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Study of the impact of civil waste on the chemical, physical and biological content of the Tigris River within Samarra

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Abstract---This study included the selection of three stations, two of which are on the Tigris River passing through Samarra and the other station representing the household wastewater - Samarra, and the duration of the study was six months from October 2021 to March 2022. The study included knowledge of the chemical, physical and biological properties of the domestic wastewater plant and river water and the observation of domestic wastewater on the water quality of the Tigris River. Chemical agents included pH, dissolved oxygen, and the bio requirement of oxygen, while physical factors included air temperature, water temperature and total dissolved salts. Results showed that pH values tended to be base, ranging from 6.6 - 8.7, dissolved oxygen showed converging values ranging from 3.8-9 mg/L, and the bio-oxygen requirement values ranged from 0.8-8 30 mg/L, the air temperature ranged from 7-32°C, the water temperature ranged from 5-26°C, and the total melt salt values ranged from 210°C - 1380 mg/L, total number of air bacteria (TPC) ranged between (0.06 – 74000*10⁵) cell/mL .

Keywords---civil waste, Tigris River, chemical content, physical content.

Introduction

Water is the backbone of existence as life begins in it and it does not continue without it, and man has realized since the dawn of history the importance of

rivers and lakes, as he supplies himself with water and uses it to do his various purposes (Ahmed, 2006). Water is a unique chemical compound that is a solvent for many substances as well as its ability to form hydrogen bonds and its high specific heat and is the only substance found in three physical conditions (solid, liquid, gaseous) at normal temperatures and pressures (Albadri, 2012). The amount of water consumed from rivers, lakes and other sources has quadrupled (Khateb, 2004), which has also increased the problem of water pollution by releasing large quantities of human pollutants reaching water through untreated sewage as well as animal and agricultural pollutants reaching river water (Mygind *et al.*, 1995). Environmental pollution may pose a health threat to humans, animals and plants (Al-Dulaimi *et al.*, 2012). Thus, These activities build up pollutants in water, resulting in the intensive growth of Phytoplankton, particularly algae, as they are the primary source of aquatic beings and are evidence of the quality of the ecosystem (Hassan *et al.*, 2015) since sewage contains a group of colon bacteria due to household waste as well as very large amounts of organic compounds and huge numbers of aerobic and anaerobic microbiology and causes major problems for the environment, accounting for 28% of water pollution sources (Alsaigh and Taqa, 2002; Thakur *et al.*, 2021). Many agencies and organizations such as the World Health Organization (WHO), The United Nations Environment Programme (UNEP) and the U.S. Environmental Protection Agency (USEPA) are particularly concerned about water and the problems of bacteriological pollution, physical and chemical pollution for the purpose of reducing, controlling and minimizing its damage (Al-Jubori, 2005 ; Khaleel, 2014), so the current study aims to assess water at the area of dumping civilian waste before and after treatment and to study the chemical, physical and biological properties of the areas of interest.

Description of the study area

The study area included the Tigris River, which passes through Samarra city, located in Salah al-Din province, where it travels approximately 250 km, three stations were selected, two of which were selected on the Tigris River passing through Samarra and the other station representing the home wastewater - Samarra, and the duration of the study was six months from October 2021 until March 2022. The first station is located on the Tigris River, south of Samarra, 1,000 meters from the al-Asala station. The second station (home wastewater treatment) is a concrete reservoir behind which water is collected and pushed into the Tigris River, about 750 meters away. The third station (domestic wastewater estuary) is located just after the sewage estuary in the Tigris River, which is about 750 meters from the second site.

Material and Methods

Collecting samples and laboratory analyses

Three stations were selected, two of them on the Tigris River passing through Samarra and the other station representing the household wastewater - Samarra, and the duration of the study was six months from October 2021 until March 2022. The samples were collected by a 5-liter polythene container for chemical and physical analyses, while samples of dissolved oxygen and the requirement of

bio-oxygen were washed glass bottles of 250 cm³ with sample water and taken into account before taking the sample to be the nozzle underwater to avoid the effect of air, and then taken to the laboratory for physical and chemical analyses. The temperature was measured for water, air and pH in the field and then filling glass bottles capacity 250 cm³ for bacteriological tests to be transported to the laboratory by a container of iced cork to maintain the properties of the sample and then implanted on the center of nutrient Agar medium (APHA, 1985) and (WHO,1996).

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

pH measurement

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

Measurement of Dissolved Oxygen (DO)

Dissolved oxygen in the field was measured using taiwan-made (Oxygen meter EZ D.O.)

Measurement of Biological Oxygen Demand (BOD₅)

I used the same method of measuring dissolved oxygen.

Measurement of Air and Water temperature

The temperature of the air and water was measured using the graduated mercury scale.

Measurement of Total Dissolved Solid (TDS)

TDS was measured using the German WTW Digital conductivity device made by HANNA.

Measurement of Total Bacteria Count (TPC)

The method of calculating the total number of bacteria in water samples included the preparation of a series of (Decimal Serial Dilutions) through sterilized apparatus and conditions.

Statistical analysis

Moral differences in chemical, physical and biological characteristics between stations were identified and the differences were tested under the moral level of significance $P \leq 0.05$

Results and Discussion

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

pH

During the study period at all stations, pH values ranged from 7.1 to 8.7, with the lowest value recorded at 7.1 in March 2022 at the second location and the highest value was recorded in February 2022 at the first location, the extent of the heterogeneity was slightly due to the regulatory capacity buffering capacity, which is consistent with the study (Alsheikh, 2013) as shown in table (1).

Dissolved Oxygen (D.O)

The values of dissolved oxygen during the study period at all stations ranged from 9-5 mg/L, with the lowest value recorded at 5 mg/L during March 2022 at the second location and the highest value of 9 mg/L was recorded during December 2021 at the first location. The concentration of dissolved oxygen (DO) in water is one of the most important criteria for assessing water quality and pollution, as it is very necessary to breathe and live for aquatic organisms. This is consistent with the study (Albadri, 2012) as shown in table (1).

Biological Oxygen Demand (B.O.Ds)

The values of the biological requirement for oxygen during the duration of the study in all the samples ranged from 0.8-30 mg/L, with the lowest value recorded at 0.8 mg/L during the month of October 2021 in the first location and recorded the highest value of 30 mg/L during the month of March 2022 in the second location, as shown in table (1). This was agreed with the (Pandey and Sundaran, 2002). The biological requirement for oxygen refers to the amount of oxygen consumed in the destruction of organic substances added to water from microscopic organisms and their transformation into a more stable state in aerobic conditions (Drever, 1997 ; Weiner,2000)

Air temperature

Air temperature values during the study period at all stations ranged from 7-32°C, with the lowest value recorded at 7°C during February 2022 at the second location and the highest value was recorded at 32°C during October 2021 in the fourth location, as shown in table (1). The reason for the varying air temperature between the months of this year is due to the variation in temperature between summer and winter and between night and day (Alsheikh, 2013).

Water temperature

The degree of surface water during the study period at all stations ranged from 26-5 °C, where the lowest value was recorded 5 °C during January 2022 in the second location and recorded the highest value of 26 °C during the month of October 2021 in the third location, as shown in table (1). Water temperatures are affected by weather changes in the region, i.e. the rise and decline in air temperature, which corresponds to the results of many researchers on water bodies in Iraq such as the study (Al-Jubori, 2009).

Total Dissolved Solid (TDS)

The values of dissolved salts during the duration of the study in all the samples ranged from 210 to 1380 mg/L, with the lowest value recorded at 210 mg/L during the month of October 2021 in the fifth location and recorded the highest value during the same month and for the same year, as shown in table (1). It contains organic molecules or minerals that are useful when they are in the media as nutrients or lead to water contamination by containing toxic substances (Hassan *et al.*, 2012) and this study was close to the results of (Almilagi, 2006) in their study of the water of the health drainage of Aleppo city.

Total Bacteria Count (TPC)

This group mostly represents bacteria entering the water from sewage waste and types of bacteria drifting with the soil into the waterways during the rainy seasons and floods as well as bacteria originally found in the water (Al-musleh, 1988). The number of bacteria during the study period at all stations ranged from 0.06 to 74000×10^5 cells/mL, with the lowest value of 0.06 cells/mL recorded during March 2022 at the first location and the highest value recorded at 74,000 cells/ml during the month of February 2022 at the fifth site. As shown in table (1). The results of this study were less than what has been found by (Abdul mawla, 2016).

Table (1) Rate of chemical, physical and biological tests of civil waste in Samarra for the period 15-10-2021 to 15-3-2022

Months checkups	2021			2022		
	October	November	December	January	February	March
PH	7.9	7.6	7.8	7.9	8.3	7.4
DO'S	5	5.9	7.7	6.3	6.4	5.8
BOD5	10.6	7.6	8.3	9.6	8.2	10.8
Air temperature	17	22	14	10	9	14
Water temperature	17	11	11	9	13	14
TDS	670	628	601	868	500	527
TPC	4.46×10^5	197×10^5	185×10^5	85×10^5	11000×10^5	40×10^5

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