Application of QUAL2K for Water Quality Modeling and Management in the lower reach of the Diyala river

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Abstract

The current study includes application of QUAL2K model to predict the dissolved oxygen (DO) and Biochemical Oxygen Demand (BOD5) of lower reach of the Diyala River in a stretch of 16.90km using hydraulic and water quality data collected from Ministry of Water Resources for the period (January-April 2014). Google Earth and Arc-GIS technique were used in this study as supported tools to provide some QUAL2K input hydro-geometric data. The model parameters were calibrated for the dry flow period by trial and error until the simulated results agreed well with the observed data. The model performance was measured using different statistical criteria such as mean absolute error (MAE), root mean square error (RMSE) and relative error (RE). The results showed that the simulated values were in good agreement with the observed values. Model output for calibration showed that DO and CBOD concentration were not within the allowable limits for preserving the ecological health of the river with range values (2.51 - 4.80 mg/L) and (18.75 – 25.10 mg/L) respectively. Moreover, QUAL2K was used to simulate different scenarios (pollution loads modification, flow augmentation and local oxygenation) in order to manage the water quality during critical period (low flow), and to preserve the minimum requirement of DO concentration in the river. The scenarios results showed the pollution loads modification and local oxygenation are effective in raising DO levels. While flow augmentation does not give significant results in which the level of DO decrease even with reduction in the BOD5 for point sources. The combination of wastewater modification and local oxygenation (BOD5 of the discharged effluent from point sources should not exceed 15 mg/L and weir construction at critical positions 6.67km from the beginning of the study region with 1m height) is necessary to ensure minimum DO concentrations