Assessment of the Contamination with Some Heavy Metals and their Impact on the Quality of Phytoplankton Algae in Some Areas of the Tigris River/ Baghdad.

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ABSTRACT

Background: Heavy metal pollution is one of the major environmental threats affecting aquatic ecosystems and phytoplankton communities in rivers. Algae are important bioindicators of water quality and may contribute to the bioremediation of pollutants. **Objective:** This study aimed to assess heavy metal contamination in selected areas of the Tigris River and evaluate its impact on non-diatom phytoplankton diversity and distribution. **Methodology:** Water and algal samples were collected from four sites along the Tigris River during autumn 2024. Physicochemical parameters, nutrients, and heavy metals (lead, nickel, and chromium) were measured using standard laboratory methods. Algal species were identified microscopically, and statistical analyses were performed. **Results:** The results showed elevated concentrations of lead, nickel, and chromium with significant variations among study sites. A total of 28 non-diatom phytoplankton species belonging to 15 genera were identified. Cyanobacteria represented the dominant group, while Euglenophyta showed the lowest occurrence. Significant correlations were observed between heavy metal concentrations and algal community composition. Some algal species demonstrated tolerance to high levels of heavy metals. **Conclusion:** Heavy metal pollution in the Tigris River affects the diversity and distribution of phytoplankton algae. Certain algal species exhibited resistance to heavy metal contamination, indicating their potential application in bioremediation processes.

Keywords: Algae, Water quality, Heavy metals, Tigris River.
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INTRODUCTION

Industrial development and the resulting wastewater, mining, and agricultural residues cause significant pollution of ecosystems, especially the aquatic environment (1). Industrial and agricultural wastes contain large amounts of metals, including copper, arsenic, zinc, and lead from automobile exhaust, as well as pesticides that release arsenic, and fossil fuel combustion that releases tin, selenium, mercury, vanadium, and nickel (2). Human activities have been found to contribute to environmental pollution (3,4)

Heavy metals are among the most dangerous pollutants, degrading most natural ecosystems due to their high stability and long persistence. They can reach places far from their areas of origin as they accumulate in the environment and the food chain, and because they are not biodegradable, heavy metal pollution significantly affects organisms (5, 6). Heavy metals can be divided into two parts: The first is essential or necessary for various activities in the organism, such as selenium, iron, zinc, and copper, and the second part is non-essential and highly toxic even in low concentrations, causing toxic effects on living organisms, such as mercury, arsenic, cadmium, chromium, and lead (7). It is worth noting that most chemicals can affect aquatic organisms under certain conditions and often lead to poisoning if their concentrations exceed the organisms' normal levels (8). Algae are autotrophic organisms that occur in fresh water, marine environments, and on soil surfaces. Most of them can live in a wide range of temperatures and salinities, with some species tolerating temperatures up to 80ºC and salinity up to 2.5% (9). They can have different sizes and colors and produce about 9% of the total oxygen in the air (10). Some algae can live on rocks in symbiotic association with fungi, forming the so-called lichens (11, 12).

Algae can contribute to the formation of oil and natural gas through the accumulation and decomposition of organic matter under anaerobic conditions in aquatic sediments (13, 14). They also play an important role in reducing carbon dioxide and increasing oxygen levels, and are used in the agar and algin industries, in the manufacture of paper for cleaning eye lenses, and in purifying the aquatic environment from harmful substances (15).

Recent studies in Iraq show that water quality and heavy-metal contamination affect growth and distribution, playing an important role in assessing water pollution levels (16, 17).

A study conducted on the Euphrates River in Babil province revealed the accumulation of heavy metals, such as cadmium, lead, and chromium, in various algal species, including *Spirogyra aequinoctialis* and *Oscillatoria tenuis*. The results showed that cadmium concentrations in the water reached 8.67 mg/L, while chromium accumulation in the algae reached 180 µg/g dry weights, indicating the algae’s ability to absorb and accumulate these metals from the surrounding environment (18). Additionally, a study in the city of Basra showed seasonal and spatial variations in heavy metal levels in the Shatt al-Arab River, with high concentrations of iron, lead, and nickel recorded during winter, indicating the impact of environmental factors on the distribution of these metals (19). These studies highlight the importance of monitoring water quality and understanding the impacts of heavy metal pollution on aquatic organisms, especially algae, due to their vital role in the food chain and their ability to bioaccumulate, which can affect human health and the environment.

Therefore, the current article aims to investigate the concentrations of heavy metals in the Tigris River in the city of Baghdad and to identify the species of non-diatomic algae present across different mineral concentrations.

METHODOLOGY

The study involved collecting water and algal samples from four sites along the Tigris River in Baghdad, including Muthanna Bridge, Al-Krayat Bridge, Al-Sarafiya Bridge, and the Al-Dora power site, as shown in Table 1 and Figure 1.

Table (1). Study sampling stations by latitude and longitude using a GPS device.

Study Sites	**Device Reading**					
	Longitude (east)			**Latitude (north)**		
	°	′	″	°	′	″
Al-Muthanna Bridge	44	20	44	33	25	43
Al-Kadhimiya (Al-Krayat Bridge)	44	22	14	33	21	08
Medical City (Sarafiya Bridge)	44	22	23	33	21	13
Dora Power site	44	48	39	33	31	75

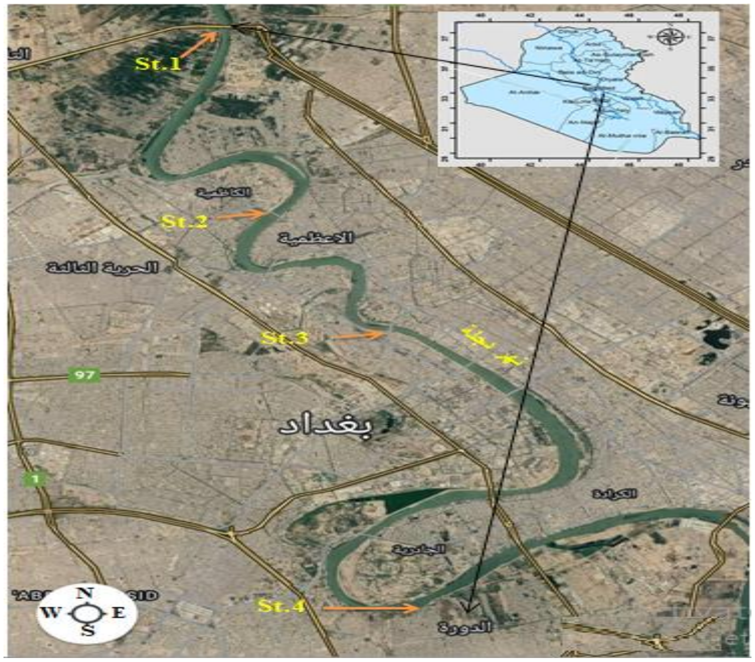


Figure (1). Satellite image of Iraq showing sites for collecting water samples from the Tigris River within the province of Baghdad.

During the Autumn season of 2024, water samples were taken with clean, sterile and sealed bottles with a capacity of 1 liter in three replicates for each site to measure the physico-chemical parameters obtained by measuring the air and water temperature with a mercury thermometer, the measurement of pH with a pH meter, the measurement of total dissolved solids (TDS), a conductivity meter and the measurement of nutrients represented by sulfates with a sulfate reagent (Hanna HI93751, Twain). Nitrates and phosphates were measured using a UV-Visible Spectrophotometer (Shimadzu UV-1800, Japan), and heavy metals such as lead, nickel, and chromium were measured using an atomic absorption spectrometer (AAS 6300, Shimadzu, Japan) at the Environmental Research Center of the Technical College. Samples of planktonic algae were collected using a 20 μm plankton collection net and preserved with a local solution for algae preservation. Slides were prepared for the diagnosis and classification of algae and examined by composite light microscopy using available diagnostic reference keys (20, 21).

Statistical analysis

The results for all analyzed parameters are presented as the mean ± standard error (SE). Statistical differences among group means were evaluated using a one-way analysis of variance (ANOVA), performed with IBM SPSS version 25.0. Subsequently, multiple comparisons were conducted using the least significant difference (LSD) test, with statistical significance set at $P \leq 0.05$. Pearson's correlation coefficient was used to assess the correlation between heavy metal levels and algal community composition. Statistical significance was defined as a probability value ($p \leq 0.05$) (22).

RESULTS

As illustrated in Table 2 and Figure 2, the highest value of air temperatures, 30.83°C, was recorded at the Al-Sarafiya Bridge site, and the lowest value of 22.33°C was recorded at the Al-Krayat Bridge site, while the water temperature recorded the highest value of 24.67°C at the Al-Sarafiya Bridge site and the lowest value of 20.67°C at the Al-Krayat Bridge and Al-Dora sites. The results of the statistical analysis show significant differences between the sites.

The water's alkalinity results showed that values ranged from 7.83 in Al-Dora to 7.60 in Al-Sarafiya Bridge. It was found that the average pH for the four sites on the Tigris was moderate, and the temperatures (water, air) were moderate and close to each other.

When total dissolved solids were measured, the highest value was recorded at the Al-Muthanna Bridge site at 396.33 mg/L, while the lowest was recorded at the Al-Krayat Bridge site at 260.33 mg/L. For electrical conductivity, the highest value was 666.33 µs/cm at the Al-Sarafiya Bridge site, while the lowest was 547.67 µs/cm at the Al-Krayat Bridge site.

As for sulfate (SO_4), the highest value was recorded at the AL-Dora site, which was 246.00 mg/L, while the lowest value at the site of the Al-Sarafiya bridge was 118.00 mg/L, which are high values but do not exceed the permissible limit of Iraqi water specifications and is due to the high percentage in the area of Al-Dora as a result of the presence of wastewater at the site.

As for nitrates, the highest value was 0.30 mg/L at the Al-Sarafiya Bridge and Al-Krayat Bridge sites, and was totally absent at the Al-Muthanna Bridge site. The permissible limit for nitrates for the growth of aquatic organisms is (13-50) mg/L according to Iraqi qualifications, while in this study, the orthophosphate levels were (0.12-1.06) mg/L.

Sites vary in lead concentration values with the highest value recorded at Al-Krayat Bridge at 527.7 µg/L, while the lowest value was recorded at Al-Sarafiya Bridge at 209.4 µg/L. The highest nickel value was measured at the Al-Muthanna Bridge at 449 µg/L, while the lowest value was measured at the Al-Krayat Bridge at 180 µg/L. The highest value for chromium was measured at the Al-Sarafiya Bridge site at 295.3 µg/L and the lowest value at the Al-Dora site at 76.00 µg/L (Table 2, Figure 2).

Table 2: Shows the rates of physicochemical parameters measured in the Tigris River in Baghdad.

Parameters		Al-Muthanna Bridge	Al-Kadhimiya (Al-Krayat Bridge)	Medical City (Sarrafiya Bridge)	Dora Power site	Total	P-value
Air temperature	Mean±Std. Error	27.67±0.33^{b}	22.33±0.33^{c}	30.83±0.33^{a}	26.07±0.07^{d}	26.73±0.93	0.01**
	Range	27.00-28.00	22.00-23.00	30.50-31.50	26.00-26.20	22.00-31.50	
	p-value	0.001*					
Water temperature	Mean±Std. Error	22.17±0.17^{b}	20.67±1.00^{b}	24.67±0.88^{a}	20.67±0.67^{b}	21.88±0.63	0.05**
	Range	22.00-22.50	19.00-22.00	23.00-26.00	20.00-22.00	19.00-26.00	
	p-value	0.01**					
pH	Mean±Std. Error	7.65±0.03^{a}	7.67±0.91^{b}	7.60±0.06^{a}	7.83±0.02^{b}	7.75±0.04	0.01**
	Range	7.60-7.69	7.91-7.92	7.50-6.70	7.79-7.85	7.50-7.92	
	p-value	0.001*					

Similar letters: there is no significant difference among sites

Different letters: There is a moral difference among sites

*High significant difference at probability level P≤0.001

**Significant difference at probability level P≤ 0.05

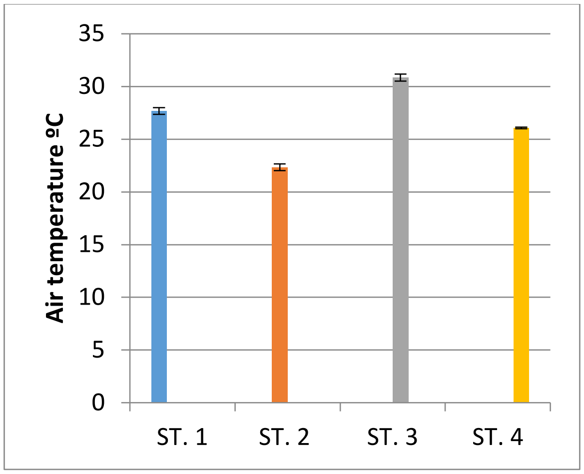
Parameters		Al-Muthanna Bridge	Al-Kadhimiya (Al-Krayat Bridge)	Medical City (Sarrafiya Bridge)	Dora Power site	Total	P-value
TDS (mg/l)	Mean±Std. Error	396.33±0.88^{b}	260.33±0.33^{c}	317.33±0.33^{a}	278.00±0.00^{d}	288.00±6.39	0.001*
	Range	295.00-298.00	260.00-261.00	317.00-318.00	278.00-278.00	260.50-318.00	
	p-value	0.001*					
Electrical conductivity (μs/cm) /l	Mean±Std. Error	592.00±0.00^{b}	547.67±0.33^{c}	666.33±0.33^{a}	551.00±0.58^{d}	589.25±14.41	0.001*
	Range	592.00-592.00	547.00-548.00	666.00-667.00	550.00-552.00	547.00-667.00	
	p-value	0.001*					
Sulfate (SO_4) (Mg/l)	Mean±Std. Error	184.00±0.58^{b}	182.00±0.00^{c}	118.00±0.58^{a}	246.00±0.58^{d}	182.00±13.65	0.01**
	Range	183.00-185.00	182.00-182.00	117.00-119.00	245.00-247.00	117.00-247.00	
	p-value	0.001*					
Nitrates (NO_3) Mg/l	Mean±Std. Error	0.00±0.00^{b}	0.30±0.00^{a}	0.30±0.05^{a}	0.13±0.04^{c}	0.18±0.04	0.05**
	Range	0.00-0.00	0.30-0.30	0.20-0.40	0.09-0.20	0.00-0.40	
	p-value	0.001*					
Phosphate (PO_4) Mg/l	Mean±Std. Error	0.12±0.01^{b}	0.22±0.00^{c}	1.06±0.01^{a}	0.24±0.01^{d}	0.41±0.11	0.05**
	Range	0.11-0.13	0.22-0.22	1.05-1.07	0.23-0.25	0.11-1.07	
	p-value	0.001*					
Lead (Pb) μg/L	Mean±Std. Error	315.50±0.06^{b}	527.70±0.00^{c}	209.40±0.06^{a}	485.50±0.00^{d}	384.53±38.77	0.001*
	Range	315.40-315.60	527.70-527.70	209.30-209.50	485.50-485.50	209.30-527.70	
	p-value	0.001*					
Nickel (Ni) μg/L	Mean±Std. Error	449.00±0.58^{b}	180.22±0.00^{c}	337.60 ±0.06^{a}	188.00±0.29^{d}	286.15±32.65	0.001*
	Range	438.00-440.00	180.00-180.00	337.50-337.70	187.50-188.50	180.00-440.00	
	p-value	0.001*					
Chrome (cr) μg/L	Mean±Std. Error	159.80±0.06^{b}	82.30±0.06^{c}	295.30 ±0.00	76.00±0.00^{d}	153.15±26.64	0.001*
	Range	159.05-159.90	82.20-82.40	296.30-295.30	76.00-76.00	76.00-295.30	
	p-value	0.001*					

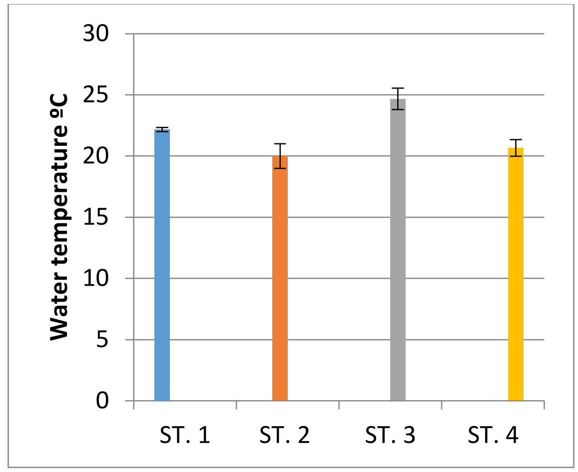
Similar letters: there is no significant difference among sites

Different letters: There is a moral difference among sites

*High significant difference at probability level P≤0.001

**Significant difference at probability level P≤ 0.05


Air temperature ºC
0
5
10
15
20
25
30
35
ST. 1
ST. 2
ST. 3
ST. 4


Water temperature ºC
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ST. 1
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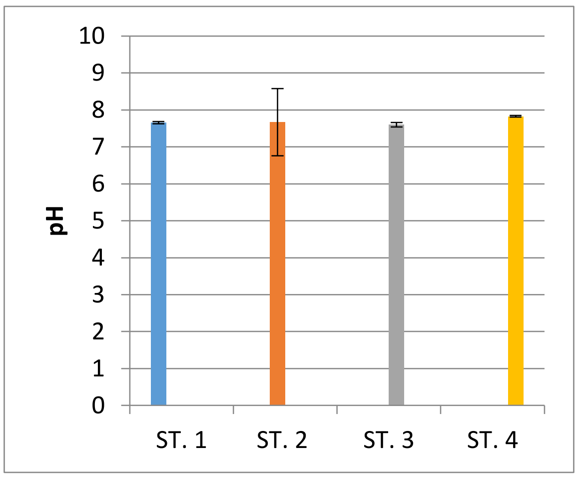
pH
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ST. 1
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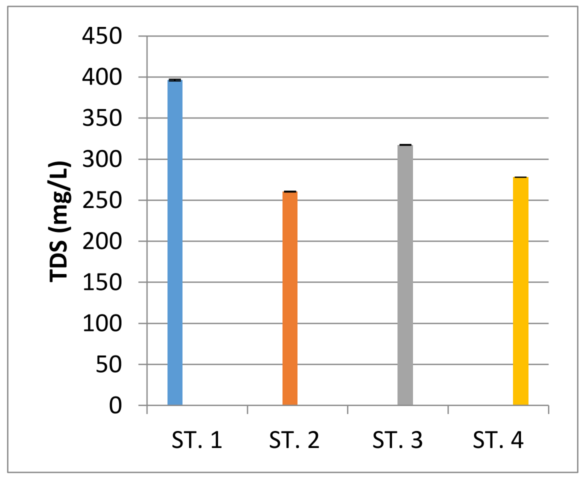
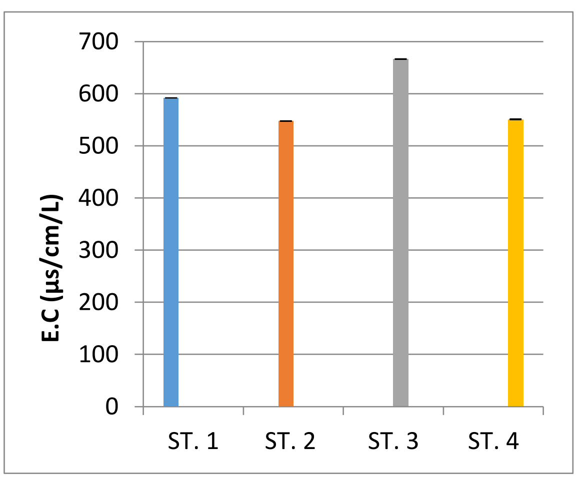
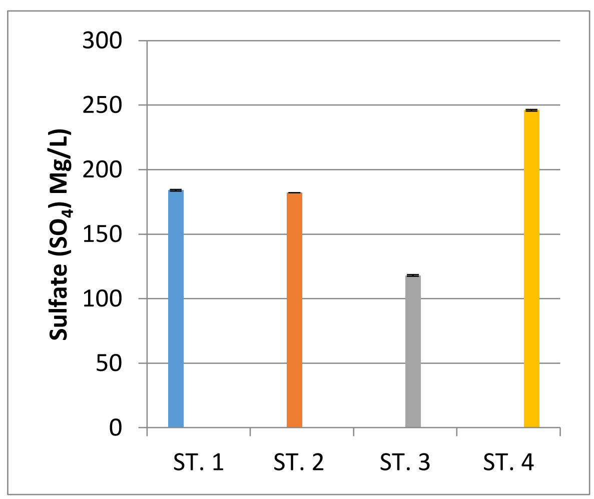
ST. 3
ST. 4


TDS (mg/L)
0
50
100
150
200
250
300
350
400
450
ST. 1
ST. 2
ST. 3
ST. 4


E.C (µs/cm/L)
0
100
200
300
400
500
600
700
ST. 1
ST. 2
ST. 3
ST. 4


Sulfate (SO_4) Mg/L
0
50
100
150
200
250
300
ST. 1
ST. 2
ST. 3
ST. 4

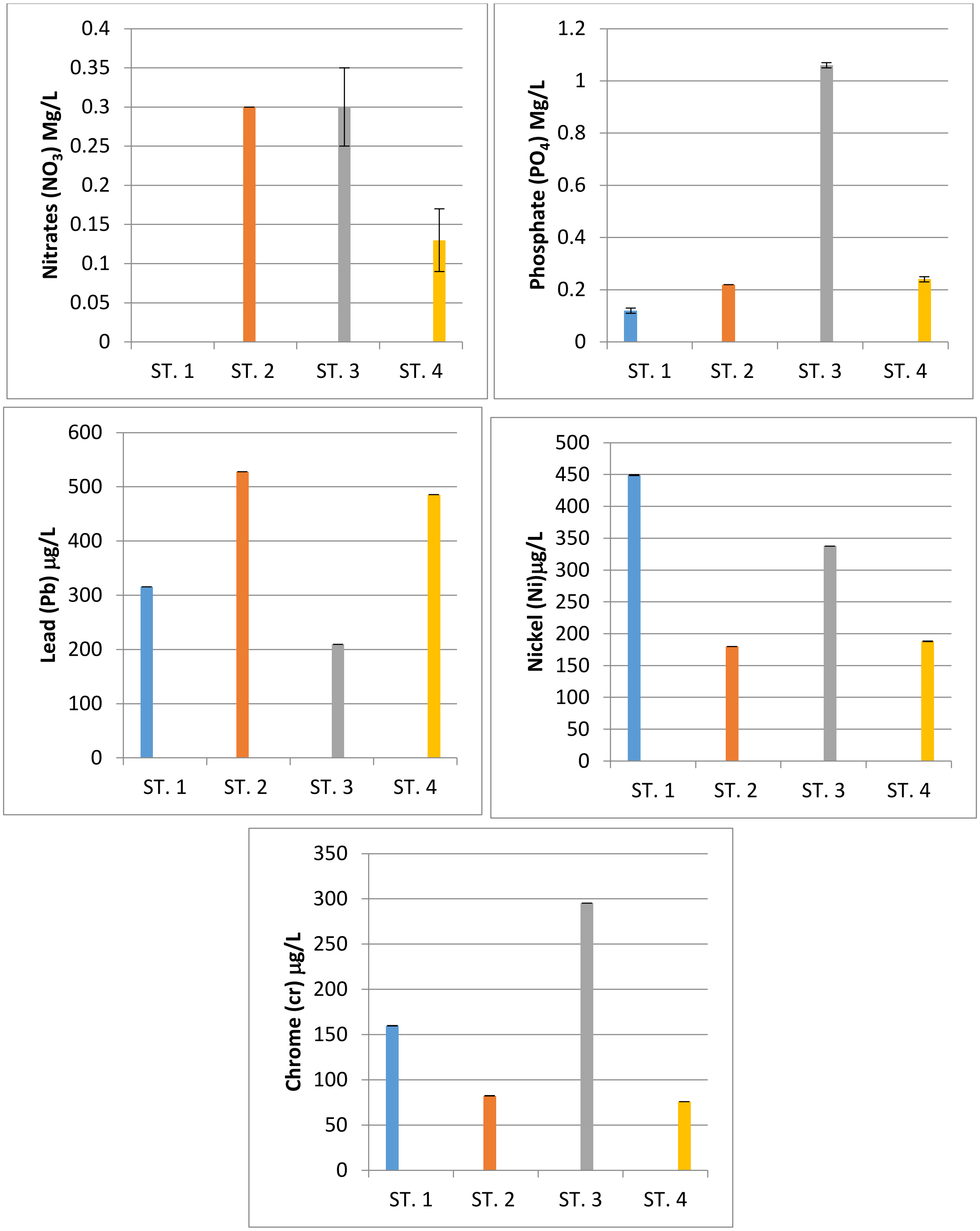


Figure 2: Physicochemical parameters measured in the Tigris River in Baghdad,ST.1:Al-Muthanna bridge, ST.2: Al-Krayat bridge, ST.3: Sarafiya bridge, ST.4: Dora power site.

The study diagnosed 28 species of non-diatomic planktonic algae belonging to 15 genera; the most species belonged to blue-green algae, which amounted to 15 species (8 genera), followed by green algae (12 species, 6 genera), and the least species was euglenid algae (Figure 3), with one species belonging to the genus *Euglena* (Table 3). The highest number of species was recorded at Al-Krayat Bridge site, amounting to 13 species, followed by the Al-Dora site, while the lowest numbers were at Al-Sarafiya Bridge site and Al-Muthanna Bridge site, where the number reached 8 species (Table 3 and Figure 4). The presence of *Chlorella vulgaris* species was observed in all sites, while *Chlorococcum humicola* algae was found at Al-Muthanna Bridge and Al-Dora sites.

The study also found a correlation between lead and a negative and high algal community composition (r=-0.711), while the correlation between the algal community composition and chromium was positive and high (r=0.876). However, no high correlation was recorded between nickel and the algal community composition(r=0.159) (Table 4).

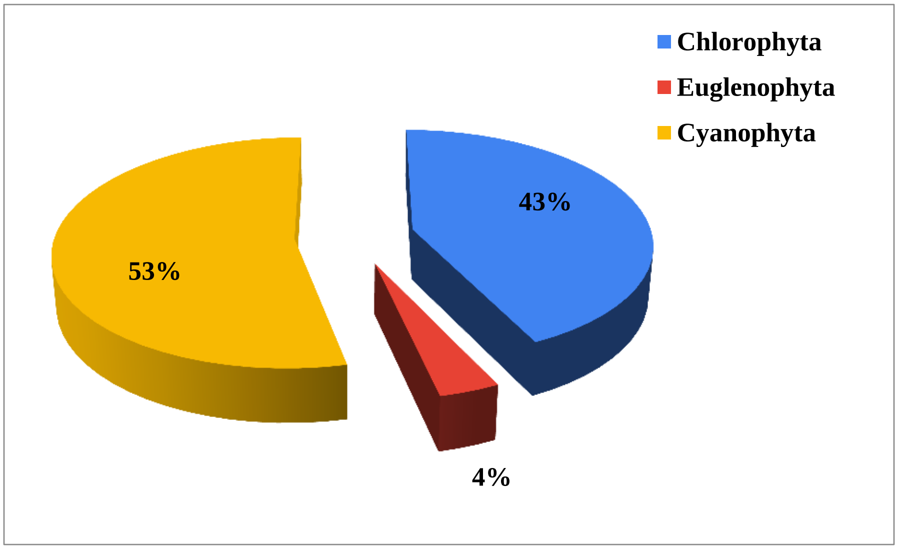


Figure 3: Ratios of planktonic algae classes at all study sites.

Table 3: Numbers of planktonic algae genera and species at all study sites.

Station Taxa	Al-Muthanna bridge	Krayat bridge	Sarafiya bridge	Dora power site
Division: Cyanophyta Class :Cyanophyceae 1-Order: Chroococcales				
Aphanocapsa elachista var. *planctonica* G. M. Smith	-	+	+	-
***Aphanothece bullosa*(Menegh .)Rabenhorst**	-	-	+	-
A. endophytica G.M. Smith	-	+	+	-
A. microspore (Menegh) Rabenhorst	-	+	-	-
Chroococcus disperses (Keissl.) Lemmermann	-	+	-	-
C. limneticus lmmermann	-	+	-	-
Dactylococcopsis smithii Chodat	-	-	-	+
- Order Oscillatoriales2				
***Arthrospira massarti* Kuffareth**	+	+	+	-
Oscillatoria prolifica (Grev.) Gomont	+	-	-	-
***O. minima* Gicklhorn**	+	-	+	-
***O. princeps* Vaucher.**	+	-	+	-
***O. tenuis* Agardh**	+	-	+	-
3- **Order : Nostocales**				
Anabaena scheremetievi Elenkin	-	-	-	+
Nostoc comminutum Kuetzing	-	-	-	+
N. linckia (Roth) Bornet & Thuret	-	-	-	+
	5	**6**	**7**	**4**
Division : CHLOROPHYTA Class: Chlorophyceae 1-Order : Volvocales				
Chlamydomonas cienkowskii Schmidle	-	+	-	-
C. epiphytica G. M. Smith	-	+	-	-
C. globosa Snow	-	-	-	+
C. polypyrenoideum Prescher	-	-	-	+
C. Snowii Printz	-	+	-	-
2-Order: Chlorococcales (Chlorosphaeroles : Chlorosphaeraceae)				
***Chlorella vulgaris* Bejerinck**	+	+	+	+
Chlorococcum humicola (Naeg.) Rabenhorst	+	-	-	+
Kirchneriella lunaris var. Dianae Bohlin	-	+	-	-
Oocystis ***elliptica* West**	-	-	-	+
O. pusilla Hansgirg**.**	-	+	-	-
Scenedesmus quadricauda var. *major* (chod) G. M. Smith	-	+	-	-
S. obliquus (*Turp*)	+	-	-	+
	3	**7**	**1**	**6**
Division: EUGLENOPHYTA order : Euglenales				
Euglena minuta Prescot.	-	-	-	+
Total	**8**	**13**	**8**	**11**

ST.1 Al-Muthanna Bridge, ST.2 Al-Krayat Bridge, ST.3 Al-Sarafiya Bridge, ST.4 Al-Dora
+present,- Not present

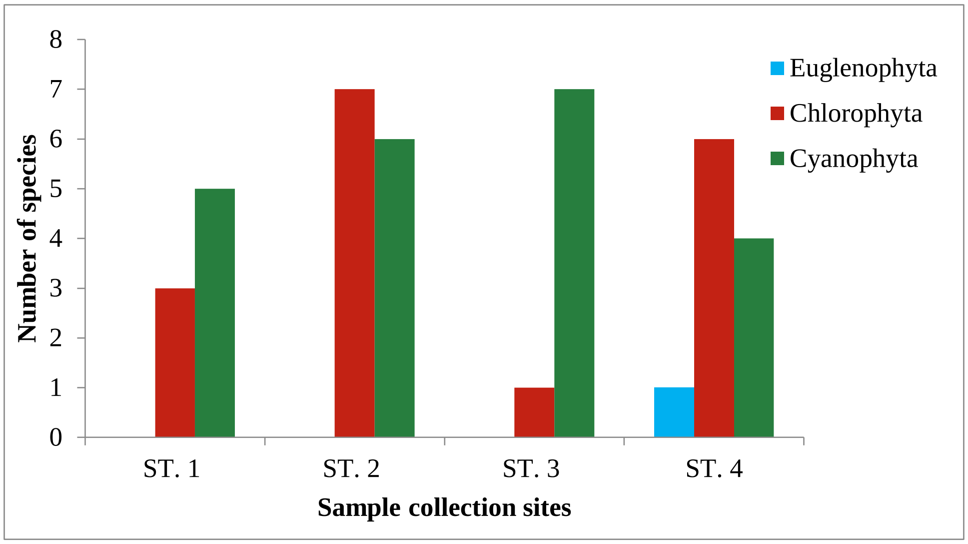


Figure 4: Number of algae species from each division diagnosed within the four study sites.ST.1:Al-Muthanna bridge, ST.2: Al-Krayat bridge, ST.3: Sarafiya bridge, ST.4: Dora power site.

Table (4). The correlation between heavy metal levels and algal community composition.

Parameters	Algal community composition	Lead	Nickel	Chrome
Algal community composition	1			
Lead	-0.711**	1		
Nickel	0.159	-0.802**	1	
Chrome	0.876**	-0.953**	0.612*	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The plus (+) means a direct correlation.

The minus (-) means an inverse correlation.

DISSCUSION

Temperature is one of the most important environmental factors on which other factors are based or that affect the properties of water, dissolved oxygen, pH, chemical content, surface tension, viscosity, density, and other properties (23, 24). In this study, air temperatures showed slight variations among sites. This variation is due to differences in sampling times and temperatures between the early morning hours and the afternoon, which is also indicated by local studies (25, 26). The pH is an important factor in determining the water's alkalinity and acidity, and is influenced by hydrogen sulfide gas, CO_2, and ammonia. It is also influenced by the presence of carbonate and bicarbonate ions in the water column. Every organism has a certain range in which it can live, but strong alkalinity or acidity can be lethal (27, 28).

Temperature can have a significant effect on the total dissolved solids and conductivity of water, as water molecules move faster at high temperatures and are able to transport more charged ions, increasing the overall conductivity (29, 30).

The present wastewater leads to an increase in the percentage of sulfate, because of the source of sulfate produced from natural processes and human activities based on the study conducted by (31), in which they found that the high sulfate concentrations in the wastewater due to insufficient aeration conditions lead to the conversion of sulfate to hydrogen sulphide gas under anaerobic conditions that prevent the microorganisms from reducing sulfate directly to hydrogen sulphide. The reason for the high concentration of sulfates in Iraqi waters lies in the nature of their chemical content, which is determined by four negative ions, namely carbonates, bicarbonates, sulfates, and chlorides, and four positive ions, namely potassium, calcium, sodium, and magnesium (32).

The decrease in nitrate levels during the autumn and winter seasons can be attributed to increased phytoplankton productivity (33). In addition, pH may play a role in changes in nitrate concentration because acidic waters reduce nitrate concentration through direct effects on nitrate stability and indirect effects through microbial processes (34).

Water is categorized into four classes according to its phosphate content (less than 7, 7-11, 11-20, or more than 20) mg/L(35). The decrease in phosphate in October (autumn) can be attributed to an increase in organisms such as algae and plants, which absorb phosphate as one of the most important nutrients for their growth (23).

The Iraqi specifications for drinking water for lead were (50, 20, 10) μg/L, and for chromium (50) μg/L and nickel (20, 100) μg/L (36). Based on our results, we can determine the extent of water pollution relative to the Iraqi specifications for drinking water (37). Based on these results, this study examined the potential of algae to resist heavy metal pollution in the waters of the Tigris River in Baghdad, as in the study conducted by (38), which showed the effectiveness of fixing *Chlorella* biomass to remove lead ions from industrial wastewater. As well as the study conducted by (6), in which the ability of *Scendesmus dimorphus* to accumulate four heavy metals, namely nickel, cadmium, lead, and copper, was investigated. As for the sources of river water pollution for each of the above heavy metals, all metals can migrate from sediment into the water, especially chromium and lead. This can happen during (strong currents, rain, boat movements, fishermen's movements) where these sediments are a potential reservoir for metals by releasing the metal into the water column, or during the change, where the drop in pH leads to the dissolution of some metals, including lead (9).

As for Algae, blue-green algae are represented by the resistance of some species to high concentrations of various pollutants, especially heavy metals, unlike green algae, which are affected by the presence of environmental concentrations of pollutants in their biological activities (39). Therefore, a decrease in the number of green algal species relative to blue-green algal species within the study sites was observed. While the green algae (40) indicated that organic pollutants, with their heavy metal contents, affect the redox processes of the first and second photosynthetic systems and the electron transfer efficiencies across the system chain to the final electron receptors in plants and algae, and therefore have a lower effect on green algae compared to others (41, 42).

Al-Krayat Bridge site was characterized by pollutants, organic matter, and household waste residues with appropriate concentrations of nutrients that help algae grow, making it the most abundant site for algae species (23, 32). Al-Sarafiya Bridge site was characterized by the rapid slope of water, the lack of residues of organic matter, and a high concentration of metals, especially lead, because of hydraulic dynamics (steep slope and fast flow) reduce sediment and organic accumulation, while proximity to urban sources contributes to metal pollution, especially lead (43). This indicated a lack of algal species at the same site, consistent with the study, which found that heavy metal pollution promotes the survival of algal species resistant to these metals.

The ratio of *Chlorococcum humicola* species indicate that this species was able to resist the presence of certain concentrations of heavy metal pollution, and this was consistent with (44) who using *Chlorococcum* sp. in the bioremediation of lead, cadmium, and chromium, where their ability to algae disinfection in the aquatic environment was evaluated, and they tolerated and able to grow for 14 days where exposure to chromium, cadmium, and lead caused their concentrations to decrease.

CONCLUSION

The study assessed the physical and chemical properties of heavy metal pollution in the Tigris River in Baghdad, focusing on its impact on non-diatom phytoplankton. Samples were collected from four sites, showing slight variations in air and water temperatures, pH values, and nutrient levels. Heavy metals were found at high concentrations, suggesting their potential use in bioremediation. The most abundant species were cyanobacteria and green algae,

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REFERANCES

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تقييم التلوث ببعض المعادن الثقيلة وتأثيره على نوعية الهائمات النباتية في بعض مناطق نهر دجلة/ بغداد

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الملخص

خلفية البحث: يُعد تلوث المياه بالمعادن الثقيلة من أهم المشكلات البيئية التي تؤثر في الأنظمة المائية والهائمات النباتية، إذ تُعد الطحالب مؤشرات حيوية مهمة لنوعية المياه ولها دور محتمل في المعالجة الحيوية للملوثات. **الهدف:** هدفت الدراسة إلى تقييم تلوث بعض مناطق نهر دجلة في بغداد بالمعادن الثقيلة وتأثير ذلك في تنوع وتوزيع الهائمات النباتية غير الدايتومية. **المواد وطرق العمل:** جُمعت عينات المياه والطحالب من أربعة مواقع على نهر دجلة خلال خريف 2024، وتم قياس الخصائص الفيزيائية والكيميائية والعناصر الغذائية والمعادن الثقيلة (الرصاص والنيكل والكروم) باستخدام طرائق مختبرية قياسية، كما شُخصت أنواع الطحالب مجهريًا، وأُجري التحليل الإحصائي. **النتائج:** أظهرت النتائج ارتفاع تراكيز الرصاص والنيكل والكروم مع وجود فروق معنوية بين المواقع المدروسة. وتم تشخيص 28 نوعًا من الهائمات النباتية غير الدايتومية التابعة لـ 15 جنسًا، وكانت الطحالب الخضر المزرقة هي الأكثر سيادة، في حين سجلت اليوغلينات أقل نسبة. كما ظهرت ارتباطات معنوية بين تراكيز المعادن الثقيلة وتركيب المجتمع الطحلبي، وأبدت بعض الأنواع قدرة على تحمل التراكيز العالية من المعادن الثقيلة. **الاستنتاج:** يؤثر تلوث نهر دجلة بالمعادن الثقيلة في تنوع وتوزيع الطحالب الهائمة، كما أظهرت بعض الأنواع قابلية واعدة للاستخدام في المعالجة الحيوية للملوثات المعدنية.

الكلمات المفتاحية: نوعية المياه، طحالب، المعادن الثقيلة، نهر دجلة.