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Prediction the Tigris River Water Quality within Baghdad, Iraq by Using Water Quality Index and Regression Analysis

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Highlights

- The model developed here can help in rapid low-cost water quality evaluation for best management in Tigris River.
- Water Quality Index as the dependent variable input improved the prediction of MLR model as a tool to understand simplify and modeling the water quality variation
- Water quality indices are useful for indicating total effect of ecological factors.
- The results can help local people in improving water quality of Tigris River.
- Tigris water is un-potable (266 WQI) due to natural and anthropogenic factors.
- Tigris River water is poor for aquatic life but fair for irrigation.

Abstract

The monthly water quality data sets of ten stations on Tigris River within Baghdad for the year 2016 were studied. The water quality index (WQI) was calculated from 11 important parameters by the assigned weight method and its values were used as the dependent variable in stepwise multiple linear regression (MLR) analysis to develop a water quality model (WQM) for the river.

Twenty-three physicochemical water quality variables (2760 values) were included in developing the WQM, they are: Aluminum (Al^{+3}), Fluoride (F^{-1}), Nitrite (NO_2^{-1}), Nitrate (NO_3^{-1}), Ammonia (NH_3), Temperature (T), Total Alkalinity (TA.), Turbidity (Tur.), Total Hardness (TH), Calcium (Ca^{+2}), Chloride (Cl^{-1}), Magnesium (Mg^{+2}), Potential of Hydrogen (pH), Electrical Conductivity (EC), Sulfate (SO_4^{-2}), Total Dissolved Solids (TDS), Iron (Fe^{+2}), Silica (SiO_2), Phosphate (PO_4^{-3}), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), and Sodium (Na^{+1}).

The annual WQI mean value during the study was 266; more than the safe value of 100; consequently, the water quality was considered as unsuitable for drinking. Significant differences in WQI values were detected among months and stations with the highest WQI values (poor quality) in winter and spring, the lowest values (better quality) were in summer and autumn. The WQM, which was developed based on the stepwise MLR analysis, consisted of five parameters: Tur, EC, COD, TH, and pH with significant value (r 0.987, R^2 0.974, $p < 0.01$) and the model formula is:

$$WQI = (-1.597) (Tur)^{0.478} (EC)^{0.409} (COD)^{0.089} (TH)^{0.291} (pH)^{0.095}$$

The study results show that the use of WQI as the dependent variable input improved the prediction of MLR model as a tool to understand, simplify and modeling the water quality variation. The model developed here can help in rapid low-cost water quality evaluation for best management in Tigris River.

Keywords: Water quality index; Tigris River model; Baghdad; Multiple linear regression; Iraq

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