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Euphrates River Pollution Acute and Chronic Toxicity Revealed by Bioassays

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Abstract: Bioassays are critical for assessing water pollution and its risks to ecosystems. This study evaluated the pollution of the Euphrates River in Nasiriyah during winter and spring, focusing on three stations: Sharif (entrance to the city), post-thermal energy, and Sedinawiyah (sewage disposal). Chlorella vulgaris growth rates were analyzed in river water samples over 24, 48, and 96 hours. The highest growth rate deviation was observed at station 2 in spring (91.0%) and station 3 in winter (66.0%). Results indicated varying levels of water toxicity, ranging from acute to chronic, influenced by human activities and seasonal changes. These findings highlight the significant impact of pollution on the Euphrates River, emphasizing the need for continuous monitoring and mitigation strategies.

Keywords: Assessment, Toxicity of Water, Euphrates River, Nasiriyah City, Iraq.

1. Introduction

Studying water resources and knowing their qualitative characteristics is an important topic because of its direct connection to agricultural, industrial, population, and environmental uses and activities. Water quality is affected by the sources of surface water recharge, the direction and movement of groundwater, and the nature of the water-bearing rock layer, as it is necessary to determine the suitability of water for domestic, agricultural and industrial uses [1]. The scarcity of water is negatively reflected in the increased focus on water quality, and as a result, the water problem has become a major concern. For this reason, directives were made to study the toxicity of the water of the Euphrates River for the purpose of determining the direct effect of pollution on living organisms through the bioassay test, which has become commonly used recently because aquatic organisms are more sensitive to pollution and give a direct result of the interaction of organisms with the environmental state of the river and an indirect result of

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pollution with chemicals is a problem. Research Although effluent standards at present are based only on chemical and physical criteria, results obtained from monitoring effluents and receiving waters may indicate the validity of the inclusion of biological criteria. Bioassays are essential in water pollution assessments because chemical and physical tests alone are not sufficient to evaluate potential effects on aquatic organisms [2].

Biological and chemical evidence is needed to effectively assess risks to ecosystems. The ability to detect a compound does not guarantee predictability of biological effects, and failure to detect the released chemical does not prevent its effects. Also, different types of aquatic organisms are not equally exposed to the same toxic substances [3].

Natural and human inputs have clearly affected the qualitative changes of the Euphrates River in Iraq and the study area, negatively affecting agricultural and industrial development, drinking water, and the environment. Thus, the study will focus on the reality of the extent of the toxic impact of these changes to achieve the requirements of environmental development in the region. Water pollution is one of the biggest challenges facing humanity, because it enters all areas of life and is indispensable in drinking, industry and agriculture. Water is exposed to pollution from several sources that affect its physical, chemical and biological properties, and water pollution leads to an imbalance.

The environment is harmful to the life of living organisms, as the basic component of the environment is water [4].

Many international conferences aim to develop successful solutions by uniting the world's efforts towards this problem, and defining environmental standards that are not permitted to be exceeded. A number of scientists have agreed to define water pollution as the addition of materials or energy from humans to the aquatic environment sufficient to cause Harm to human health, living resources, or environmental systems, or interference between the legitimate uses of the environment, including aspects of rest and recreation, as this definition is broad and comprehensive, confirming that humans are an essential element in environmental pollution [5].

There are many solutions to reduce water pollution, which affects the various organisms that live in the environment, including monitoring closed water bodies such as lakes and rivers and preserving them to prevent the arrival of water pollution. Water pollution is a growing global crisis that directly affects health, economic development and food security. Although other human activities such as human settlements, urbanization and industry are major contributing factors, agriculture has become the dominant source of pollution in many countries and deteriorating water quality poses a major threat to food safety and food security.

In a study of the Euphrates River within the city of Ramadi and Lake Habbaniyah, it was found that the values of electrical conductivity and the concentration of chloride, sodium, and sulfate ions were higher compared to the concentrations of calcium, magnesium, and potassium, while the concentration of phosphate, aluminum, and nitrate ions in the river water was within standard limits [6]. A study of the Euphrates River showed that From the Syrian city of Dur al-Zour to the city of al-Baghdadi in the Iraqi Anbar city, the concentration of trace heavy metals in the water of the Euphrates River was within permissible limits, with the exception of aluminum, mercury, and lead. The study also showed that the physical and chemical specifications of the water of the Euphrates River fall within the permissible limits internationally and locally, with the exception of aluminum and nitrite, which exceed the permissible limits [7].

The Euphrates River can hardly breathe due to the many pollutants thrown into it, which has led to high levels of water pollution from one region to another, especially since the most prominent of these pollutants is sewage [8].

The cause of the pollution is due to the lack of water releases and the continuation of government departments in throwing their waste into the river. The most prominent government departments that caused the increase in pollution of the Euphrates River in the governorate is the Dhi-Qar Sewerage Department, which is still throwing its sewage waste into the Euphrates River, and thus it must be operated. Special pumps for treating water going to the Euphrates River, although changing the route of sewage pipes going to the Euphrates River towards the general downstream river does not cost as much as the damage caused by pollutants [9].

In recent years, changes have occurred in the waters of the Euphrates River, especially in southern Iraq. As a result of the drought, environmental pollution is expected to increase in this important body of water [10].

The study aimed to evaluate the toxicity of Euphrates River water using a bioassay method using the unicellular alga Chlorella vulgaris.

2. Materials and Methods:

The current study was conducted within the Nasiriyah city, where samples were collected from two stations on the Euphrates River in both seasons Winter and Spring 2024, and a toxicity degree (acute and chronic) was conducted on the same day as the samples were taken (intial time), then calculating algae Chlorella vulgaris growth deviation coefficient percentage.

Samples were taken from the following stations:

The first station: Al-Sharif area, entrance to the Euphrates River, Nasiriyah City.

The second station: a thermal energy station in Nasiriyah City.

Samples were taken from the above-mentioned stations to the laboratory of the Life Sciences Department/College of Science.

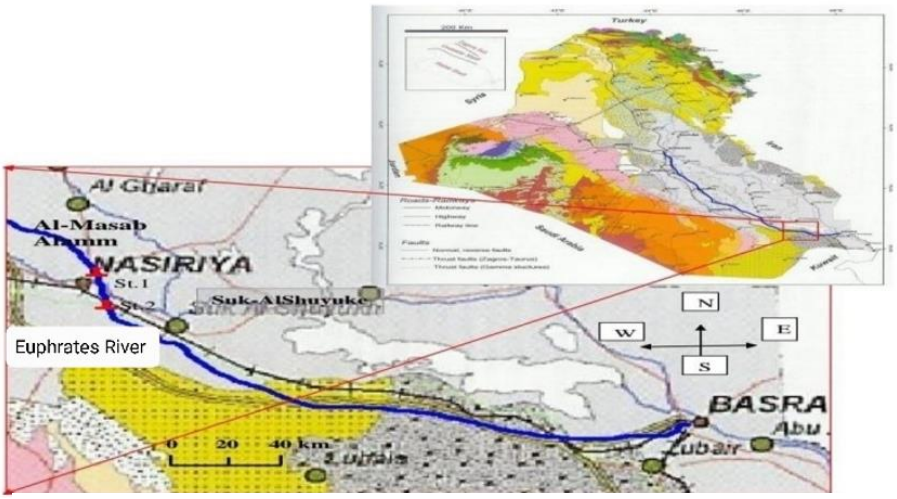

Figure 1. A Map showing the study stations on the Euphrates River.

The method of work :

Water samples were taken using bottles that were washed several times with distilled water to ensure that no chemical contamination occurred from the bottles.

The samples were transferred to the Advanced Environmental Laboratory in the Department of Biology / College of Science, and a toxicity test was conducted using a bioassay method , where the number of algae cells Chlorella vulgaris was calculated in in the intial time and after (24,48,96) hours for the purpose of calculating the growth rate and growth deviation coefficient. The bioassay was performed according to the (R 52.24.808-2014).

3. Results and Discussion

The results of the current study in the Winter season did not record a noticeable decrease in the growth rates of Chlorella vulgaris during the test period [11]. The highest growth rate was recorded at St.2 after 24 hours, while the lowest value for the growth rate was recorded at St. 2 also after 96 hours. Then, the percentages of the growth deviation coefficients more than 25% of the alga Chlorella vulgaris were not recorded out of control in the Winter season, and the highest values were recorded at St.1 after 24 hours. The percentages of the deviation coefficients were low at stations 1 and 2 in this season, and no toxicity was recorded during 24, 48 hours and 96 hours [12]. The electrical power station had small deviations in the Winter season, which may be attributed to suitable climatic conditions in this season with the hot water discharged from the station as a result of thermal mixing.

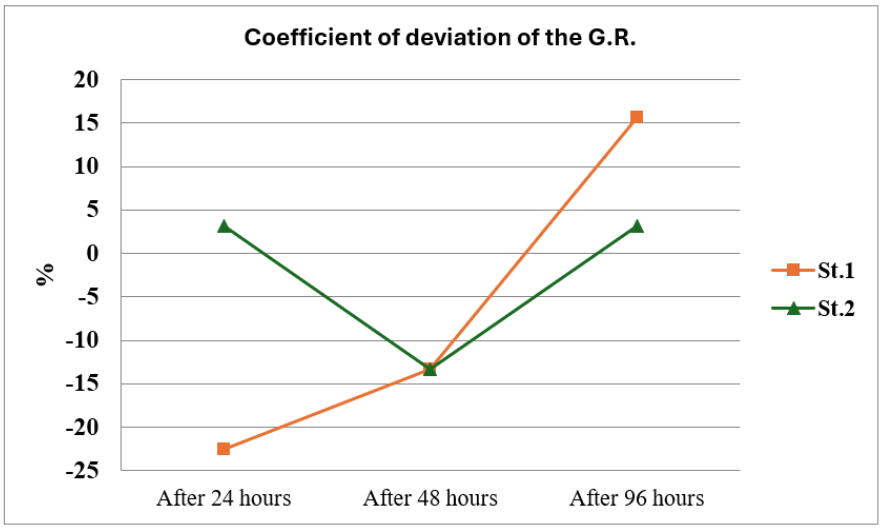

Figure 2. Percentage coefficient of deviation of the growth rate of Chlorella vulgaris at the study stations for the Winter 2024.

In the Spring, the growth rates of Chlorella vulgaris were different and higher than in the Winter, where the highest growth rate was recorded in stations 1 and 2 after 24 hours. Algae growth flourishes in the Spring and Autumn months due to the favorable climate conditions for the growth of phytoplankton [13].

The percentage of growth deviations of Chlorella vulgaris from the control was recorded in the Spring, toxicity (percentage of growth deviations more than 25%) was recorded at all stations, with a stimulant effect, as the highest deviation coefficient for the growth rate was at st. 2 after 72 hours. This toxic effect may be attributed to accumulated as a result of the environmental conditions suitable for algae bloom in this season [14].

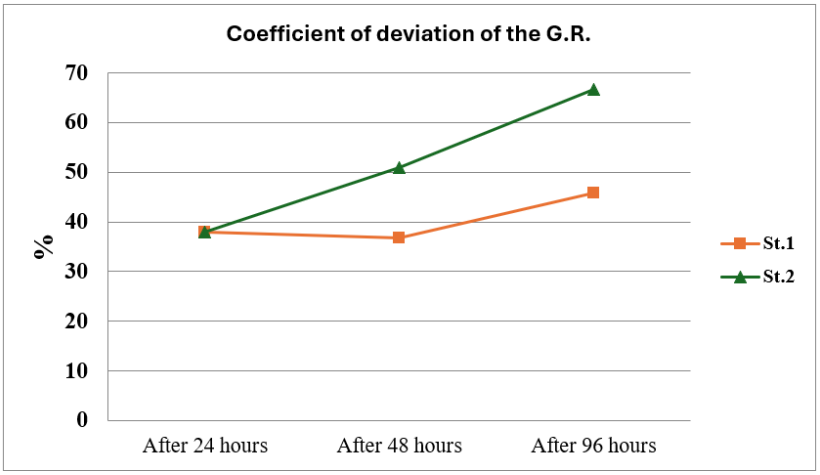

Figure 3. Percentages of coefficients of deviation of growth rate of the alga Chlorella vulgaris at the study stations for the Spring 2024

Algae are considered sensitive organisms to chemical and thermal pollution and have been widely used as a biological indicator [15]. Their flowering is linked to the presence of nutrients and appropriate environmental conditions. This is why the decrease

in growth rates of Chlorella vulgaris is attributed. Also, the environmental conditions of Winter and thermal pollution in st.2 may have led to thermal mixing of water in this station [16].

Pollution resulting from water releases and thermal pollution from the electric power station in the river without treatment causes deterioration of the environmental condition of the river [17].

4. Conclusion

Bioassays are essential in water pollution assessments because chemical and physical tests alone are not sufficient to evaluate potential effects on aquatic organisms. Biological and chemical evidence is needed to effectively assess risks to ecosystems. The current study, using bioassay, showed that the water of the Euphrates River was acutely toxic in the thermal power station in Al-Rabi', while the water was toxic in both types (acute and cumulative) with a stimulant effect as a result of the river water being polluted in this season with nutrients such as phosphates and nitrates. The water of the Euphrates River is subject to the polluting effects of human activities and seasonal changes in the study area.

REFERENCES

[1] M. K. Al-Ajrash, "Environmental Assessment of Pollution at the Nasiriyah Thermal Power Station," M.S. thesis, College of Arts, Dhi Qar Univ., 2020, p. 84.

[2] H. A. Al-Saadi, N. Q. Al-Daham, and L. A. J. Al-Hussan, *Aquatic Ecology*, Basra, Iraq: Mosul University Press, 1986, p. 425.

[3] M. M. Sharqi, "Pollution of the Euphrates River in the City of Ramadi: Causes and Responsibilities," Dept. Life Sci., Coll. Educ. Girls, Anbar Univ., Ramadi, Iraq, 2022.

[4] Al-Dosari, "Study of Some Bacterial Contaminants in the Water of the Euphrates River," *Iraq Academic Scientist Journals*, 2006.

[5] J. Van Der Heever and J. Grobbelaar, "The Use of Algae in Bioassays to Detect the Presence of Toxic Compounds in Natural Waters," 1995.

[6] M. B. Ray et al., "Development of Microalgal Bioassay Based on the Community Level Physiological Profiling (CLPP)," 2016.

[7] D. N. Lerner and R. Harris, "The Relationship Between Land Use and Groundwater Resources and Quality," *Land Use Policy*, vol. 26, no. 3, pp. S265–S273, Dec. 2009, doi: 10.1016/j.landusepol.2009.09.005.

[8] E. N. Bakaeva, "Biological Approaches to Assessing the Ecotoxicological State of Aquatic Ecosystems," *News of Higher Educational Institutions. North Caucasus Region. Natural Sciences.*, no. 1, pp. 72-83, 2015.

[9] E. N. Bakaeva, N. A. Ignatova, and G. G. Chernikova, *Assessment of the Toxicity of Land Surface Waters Using Biotesting Using Chlorophyll a*, Roshydromet, Federal State Budgetary Institution "GHI", Rostov-on-Don, Russia, 2014, p. 23.

[10] T. A. Ziehl and A. Schmitt, "Sediment Quality Assessment of Flowing Waters in South-West Germany Using Acute and Chronic Bioassays," *Aquatic Ecosystem Health & Management*, vol. 3, no. 3, pp. 347-357, 2000.

[11] Azizullah et al., "Fast Bioassessment of Wastewater and Surface Water Quality Using Freshwater Flagellate Euglena Gracilis—A Case Study from Pakistan," *Journal of Applied Phycology*, vol. 26, pp. 421-431, 2014.

[12] U. Schreiber et al., "New Type of Dual-Channel PAM Chlorophyll Fluorometer for Highly Sensitive Water Toxicity Biotests," *Photosynthesis Research*, vol. 74, no. 3, pp. 317-330, 2002.

[13] E. R. Palm et al., "Sinapis Alba L. and Triticum Aestivum L. as Biotest Model Species for Evaluating Municipal Solid Waste Leachate Toxicity," *Journal of Environmental Management*, vol. 302, p. 114012, 2022.

[14] Z. Romanowska-Duda and M. Tarczyńska, "The Influence of Microcystin-LR and Hepatotoxic Cyanobacterial Extract on the Water Plant Spirodela Oligorrhiza," *Environmental Toxicology: An International Journal*, vol. 17, no. 5, pp. 434-440, 2002.

[15] I. I. Tomilina, R. A. Lozhkina, and M. V. Gapeeva, "Toxicity of Bottom Sediments of the Rybinsk Reservoir According to Long-term Biotesting Data: Report 1. Toxicological Studies," *Inland Water Biology*, vol. 14, pp. 777-787, 2021.

[16] S. Szklarek et al., "Comparing Ecotoxicological and Physicochemical Indicators of Municipal Wastewater Effluent and River Water Quality in a Baltic Sea Catchment in Poland," *Ecological Indicators*, vol. 126, p. 107611, 2021.

[17] M. N. Saksonov, A. E. Balayan, and D. I. Stom, "Assessment of Toxicity of Technical Detergents Using Complex of Bioassay Methods," *IOP Conference Series: Earth and Environmental Science*, vol. 272, no. 2, 2019.