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Water Quality Assessment of the Tigris River in Amarah City, Maysan Governorate, Iraq

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Abstract

According to the results of the water quality assessment conducted in Amarah City, the physical, chemical, and microbiological characteristics of the Tigris River have drastically decreased particularly true in contrast to the water that enters the city (from the upstream) and exits it (outfall). The amounts of nutrients (phosphate and nitrate), organic matter (BOD and COD), and dissolved salts (as determined by a conductivity test) are markers of significant waste water, agricultural, and industrial water pollution. These results indicate that environmental restrictions must be enforced immediately, and effluent must be cleaned before being released into waterways.

Keywords: Tigris River; Amarah City; COD; BOD; Water Quality Assessment

1. Introduction

Mining, industrial production, electricity generation, and the extraction of water for agriculture and domestic use can all lead to a decline in water quality. Both the aquatic environment and the availability of drinking water would be impacted [1]. The significance of keeping an eye on the water quality in rivers and streams affected by pollution dumping has grown in recent years. The discharge of domestic and industrial effluents is the main source of water pollution. Physical and chemical characteristics such as pH and dissolved oxygen (DO) can be used to evaluate the safety of water [2,3]. Water quality is also impacted by the amount and caliber of supplies coming from various sources. For a number of reasons, water resources need to be carefully planned for and maintained [3,4]. The population, agriculture, and economy of Iraq depend on Amarah City, the headquarters of the Maysan Governorate, and the Tigris River, which is the main source of life for the areas it passes through. Recent environmental stress on the river has been caused by a number of factors, including dam effects, industrial and agricultural pollutants, population growth, direct untreated sewage outflow, and climate change. Finding the main causes of pollution and assessing the current condition of the river water quality in Amara are the main objectives of this study [4,5].

2. Goals of the Research

To evaluate the physical, chemical, and microbiological properties of the Tigris River water in the city of Amarah, as well as the degree to which human activity is contributing to the water's deteriorating quality. The results will also be evaluated in light of Iraq's drinking water needs as defined by the World Health Organization [1–5].

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3. Research Methodology

3.1. Study Site and Sampling

To represent the pollution gradient, three primary locations on the Tigris River in Amarah were chosen:

- Site 1 (M1): Source (north of the city): this site acts as a reference (control) site and symbolizes the water entering the city.
- Site 2 (M2): City center: impacted by both commercial activity and direct sewage discharge.
- Site 3 (M3): Estuary (south of the city): represents the total buildup of all contaminants following the water's passage through the city.

3.2. Measured Parameters

Seasonally, samples were gathered and examined for the following factors

- Physical: temperature, turbidity, electrical conductivity, and total dissolved solids (TDS).
- Chemical: include dissolved oxygen (DO), phosphate (PO_4^-), nitrate (NO_3^-), total hardness (TH), and chemical oxygen demand (COD).
- Microbiological: *Escherichia coli* (*E. coli*) and total coliform as markers of fecal contamination [6-8].

4. Results and Discussion

Table 1 Average values of the parameters measured at the study sites compared to the WHO drinking water standards

Physical and chemical standard	Unit	Station 1 (M1) The source	Station 2 (M2) downtown	Station 3 (M3) The estuary	Allowable limit (WHO)
pH	-	7.6	7.9	8.3	6.5 - 8.5
TDS	mg/l	644	989	1270	1000
Turbidity	NTU	21	80	104	5
dissolved oxygen (DO)	mg/l	7.3	4.8	2.5	> 5
BOD	mg/l	3.2	8.4	15.7	< 4
COD	mg/l	15	42	71	-
Nitrates (NO_3^-)	mg/l	4.2	10.1	18.5	50
Phosphate (PO_4^{3-})	mg/l	0.29	0.95	1.70	-
Total of Hardness	mg/l	283	387	459	500
Total Coliform Bacteria	CFU/100ml	1229	9546	> 24500	0

4.1. Physical and Chemical Analysis:

4.1.1. Total Dissolved Solids (TDS) and Turbidity:

TDS and Turbidity Values Rise from Upstream to Downstream (Figure 1 as below):

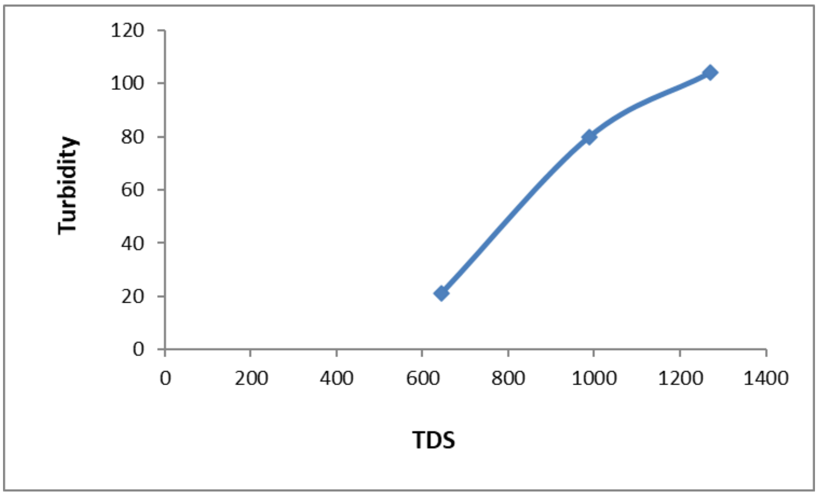

Figure 1 Relationship between Turbidity and TDS

TDS and turbidity levels significantly rise from Site M1 to M3. This suggests that there has been a significant inflow of dissolved and suspended materials from sources including agricultural practices, river erosion, and sewage [7-9].

4.2. Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD):

DO and BOD Have an Inverse Relationship (Figure 2 as below):

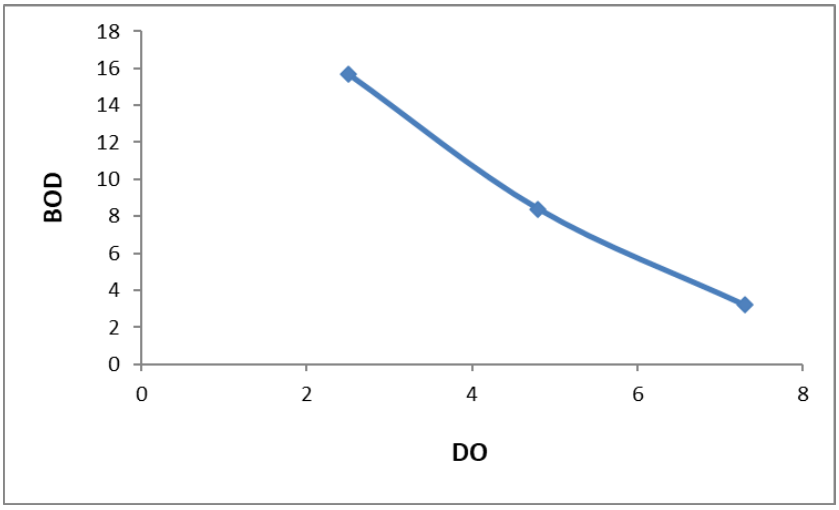

Figure 2 Relationship between BOD and DO

Analysis shows that the concentration of dissolved oxygen (DO) drops significantly from 7.3 mg/L upstream to 2.5 mg/L downstream. On the other hand, BOD rises sharply from 3.2 to 15.7 mg/L. Since bacteria use oxygen to break down organic matter, this inverse connection is unmistakable proof of severe organic pollution, mostly from wastewater, which puts aquatic life in danger by causing anaerobic conditions [8-10].

4.3. Nutrients (nitrate and phosphate)

Concentrations of phosphate and nitrate at sample locations (Figure 3 as below):

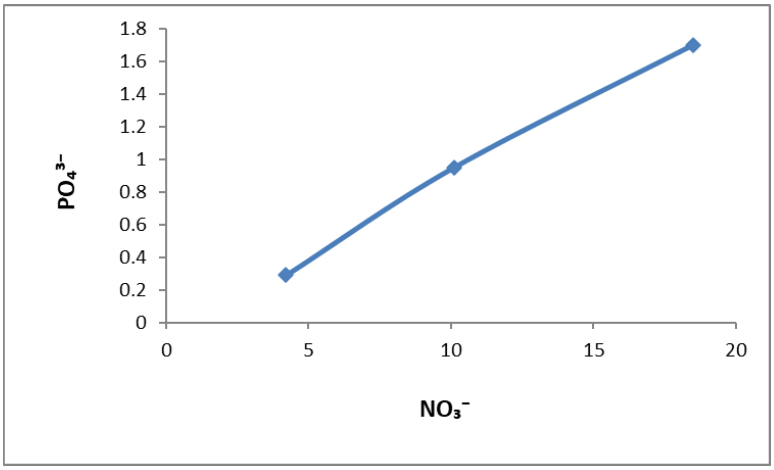

Figure 3 Relationship between Phosphate and Nitrate

The amounts of phosphate and nitrate grow steadily from source to outflow. Agricultural fertilizers and wastewater are the main sources of these elements. Eutrophication, which is caused by an increase in these nutrients, encourages the rapid growth of cyanobacteria and algae, which destroy oxygen, produce toxins, and contaminate the water [9,10].

4.4. Microbiological Analysis:

Total Coliform Bacteria in Bacterial Contamination (Figure 4 as below)

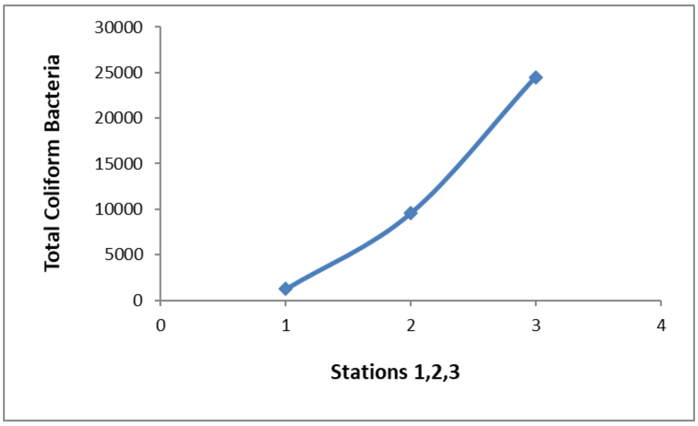

Figure 4 Relationship between Total Coliform Bacteria with Stations

Analysis: The levels of E. coli and total coliform bacteria are thousands of times higher than what is allowed for drinking water. This unequivocally demonstrates that there is significant fecal contamination as a result of untreated sewage and river water being mixed. For those who bathe or wash in the water or who could come into direct contact with it, this presents a serious health concern [6-10].

5. Conclusions

Severe Quality Deterioration: Amarah's Tigris River water has a serious decline in quality, which becomes worse as you move downstream in the city.

Principal Pollution Sources: Direct, untreated sewage discharge is the main source of pollution, followed by contamination from agricultural waste (pesticides and fertilizers).

Health and Environmental Risk: Excessive levels of bacterial, nutrient, and organic pollution are dangerous for human health and the aquatic environment because they make the water unsuitable for direct human use and have a detrimental effect on the biodiversity of the river.

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