How to Cite:
Fattah, M. A. A., Khaleel, R. I., & Nijris, O. N. (2022). Study of the effect of industrial waste on the chemical, physical and biological content of the Tigris River within the city of Samarra. *International Journal of Health Sciences*, *6*(S4), 6102–6108.
https://doi.org/10.53730/ijhs.v6nS4.9539

Study of the effect of industrial waste on the chemical, physical and biological content of the Tigris River within the city of Samarra

Mardin Ali Abbas Fattah
University of Samarra, College of Education, Department of Biology
Corresponding author email: mardeenkarkash@gmail.com

Associate Prof. Dr. Rana Ibrahim Khaleel
University of Samarra, College of Engineering

Prof. Dr. Osama Nadhom Nijris
University of Samarra, College of Applied Science

***Abstract*---**This study included the selection of three stations, two of them on the Tigris River passing through the city of Samarra, and the second station representing industrial wastewater - Samarra. The study period was for six months, starting from October 2021 until March 2022. The study included knowing the chemical, physical and biological properties of the industrial wastewater plant and river water and observing the effect of industrial wastewater on the water quality in the Tigris River. The chemical factors included pH, dissolved oxygen and the biological requirement for oxygen, while the physical factors included air temperature, water temperature and total dissolved salts. The results showed that the pH values tended to be alkaline , ranging between 6.6 - 8.7, and dissolved oxygen showed similar values, ranging between 3.8 - 9 mg / l, and the values of the vital oxygen requirement ranged between 0.8 - 30 mg / l, the air temperature ranged between 7 - 32 ° C, the water temperature ranged between 5 - 26 ° C, the values of total dissolved salts ranged between 210 - 1380 mg / l, the total number of coliform bacteria (TC) 0 - 1100 cells / 100 ml.

***Keywords*---**industrial waste, Tigris River, chemical content, physical content.

Introduction

Water is one of the most important basics of existence and the most valuable contents on the planet because of its importance in the sustainability of the life of various living creatures (Hassan *et al.*, 2015). Environmental pollution constitutes a great health hazard to human, animals and plants with local, regional and global implications (Al-Dulaimi *et al.*,2012), Water sources can be divided into several main sections, including rivers, seas, oceans, ground water and rain water. River water is the most important of the previous sources as it is the main source for meeting human needs (Chougule *et al.*, 2009). Although the quantities of water are fixed on the surface of the globe at any point in time, the rate of its change from one form to another and the fluctuation in this rate from one place to another led to the emergence of a difference in the abundance of water sources from one region to another on the surface of the earth (Qadora, 2014). Wastewater contains a group of colon bacteria due to household waste, as well as contains very large amounts of organic compounds and huge numbers of aerobic and anaerobic microorganisms and causes great problems for the environment, as it constitutes 28% of the sources of water pollution (Al-Saigh and Taqa, 2002; Thakur *et al.*, 2021).

Also, in some cities there are industrial facilities such as iron factories, oil factories, battery factories, or pharmaceutical factories, which makes it a source of water pollution in those cities (Chandra and Sobti, 2019), especially a city like Samarra, which contains the Samarra pharmaceutical factory. Industrial waste is the most important and most polluting source of water, especially with chemicals because it contains heavy elements such as mercury, silver, copper, iron, lead, and cadmium, Especially if we know that factories in developing countries do not adhere to the controls on the disposal of waste, which are included in the components of some materials such as oils, soaps, and disinfectants that are not subject to disintegration, such as acids, bases and toxic substances (Fahad and Rabie, 2011; Yassin and Abbas , 2018). In view of the limited sources of water suitable for agricultural use and the increasing demand for water to meet the population density, the use of treated shelf water in agriculture is considered a way to safely dispose of wastewater (Khaleel,2014) therefore, the current study aims to assess water at the industrial waste dumping area before and after treatment and study the chemical, physical and biological properties of the studied areas.

Description of the study area

The study area included the Tigris River passing through the city of Samarra, located in Salah al-Din Governorate, where it covers a distance of approximately 250 km. October 2021 to March 2022.

The first station (near the liquefaction) The first station is located on the Tigris River, south of the Samarra Dam, which is 1000 meters away from the liquefaction station.
The second station (industrial wastewater treatment), as the station contains two rotating wheels, and pushes into the Tigris River, which is approximately 750 meters away from it.

The third station (industrial wastewater estuary) This site is located directly after the sewage effluent in the Tigris River, which is approximately 750 meters away from the second site.

Material and Methods

Sample collection and laboratory analyzes:
Three stations were selected, two of them on the Tigris River passing through the city of Samarra, and the second station representing industrial wastewater - Samarra. The study period was six months, starting from October 2021 until March 2022.

The samples were collected by a polythene container with a capacity of 5 liters for chemical and physical analyzes. As for the samples of dissolved oxygen and the biological requirement for oxygen, 250 cm^3 glass bottles were washed with sample water and it was taken into account that the nozzle was under the surface of the water before taking the sample to avoid the influence of air, and then it was taken to the laboratory for a procedure The physical and chemical analyzes were measured, and the temperature of water, air and pH were measured in the field, then the 250 cm^3 glass bottles for bacteriological examinations were filled to be transported to the laboratory by a chilled cork container to preserve the properties of the sample and then cultured on MacConkey broth medium (APHA , 1985) and (WHO, 1996).

Estimation of some physical, chemical and biological properties of the three studied stations

pH measurement

The pH was measured using a PH-meter made by JENWAY in England.

Dissolved Oxygen (DO) measurement

Dissolved oxygen was measured in the field using an Oxygen meter EZ D.O made in Taiwan.

chloride ion Cl-Chloride

Chloride was measured according to the method (ASTM, 1984) by taking 50 ml of sample water, then adding some drops of potassium chromate (K2CrO4), then crushing it with silver nitrate (AgNO3) at a concentration (N 0.025) until the yellow color turned into a dark red. The chloride was calculated according to for the following equation:
(atomic weight x 1000 x standard x silver nitrate volume)/(sample volume) = (liter/mg) chloride
The result is expressed in mg / l.

Air and Water temperature

Air and water temperatures were measured using a graduated mercury thermometer.

Electrical conductivity

The electrical conductivity of the samples was measured in the field using a digital conductivity device model WTW made by the German company HANNA.

Total coliform bacteria (TC)

The total number of colon bacteria (TC) was calculated using the Multiple Tube Method and by means of the most likely number (MPN) Most Probable Number.

Statistical analysis

The significant differences were determined in the spatially measured chemical, physical and biological properties between stations, in which the differences were tested according to the level of significance $P \leq 0.05$.

Results and Discussion

Some of the chemical, physical and biological properties of the three studied stations.

pH

The pH values ranged during the study period in all stations between 7.1 - 8.7, where the lowest value was recorded at 7.1 in March 2022 in the second site, and the highest value was recorded at 8.7 in February 2022 in the first site. The range of pH variation was little, which is due to Organizational capacity Buffering capacity, and this is consistent with the study (Sheikh, 2013), as shown in Table (1).

Dissolved Oxygen (D.O)

The values of dissolved oxygen during the study period in all stations ranged between 9-5 mg / liter, where the lowest value was recorded at 5 mg / liter during the month of March 2022 in the second site, and the highest value was recorded at 9 mg / liter during the month of December 2021 in the first site. Dissolved oxygen in DO in water is one of the most important criteria for assessing water quality and the degree of its pollution, as it is very necessary for the breathing and livelihood of aquatic organisms, and this agrees with the study (Al-Badri, 2012), as shown in Table (1).

Chloride ion (Cl^-)

The values of chloride during the study period in all stations ranged between 12-38 mg / liter, where the lowest value was recorded at 12 mg / liter during the

month of December 2021 in the second site, and the highest value was recorded at 38 during the same month and the same year in the fourth site, as shown in the table (1). One of the most important factors that lead to an increase in chloride ion concentration is sewage water, as well as human and industrial waste that is thrown into rivers (Janardhana, 2015). The results of the current study show that the values of chloride varied from month to month and were higher than the results reached by (Al-Hadidi, 2018).

Air temperature

The air temperature values during the study period in all stations ranged between 7-32 ° C, where the lowest value was 7 ° C during February 2022 in the second site, and the highest value was 32 ° C during October 2021 in the fourth site, as shown in Table (1). The reason for the difference in air temperature between the months of the current year is due to the difference in temperature between summer and winter and between night and day (Alsheikh, 2013).

Water temperature

The surface water temperature ranged during the study period in all stations between 5–26°C, where the lowest value was 5°C during January 2022 in the second site, and the highest value was 26°C during October 2021 in the third site, as shown. in Table (1). Water temperatures are affected by weather changes in the region, that is, the rise and fall of air temperature, and this coincides with the results of many researchers on water bodies in Iraq, such as the study (Al-Jubouri, 2009).

Electrical conductivity

The electrical conductivity values ranged during the study period in all stations between 294-1750 microsiemens / cm, where the lowest value was recorded at 295 microsiemens / cm during the month of February 2022 in the fifth site, and the highest value was recorded at 1750 microsiemens / cm during the month of November 2021 in the second site, as shown in the table (1), and through the results of the study, it was found that it is higher than the previous studies of the Tigris River, but it is lower than the study of (Al-Shindah 2008).

Total Coliform Bacteria (TC)

Coli bacteria are usually found in the intestines of humans and warm-blooded animals, and they accompany pathogenic bacteria (Cowan, 1979) and are a general indicator of pollution that can come from nature or feces and is suitable for assessing their suitability for human consumption, as it ranged between 0 - 1100 cells / 100 ml , as shown in Table (1), and the study showed an increase in the number of colon bacteria during the winter and a decrease in the summer, which is an approach to the study (Al-Badri, 2012).

Table (1) Average chemical, physical and biological tests for industrial waste in Samarra for the period from 15-10-2021 until 15-03-2022

Months checkups	2021			2022		
	October	November	December	January	February	March
PH	7.8	7.3	7.7	7.7	8.2	7.3
DO	5	5.8	7.8	6.4	6.5	5.7
Cl-	22	23	13	10	12	16
Air temperature	16	21	15	11	9	13
Water temperature	18	11	12	9	12	15
E C	418	496	453	455	415	606
T C	463	473	496	445	452	415

References

Albadri, A. T. KH. (2012). Study of the effect of Samarra sewage water on water quality in the Tigris River, Master Thesis, College of Education for Girls - Tikrit University.

Al-Dulaimi, R. I., Ismail, N. B., & Ibrahim, M. H. (2012). The effect of Industrial Waste water in Seed Growth Rate: A Review. Int. J. Sci. And Res, 2(3), 1-4.

Al-Hadidi, A. F. F. (2018). Assessment of the water quality of the Tigris River in the area between Mosul and Qayyarah Dam for various uses. Master's thesis, College of Environmental Sciences and Technologies, University of Mosul

Aljubori, M. H. S. .S (2009). An environmental diagnostic study of algae in cross sectional areas of the Tigris River within Salah Al-Din province. Master's thesis, College of Sciences - Tikrit University.

Alsaigh, Ab. Y. , Taqa, A. Sh. (2002). Environmental pollution, Baghdad, Ministry of Higher Education and Scientific Research. House of Books and Documents, Baghdad.

Alsheikh, A. N. A. (2013). Evaluating the efficiency of processing the sewage of Samarra City. Master's Thesis, College of Sciences, Tikrit University.

Al-Shindah, B. T. (2008). Study of some chemical, physical and biological properties of the Tigris River in the city of Tikrit. Master's Thesis, College of Science - Tikrit University

APHA (American Public Health Association) (1985). Standered Methods for examination water and waste water, 16th Ed. New York. pp 1268.

Chandra. Ram, Sobti. R.C. (2019). Microbes for Sustainable Development and Bioremediation.

Chougule, M. B,. Wasif, A. I. and Naik, V. R.(2009). Assesment of water Quality index (WQI) for monitoring pollution of river panchganga at ichalkaranji. Proceeding of international conference on energy and environment.19-21 March.

Exposto, L. A. S., & Januraga, P. P. (2021). Domestic waste characteristics and the management systematic review. *International Journal of Health & Medical Sciences*, *4*(2), 253-259. https://doi.org/10.31295/ijhms.v4n2.1731

Fahad H. J. , Rabie A. M. (2011). Water pollution, its sources, its risks, and its treatment, 1st Edition, Arab Society Library for Publishing and Distribution, Amman - Jordan

Hassan , F.M; Al- Salman , I. M; Abdul – ammer , H.M.T. (2015) .Qualitative and quantative study of Phytoplankton in Lotic ecosystems Iraq . Mesopotamia Environmental Journal . Vol 2 , No (1) ; 46-63

Janardhana, M.R. (2015). Assessment of Growndwater Quality for drinking purpose in Rural Areas Surrounding a Defunct Copper Mine. Aquatic Procedia (4) 685_692.

Khaleel, R. I. (2014). Treated Wastewater Irrigation on Plant Growth of Vigna Radiata L, Abelmoschus Esculentus L and Brassica Juncea L. PhD diss., Universiti Sains Malaysia,.

Qadora , M. A. (2014). Groundwater wells and springs and their characteristics in the West Bank - Palestine for the period from 2008 to 2010 A.D. An applied study in physical geography, Palestine University Journal for Research and Studies , No.6

Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, *6*(1), i-v. https://doi.org/10.53730/ijhs.v6n1.5949

Suryasa, I.W., Sudipa, I.N., Puspani, I.A.M., Netra, I.M. (2019). Translation procedure of happy emotion of english into indonesian in kṛṣṇa text. *Journal of Language Teaching and Research, 10*(4), 738–746

Thakur. Monika, V.K. Modi, Renu Khedlkar, Karuna Singh. (2021). Sustainable Food waste Management Concepts and Innovations.

WHO. (1996).) World Health Organization, Guideline for Drinking Water Quality Health Criteria and Other Supporting Information 2nd . Ed. Vol. 21. Geneva

Yassin, B. R. , Abbas, E. K. (2018). Wastewater properties and their impact on the biological environment in Basra Governorate, Basrah Studies Journal, 27 (1994-4721) 91-124.