Range(Mini -Max	S3K Mean±SD Range(Mini -Max	S4ASH Mean±SD Range(Mini-Max	S5KH Mean±SD Range(Mini-Max	S6FA Mean±SD Range(Mini-Max
Alpha-lindane	1.032±1.232 R (0.1-2.7)	0.29±0.147 R(0.1-0.46)	0.29±0.147 R(0.1-0.46)	0.462±0.180 R(0.27-0.7)	1.08±1.142 R(0.1-2.25)	4.31±4.768 R(0.2-8.99)
Delta-lindane	0.067±0.037 (0.04-0.1)	0.2±0.173 R(0-0.4)	0.2±0.173 R(0-0.4)	0.163±0.126 R(0-0.3)	0.126±0.082 R(0.08-0.2)	0.177±0.165 R(0.09-0.4)
lindane	0.29±-0.324 (0.05-0.7)	0.23±0.125 R(0-0.3)	0.23±0.125 R(0-0.3)	0.262±0.220 R(0.09-0.5)	0.25±0.189 R(0.0.4)	0.5±0.365 R(0.1-0.9)
Heptachlor	0.252±0.121 (0.13-0.4)	0.76±0.554 R(017-1.5)	0.76±1.5 R(0.17-1.5)	0.432±0.258 R(0.2-0.8)	0.182±0.109 R(0.1-0.33)	0.533±0.444 R(0-1.02)
Aldrine	0.402±0.236 (0.2-0.65)	0.967±0.928 R(0.27-2.3)	0.967±0.928 R(0.27-2.3)	0.78±0.390 R(0.46-1.3)	0.355±0.201 R(0.2-0.65)	0.52±0.446 R(0.14-1)
Epoxyhepta chlor	0.61±0.238 (0.4-0.9)	0.557±0.244 R(0.2-0.73)	0.557±0.244 R(0.2-0.73)	0.945±0.862 R(0.22-2)	0.47±0.295 R(0.08-0.7)	0.505±0.11 R(0.4-0.6)
D.D.E	0.06±0.047 (0-0.1)	0.2±081 R(0.1-0.3)	0.2±081 R(0.1-0.3)	0.1±0.05 R(0-0.1)	0.2±0.129 R(0-0.3)	0.15±0.095 R (0-0.2)
Dieldrin	1.163±0.950 (0-1.72)	0.92±0.890 R(0.1-1.73)	0.92±0.890 R(0.1-1.73)	1.173±1.184 R(0-2.56)	0.905±0.907 R(0.2-2.1)	0.87±0.840 R(0.1-1.93)
D.D.D	1.383±1.151 (0.3-2.55)	1.06±1.497 R(0-3.04)	1.06±1.497 R(0-3.04)	0.253±0.276 R(0.0.6)	0.977±1.617 R(0.1-3.4)	1.28±1.217 R(0-2.59)
Endrin ketone	1.015±0.700 (0.1-1.8)	0.25±0.129 R(0.1-0.4)	0.25±0.129 R(0.1-0.4)	0.533±0.605 R(0-1.3)	0.1±0.057 R(0-0.1)	0.682±0.435 R(0.03-0.9)
Methoxy chlor	0.6±0.704 (0-1.5)	0.305±0.298 R(0-0.6)	0.305±0.298 R(0-0.6)	0.643±0.702 R(0-1.5)	0.2±0.129 R(0-0.2)	0.45±0.262 R(0-0.5)
Endrin	3.02±4.434 (0.25-9.6)	2.095±2.516 R(0.18-5.8)	2.095±2.516 R(0.18-5.8)	0.737±0.406 R(0.25-1.2)	1.225±0.865 R(0.4-2.2)	0.752±0.553 R(0.21-1.5)
Endosulfan	0.4±0.231 (0-0.41)	0.505±0.301 R(0-0.6)	0.505±0.301 R(0-0.6)	0.28±0.174 R(0-0.36)	0.56±0.329 R(0-0.64)	0.175±0.101 R(0-0.18
Total Pesticides	9.28	5.485	7.573	5.91	5.945	10.385

As for the pesticide Heptachlor, it recorded the highest rate 1.5 micrograms - kilograms in both Al-Karma and Al-Diyar stations. As for Aldrine pesticide, it recorded the highest rate 2.3 micrograms - kilograms in Al-Diyar station. This may be attributed to the large number of farms there, and the lowest rate was 0.14 micrograms \kg in the station Al-Fao.

As for the pesticide Epoxyheptachlor, the highest rate was recorded at 2 micrograms \gm in Al-Ashar station. This is due to its being a densely populated residential area and the frequent use of pesticides in addition to the large number of carpentry workshops that use floor pesticides to protect wooden boards. The lowest rate was 0.08 micrograms \kg at Abu Al-Khasib station.

As for D.D.E pesticide, the highest rate was recorded at 0.3 micrograms per kilogram at Al-Diyar and Al-Karma station, and the lowest rate was 0.05 micrograms per kilogram at Al-Ashar station.

As for the pesticide Dieldrin, the highest rate was 2.56 micrograms \kg at Al-Ashar station, which is due to it being a densely populated area and the frequent use of pesticides to control insects and rodents. The lowest rate was 0.1 micrograms\kg at both the Qurna and Al-Diyar stations.

As for DDD pesticide the highest rate was recorded at 3.4 micrograms \kg at Abu Al-Khasib station, and the lowest rate was 0 micrograms \kg at both Al-Ashar and Al-Fao stations. As for the Endrine ketone pesticide, it recorded the highest rate 1.8 micrograms \kg at Al- Qurna station and the lowest rate was 0 micrograms \kg in each of Al-Ashar and Abu Al-Khasib stations. As for the pesticide Methoxychlor, the highest rate was recorded at 1.5 micrograms \kg in Al-Qurna and Al-Ashar stations, and the lowest rate was 0 micrograms \kg in each of Al-Diyar, Qarmmat Ali, Abu Al-Khasib and Al-Fao stations.

As for the Endrine pesticide, the highest rate was 9.8 micrograms \kg at Qarmmat Ali station. This is due to the fact that they are agricultural areas where pesticides are widely used to eliminate agricultural pests. The lowest rate was 0.18 micrograms \ kg at both Al-Diyar and Qarmmat Ali stations.

As for the pesticide Endosulfan, the highest rate was recorded at 0.64 micrograms per kilogram in Abu Al-Khasib station, while the lowest rate was 0 micrograms per kilogram in all stations studied.

The highest total of total pesticides 10.385 was recorded at Al-Fao station. This may be attributed to the fact that it is an agricultural area in addition to the fact that it is a hunting area, and pesticides are used in illegal hunting. This is due to the fact that this station has many animal pens and the use of pesticides. The area is also surrounded by agricultural land, and pesticides are usually used on farms. Also, the silty clay nature of the sediments of Al- Qurna station, and thus the adsorption of silt particles to pesticides increases and the concentration of pesticides increases.

This may be due to the large number of farms there, in addition to the fact that they are hunting areas and pesticides are used in illegal fishing. Also, the nature of the sediments in the Qarmmat Ali station is sandy silt, and therefore suspended pesticide particles increase, as there is a positive correlation between the concentration of pesticides and the percentage of silt in the sediments r = 0.454, It was observed that there is a positive significant correlation between the total concentration of pesticides and TOC% r = 0.300. This is consistent with what (Al-Ali ,2012) found, as he found that there is a positive correlation relationship r = 0.196. Also, the total number of pesticides recorded in Al-Qurna station was 9.28. This was attributed to those densely populated areas and the greater use of insect and rodenticides in homes, in addition to the presence of a proposal Wood and carpentry workshops, in which pesticides are used to prevent the growth of fungi, land insects, and earthworms, and also in which there are many farms, in which pesticides are often used to combat agricultural pests. As for the lowest total number of pesticides 5.485, it was recorded at Al-Diyar station, which is the lowest rate of pesticides. This is due to the low population density in the study station and the lack of farms. There are fish farms in it, which only use fungicidal and bacterial pesticides in very small quantities compared to what is used in combating agricultural pests. The results of the current study showed higher concentrations of total organochlorine pesticides at Al-Fao station compared to Al-Diyar, and this is consistent with what was found by (DouAbul *et al.,* 1988; DouAbul *et al*., 2014; Zhang *et a*l.,2021). The current study showed that there is seasonal variation in the total concentrations of pesticides, as the results showed an increase in pesticide values. In general, in winter and spring, there was an inverse correlation r = -0.262 between pesticide concentration and temperature, as lowering the temperature reduces decomposition processes. For organic matter, the percentage of CO2 produced in the water decreases, so the basicity of the water increases, and there is a correlation positive r = 0.435 between the concentration of pesticides and the pH. As for the fall season, an increase in the rate of pesticide concentration was recorded, as the rivers and bodies of water begin to stabilize in the fall season, and thus the sedimentation process increases, increasing the percentage of pesticides in the sediments. This is due to the fact Sediments act as reservoirs for pollutants in the aquatic environment (Al-Hejuje *et al.*, 2017;Prajapati *et al*. ,2022), and the rates were lowest in the summer, when the rate reached 6.48 micrograms/kg. The reason for this is the lack of use of pesticides in this season because it affects plant growth due to high temperatures.

Conclusions

In this study, it was observed that high concentrations of some chlorine pesticides in Shatt al-Arab sediments resulted from various human activities, including agriculture, pest control, and other various human activities. It was also noted that there is a correlation between pesticide concentrations in sediments and environmental variables the relationship studied was weak between some environmental variables and pesticides, such as conductivity electrical, temperature, and strongly with other environmental variables such as pH ,the total content of organic carbon and pesticides. The concentrations of pesticides in sediments according to the seasons were in the following sequence: winter season> Spring season > Autumn season > Summer season.

Reference

Al-Ali, B. S. 2012. Residues of some pesticides in water, sediments and neighborhoods from areas east of the Hamar Marsh. Doctoral thesis, College of Agriculture. University of Basra, 257 pages (in Arabic).

Al-Asadi, A. A. 2019. Evaluating the impact of wastewater on water quality and the level of pollution and nutrition in the central marshes/southern Iraq. Master's thesis, College of Science, University of Basra: 160 pages (in Arabic).

Al-Awady, A. A.; Al-Khafaji, B. Y. and Abid, N. M. 2015. Concentration of some heavy metals in water, sediment and two species of aquatic plants collected from the Euphrates river, near the center of Al-Nassiriyia city, Iraq. Marsh Bulletin, 10(2): 161-172**.** https://www.iasj.net/iasj/pdf/f3beca0e50678f42

Al-Hejuje , M.M. 2014.Application of water quality and pollution indicides to evaluate the water and sediments status in middle part of Shatt Al-Arab River .Ph. D Thesis, collage of science, University of Basrah,240.

Al-Hejuje, M.M.; Hussain, N.A. and Al-Saad, H.T. 2015. Total Petroleum Hydrocarbons (TPHs), n-alkanes and Polynuclear Aromatic Hydrocarbons (PAHs) in water of Shatt Al-Arab River – part 1. Global Journal of Biology, Agriculture & Health, 4(1):88-94. https://www.walshmedicalmedia.com/open-access/total-petroleum-hydrocarbons-tphs--nalkanes-and-polynuclear-aromatic-hydrocarbons-pahs-in-water-of-shatt-alarab-river--p.pdf

Al-Hejaje, M. H. K. 2019. The Effect of Environmental Factors on the Distribution of Hydrocarbons in Waters and Sediments of the Northern Part of Shatt Al-Arab River [Master thesis]. University of Basrah.

Al-Hejuje, M.M., Hussain, N.A. and Al-Saad, H.T. 2017. Applied heavy metals pollution index (HPI) as a water pollution indicator of Shatt Al-Arab river, Basrah-Iraq, International Journal of Marine Science, 7(35): 353-360. doi: 10.5376/ijms.2017.07.0035

Al-Hassani, J. S. and Hassan, F. M. and Nader, R. .2014. An environmental study of algae attached to the chelicet plant in the Tigris River within the city of Baghdad. Baghdad Journal of Science, 11(3): 1353(in Arabic).

Al-Hemidawi, F. N. M.; Mohammed, A. H., and Al-Saad, H. T. 2021. Water Quality of Al-Dalmaj Marsh, Iraq. Mesopotamian Journal of Marine Sciences, 35(1), 13–24. https://doi.org/10.58629/mjms.v35i1.27.

APHA: American Public Health Association. 2005**.** Standard methods for the examination of water and wastewater, 21sh Edition Washington, D.C. USA.

Al-Mahmoud, H. K. 2020. Proposed models for establishing a regulatory block in the Shatt al-Arab stream. Journal of Basra Studies. University of Basrah, 15 (35): 110-73.

Al-Zabad, R. A.; Al-Khafaji, A. H. and Al-Saad, H. T. 2021. Concentrations of Polychlorinated Biphenyls (PCBs) in Phragmites australis of Shatt AL-Arab River. South of Iraq. Al-Qadisiyah Journal of Pure Science, 26(4): 199-209. https://doi.org/10.29350/qjps.2021.26.4.1422.

Cui, S.; Hough, R.; Yates, K.; Osprey, M.; Kerr, C.; Cooper, P.; Coull, M. and Zhang, Z. 2020. Effects of season and sediment-water exchange processes on the partitioning of pesticides in the catchment environment: Implications for pesticides monitoring. Science of The Total Environment, 698, 134228. https://doi.org/10.1016/j.scitotenv.2019.134228

DouAbul , A.A.Z. ; Al-Saad , H.T. ; Al- Timari, A.A.K. and Al- Rekabi, H. N. 1988 . Tigris – Euphrates Delta : A major Source of pesticides to the shatt Al-Arab River (Iraq) . Archives of Environmental Contamination and Toxicology, 17:405-418. https://doi.org/10.1007/bf01055178 .

Douabul, A. A. Z. and Al-Timari, A. A. K. 2014. On the Organochlorine pesticide residues in the Marshes, Shatt Al-Arab and the Arabian Gulf system. Mesopotamian Journal of Marine Sciences, 29(2), 97–114. https://doi.org/10.58629/mjms.v29i2.129.

EPA. U.S. Environmental Protection Agency. 2007. Method 1699: Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS ,1200 Pennsylvania Avenue NewYork , Washington, 2046pp.

Helal, I.M. and Abo-El-Seoud, M.A. 2014. Fungal biodegradation of pesticide vydatein soil and aquatic system. International Conference on Radiation, :87-94. https://www.researchgate.net/profile/Ismail-Helal/publication/324221863_Fungal_Biodegradation_Of_Pesticide_Vydate_In_Soil_And_Aquatic_System/links/5ac5e1b3458515798c3085d5/Fungal-Biodegradation-Of-Pesticide-Vydate-In-Soil-And-Aquatic-System.pdf

Karishma, B. and Hari, P.S. 2015. Advances in biodegradation of organophosphorus pesticides. Architecture Applied Research Science., 7 (4):37-43. https://www.scholarsresearchlibrary.com/articles/advances-in-biodegradation-of-organophosphorus-pesticides.pdf.

Kurt, B. 2015. Discovery of oil and oil based environmental pollution in ottoman Iraq: the incident of Mohammarah (1913–1914). Journal of Eurasian Studies, IV(2):162–177. https://dergipark.org.tr/tr/download/article-file/256598.

Kumar, S. K. ; Logeshkumaran, A. ; Magesh, N. S. ; Godson, P. S. and Chandrasekar, N. 2015. Hydrogeochemistry and application of water quality index (WQI) for groundwater quality assessment, Anna Nagar, part of Chennai City, Tamil Nadu, India. Applied Water Science. 5: 335–343. http://dx.doi.org/10.1007/s13201-014-0196-4.

Muslim, A. A. 2020. Evaluation of the concentrations of some hydrocarbon compounds and trace elements in water, sediments, and Nile tilapia (LOreochromis niloticus) in the Shatt al-Arab. Master's thesis, College of Science, University of Basra, 127 pages(inArabic).

Mohammad ,A. J.; Alyousif ,N. A.; Al-Mosawi, U. S. and Al-Hejuje ,M. M. 2021. Assessment of water quality supplies in some areas of Basrah Governorate, Iraq. Ecology Enviroment and Conversation, 27 (1) :404-409. http://www.envirobiotechjournals.com/article_abstract.php?aid=11252&iid=327&jid=3.

Prajapati, S.; Challis, J. K.; Jardine, T. D. and Brinkmann, M. 2022. Levels of pesticides and trace metals in water, sediment, and fish of a large, agriculturally-dominated river. Chemosphere, 308, 136236. https://doi.org/10.1016/j.chemosphere.2022.136236.

Qzar, I. A.; Al-Hejuje, M. M.; Talib, A. and Rajab, A. M. 2021. The effect of Qarmmat Ali channel on the water quality of Shatt Al-Arab river. Marsh Bulletin, 16 (2): 106.

Qu, C.; Albanese, S.; Cicchella, D.; Fortelli, A.; Hope, D.; Esposito, M.; Cerino, P.; Pizzolante, A.; Qi, S.; De Vivo, B. and Lima, A. 2022. The contribution of persistent organic pollutants to the environmental changes in Campania region, Italy: Results from the Campania Trasparente project. Journal of Geochemical Exploration, 241, 107071. https://doi.org/10.1016/j.gexplo.2022.107071 1.

Singh, N. K.; Sanghvi, G.; Yadav, M.; Padhiyar, H.; Christian, J. and Singh, V. 2023. Fate of pesticides in agricultural runoff treatment systems: Occurrence, impacts and technological progress. Environmental Research, 117100. https://doi.org/10.1016/j.envres.2023.117100.

Yadav, S., Chauhan, A. K., Kumar, S., & Kataria, N. 2022. Advanced membrane technology for the removal of pesticides from water and wastewater. In Pesticides Remediation Technologies from Water and Wastewater (pp. 143-156). Elsevier. https://doi.org/10.1016/B978-0-323-1.00007-6.

Zaghloul, A.; Saber, M. and Abd -El- Hady, M. 2019. Physical indicators for pollution detection in terrestrial and aquatic ecosystems. Bulletin of the National Research Centre, 43(1):1-11. https://doi.org/10.1186/s42269-019-0162-2.

Zhang, Y.; Wang, C. and Du, L. 2021. Distribution, Source and Potential Risk Assessment of Polychlorinated Biphenyls (PCBs) in Sediments from the Liaohe River Protected Area, China. Sustainability, 13(19), 10750. https://doi.org/10.3390/su131910750.