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Evaluation of the Euphrates River's Water Pollution in Babil Governorate

Shayma Abdulwahab Luibi *

Third Rusafa Education, Ministry of Education, Baghdad, Iraq.

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Abstract

Euphrates water quality in the Babil Governorate has suffered a decline with addition of industrial waste, raw sewage, and agricultural effluent. Lab data and review of core variables depict the situation in some parts of governorate such as Mahmoudiyah, Hillah and Al-Kifl. Water quality evaluation and implications to the local environment and human health were determined by determining turbidity, pH, DO in water total dissolved solids TDS and COD.

Keywords: Euphrates River; Water Pollution; Bod; Cod; Water Quality Indicators

1. Introduction

The Euphrates River, containing Babil Governorate, is considered one of the Middle Euphrates governorates which depend on the Tigris and Euphrates to make sales. However, this precious asset is threatened by the increasing level of pollution due to demographic and urban, agricultural and industrial development. This dangerous cocktail of pollutants is turned loose in the river when it is mixed with pesticides, industrial waste and untreated sewage and enhanced by bacteria and too much nutrients causing great misery to human being and an increase in risks to their health [1-3]. Moreover, the productivity of livestock and agriculture is reduced, impact is exerted on the aquatic ecosystem and biodiversity, water quality deteriorates more quickly such that it has become not available for any irrigation or drinking. For this reason, an in-depth study and a lasting strategy is required to preserve the Euphrates River as a cornerstone of the environmental and economic sustainability of this part of the world [4-6].

2. Causes of Pollution in the Euphrates River, Babil Province

Runoff and wastewater One of the sources of severe pollution is the discharge of untreated waste water directly to surface waters from cities such as Mahmoudiyah, Hillah, and Al-Khifl. This leads to high concentrations of organic load, pathogenic microorganisms, intestinal parasites, nitrates and phosphates in the river. Agricultural runoffs: Phosphorus and nitrogen compounds, as well as pesticides and herbicides in runoff may cause excessive growth of some algae which can result in water quality problems such as fish kills and overfeeding that reduces the intrinsic oxygen of the water [7-9].

2.1. Industrial waste

Raw effluents from some businesses and construction sites has been discharged into riverbanks. "Very commonly that includes heavy metals, like cadmium and lead it results in causing, increasing risk of pollution [10-12].

2.2. Solid waste

This worsens pollution and harms the environment when construction and household waste is carelessly dumped in rivers or along their banks. Solid materials are also added to this waste [11-13].

* Corresponding author: Shayma Abdulwahab Luibi

Slaughterhouse waste: When slaughterhouse fat and blood are dumped directly into waterways, the amount of organic and bacterial pollutants increases [12-14].

3. Methods of Research and Gathering Samples

Water samples were taken from three strategic locations within Babil Governorate to assess river water pollution: Site 1 is in the Mahmoudiyah area in northern Babil, generally located above major population centers. Site 2 is in the center of Hillah city (central Babil), a site with many sources of pollution. (Site 3; South of Babylon) in the Al-Kifl area after the river passes through agricultural, industrial and urban areas. The physical and chemical properties are: turbidity, dissolved oxygen (DO), acidity (pH), chemical oxygen demand (COD), and total dissolved solids (TDS), as measured for each sample.

4. Results and Discussion

Table 1 Analytical Results of Euphrates River Water Samples in Babil Governorate

Standard	unit	Station1 North	Station2 Central	Station3 South	Permissible limit (drinking water specifications)
pH	-	7.5	7.8	8.1	6.5 - 8.5
dissolved oxygen (DO)	mg/l	7.2	4.5	2.8	> 5
chemical oxygen demand (COD)	mg/l	15	45	85	< 20
Turbidity	NTU	12	35	60	< 5
Total dissolved solids (TDS)	mg/l	450	750	1100	1000

4.1. pH

Site 1's pH readings were observed to be neutral (7.5), while Site 3's pH was slightly alkaline (8.1). This is considered within the safe limits, but could be due to contamination by alkaline wastewater inflow from industrial or agricultural sources or increased photosynthetic activity resulting from algae blooms. Also, low dissolved oxygen (DO) levels are causing a sharp decline in the riverbed, which is a good indicator of water health. The concentration of 7.2 mg/L at Site 1 is within the range tolerated by aquatic life [15-16].

For many aquatic organisms, the stress at Site 2 (4.5 mg/L) was less than acceptable (over 5 mg/L). In Station 3, fish mortality from large oxygen deficit (2.8 mg L⁻¹) and anaerobic condition of water suggest organic pollution by the consumption of oxygen during microbial degradation [17].

4.2. COD

At stations 2 and 3, COD values are much higher than the value of 20 mg L⁻¹. This trend is following the concentration of oxidizable substances. This association is supported by the lowering of oxygen and high organic pollutants consumption, probably from industrial wastewater and non-treated sewage [17].

Turbidity was increased downstream at all sites and exceeded the threshold of ; The particles can also release absorbed toxins, which may be damaging to underwater plants [18-20].

4.3. TDS

At Site 3, TDS concentrations were above the usual drinking water threshold of 1000 mg/L at 1100 mg/L; this increase is probably due to what were agricultural return flow, industrial waste water, and natural evaporation concentrating salts in the riverbed. The rising behavior suggests that the dissolved salts are in additions. The DO and COD inter-relationship is in the other way, where COD increased from 15 mg/L (Site 1) to 85 mg/L and DO decreased from 7.2 to 2.8 mg/L (Site3). This much-publicized pattern is explained by aerobic bacterial decomposition of organic waste, the major force depleting dissolved oxygen and disturbing ecosystems. Dissolved solids and turbidity are positively correlated and indicate poor water quality when they rise together. Sources of pollution, such as agriculture runoff and sewage discharges, discharge a complex mixture of dissolved salts and suspended particles [17-20].

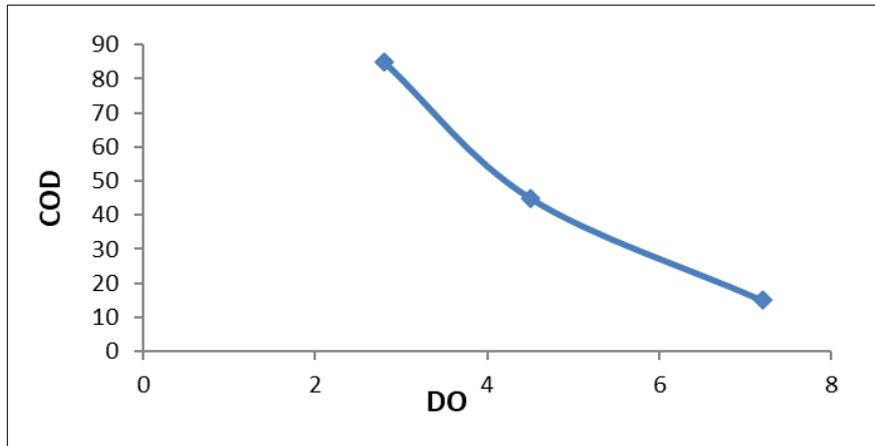


Figure 1 Relationship between COD and DO

The correlation between DO and COD describes in Fig. 1. The inverse relation is highly strong and DO from station 1 (15 mg/l) to station 3 (85 mg/l) increased by COD changes from 7.2 mg/l during dilution, reaching up to be 2.8 mg/l.

High COD means a lot of oxidizable organic substances, which is generated from the sewage, agriculture waste and industrial production. The organic matter is consumed by the natural, water-borne organisms already present in the river, which consist of aerobic bacteria [16-19].

Oxygen is essential for the decomposition process and as a result, in response to increased organic loads, these microbes rapidly consume dissolved oxygen in the water as their metabolic activity increases, resulting in a decrease in oxygen or its depletion, which kills aerobic aquatic organisms such as fish and insects, and causes deterioration in the ecosystem [18-20].

Conclusion from Figure 1: The clear correlation sufficiently supports the idea that the Euphrates River receives large amounts of organic waste in this area, causing a decrease in the oxygen levels of the riverbed.

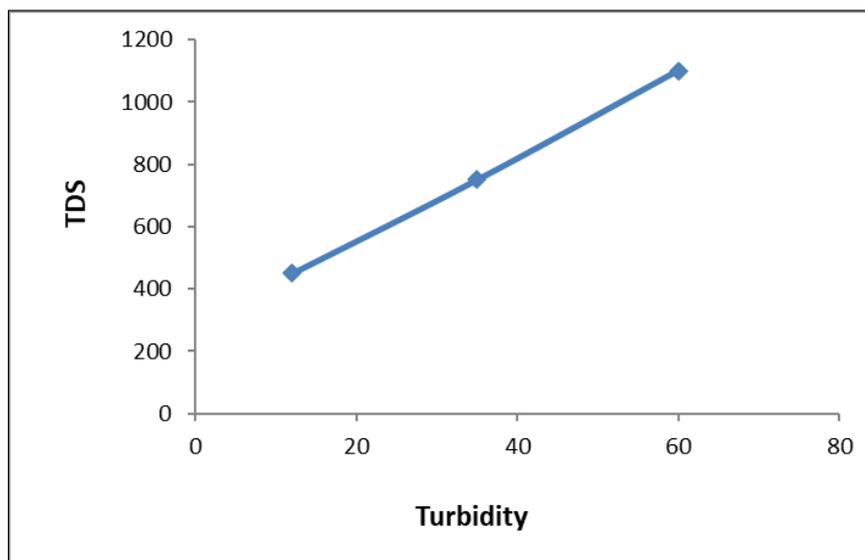


Figure 2 Relationship between TDS and Turbidity

Figure 2: Relationship between turbidity and total dissolved solids (TDS). There is a strong direct relationship between TDS and turbidity. Furthermore, TDS will continuously increase from 450 mg/L to 1100 mg/L as turbidity increases from 12 BTU at Station 1 to 60 BTU at Station 3 [15-17].

Turbidity (suspended particles) and dissolved solids (TDS) often increase simultaneously in rivers polluted from the same water sources. These sewage discharges, soil erosion, and agricultural runoff introduce suspended particles such as clay, algae, silt, plankton, and fine organic compounds that cause turbidity, as well as dissolved materials such as synthetic fertilizers and organic compounds that contribute to TDS and salts [17-19].

Untreated wastewater is a liquid containing a high load of both dissolved particulate materials and suspended organic materials especially TDS-increasing nutrients, but also soil particles passed through the decompose process into turbidity. Nitrogen promotes algal growth and is also a constituent of TDS, contributing to turbidity. Positive relationship between turbidity and TDS also indicates that pollution from intense agriculture practices and municipal wastewaters outfalls are affecting the river. Both these parameters deteriorate concurrently due to the mixture of suspended matter released from these sources and pollutants in solution further downstream [18-20].

5. Conclusion

The Euphrates in Babil Governorate is extremely polluted. Inland and Southern analyses show that the environment is under serious degradation. This is due to a significant decrease in dissolved oxygen and high COD value. The organic pollution is mainly caused by domestic sewage and agricultural drainage. In addition, elevated values of total dissolved solids and turbidity make water unfit for irrigation or human consumption except after suitable treatment. Immediate action is imperative to address this environmental disaster and devise sustainable water management plans.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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