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Assessment of Water Quality and Pollution Sources in Al-Rumaytha River, Iraq

A Thesis Submitted to the Counical of collage of Science /Al-Muthanna University as Partial Fulfillment of the Requirements for the Degree of Master of Science in Biology

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Abstract

The current study was conducted to identify potential pollution sources in the Al-Rumaytha River. Water samples were collected from three sites along the Al-Rumaytha River. These samples were collected monthly from November 2021 to October 2022 to measure various physical, chemical, and bacteriological pollutants, including heavy metals and polycyclic aromatic hydrocarbons (PAHs).

The study results indicated that the average air and water temperatures ranged between 12-40.66 ^{o}C and 7.66-32.66 C^{o}, respectively. The mean electrical conductivity (EC) ranged from 450.33 µS/cm to 3370 µS/cm. Turbidity varied, with the highest mean at 67.72 NTU and the lowest mean at 2.54 NTU. Total dissolved solids (TDS) peaked at an average of 3088 mg/l and had a minimum mean of 723 mg/l. Total suspended solids (TSS) had a maximum average of 276 mg/l and a minimum of 6 mg/l.

The concentrations of dissolved oxygen (DO) and biological oxygen demand (BOD_5) ranged from 6.3 - 16 mg/l and 0.66–17.33 mg/l, respectively. The nitrite (NO_2), nitrate (NO_3), and phosphate (PO_4) concentrations varied between 0.09–5.47, 2.33–182.86, and 0.10–5.66 µg/L, respectively. The heavy metal concentrations (dissolved phase) of Cd, Pb, Cu, and Cr ranged between 0.06-49, 0-163.13, 0-1328.9, and 0-28.33 µg/L, respectively.

Sixteen PAH compounds were detected in the water, including Acenaphthene and Acenaphthylene, which ranged from 47.1-91.5 and 24.9-55.7 ppm, respectively. The concentrations of Anthracene, Naphthalene, Phenanthrene, and Fluorine varied from 14.9-48.9, 18.9-68.7, 8.9-41.7, and 8.5-41 ppm. Furthermore, the concentrations of benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h]perylene, benzo[a]pyrene, chrysene,

dibenzo[a,h]anthracene, fluoranthene, indeno, and pyrene were 4.1-20.6, 20.1-69.7, 30.1-97.4, 4.1-36.9, 0.29-1.6, 10.5-40.8, 8.9-36, 6.5-33.4, 2.5-10.2, and 1.3-10.4 ppm, respectively.

Additionally, the highest total bacterial count was 288.3×10^5 cfu/ml, while the lowest was 52.33×10^5 cfu/ml. The highest total Coliform count averaged at 237.6×10^5 cfu/ml, and the lowest average was 15×10^5 cfu/ml.

Physical and chemical parameter results revealed that some parameters exceeded permissible limits, including electrical conductivity, total dissolved solids, and biological oxygen demand. The levels of studied heavy metals in the water surpassed both the permissible limits of Iraqi standards and the WHO guidelines.

Of the 16 PAHs detected in the Al-Rumaytha River, Site 2 was the most polluted. The study also observed a significant increase in bacterial numbers, which is indicative of pollution. These levels serve as environmental and biological indicators of substantial organic pollution and indicate the presence of microorganisms hazardous to both the health of the ecosystem and its biota.

There were significant differences based on month and study site. A positive correlation was observed between physical and chemical parameters, bacteriological characteristics, heavy metals, and PAH pollutants.