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WATER QUALITY MODELS: A REVIEW

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Abstract

Maintaining water quality and predicting the fate of water pollutants are one of the important tasks of present environmental problems. The best tool for predicting different pollution scenarios are the simulation of mathematical models which can provide a basis and technical support for environmental management.

Keywords: Water Quality Model; Environmental Management; Water Pollutants.

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1. Introduction

Now-a-days a rapid growth of industrialization, urbanization and agricultural practices results in the pollution of water bodies with high rate. These practices not only pollute the reservoirs with high pollutant concentration but also increase number of pollutants. The discharging of degradable wastewater in water bodies result in decrease in water quality generally and particularly DO (Dissolved Oxygen) concentrations [1]. This has caused a serious concern over the deterioration of river water quality. As a result of which the need of satisfying water quality is growing. For establishing strategies for management of future river water quality, analysis of past trend and study of present status of river water quality is imperative. To understand the present pollutant load, pollutant transfer and future cause – effect relation between pollutant source and water quality, Mathematical Modelling is considered as one of the best tools for estimation. With the help of these models the response of the aquatic environment to different scenarios can also be predicted. Mathematical modelling can also be beneficial for all those sites which are inaccessible due to special environmental issues. Therefore, water quality models become an important tool to identify water environmental pollution and the final fate and behaviours of pollutants in water environment [2]. With the development of model theory and the fast-updating computer technique [3], more and more water quality models have been developed with various model algorithms [4, 5]. Up to date, tens of types of water quality models including hundreds of model software have been developed for different topography,

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water bodies, and pollutants at different space and time scales [5, 6].Therefore, it is very necessary for most developing countries to better understand the availability and precisions of different water quality models and their methods of calculation and calibration and progress in the model standardization in order to apply effectively these models and form a good model regulation system [7, 8]. The study of different water quality models can result in contributing better environmental management policies and authorising reasonable construction projects. From 1925 to till date many water quality models have been introduced such as as QUAL 2K model [9], WASP 6 model(10], QUASAR model [11, 12], SWAT model [13), and MIKE 21 [14] and MIKE 31 models [15] (Table 1)

Table 1: Main surface water quality models and their versions and characteristics.

Model	Model Version	Characteristics	Reference
Streeter-Phelps models	S-P model Thomas BOD-DO	Streeter and Phelps established the first S-P model in 1925. S-P models focus on oxygen balance and one-order decay of BOD and they are one-dimensional steady-state models.	16
QUAL models	QUAL I; QUAL II; QUAL2E; QUAL2E UNCAS; QUAL 2K.	The USEPA developed QUAL I in 1970. QUAL models are suitable for dendritic river and non-point source pollution, including one-dimensional steady-state or dynamic models.	7, 17, 18, 19, 20.
WASP models	WASP1-7 models.	The USEPA developed WASP model in 1983. WASP models are suitable for water quality simulation in rivers, lakes, estuaries, coastal wetlands, and reservoirs, including one-, two-, or three-dimensional models.	21
QUASAR model	QUASAR model	Whitehead established this model in 1997. QUASAR model is suitable for dissolved oxygen simulation in larger rivers, and it is a one-dimensional dynamic model including PC_QUA SAR, HERMES, and QUESTOR modes.	7, 10, 11
MIKE models	MIKE11; MIKE 21; MIKE 31.	Denmark Hydrology Institute developed these MIKE models, which are suitable for water quality simulation in rivers, estuaries, and tidal wetlands, including one-, two-, or three dimensional models.	21, 14, 15.
BASINS models	BASINS 1; BASINS 2; BASINS 3; BASINS 4.	The USEPA developed these models in 1996. BASINS models are multipurpose environmental analysis systems, and they integrate point and nonpoint source pollution. BASINS models are suitable for water quality analysis at watershed scale.	7, 22.
EFDC	EFDC model.	Virginia Institute of Marine Science	23, 24.

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model		developed this model. The USEPA has listed the EFDC model as a tool for water quality management in 1997. EFDC model is suitable for water quality simulation in rivers, lakes, reservoirs, estuaries, and wetlands, including one-, two-, or three-dimensional models.	

2. Conclusion

In the changing environmental scenario the water quality models are playing very important role in predicting the present and future status of water pollution. Many water quality models have been developed since 1925 and some developed countries have provided some regulated models for surface water quality simulation. Hence the standardization of some water quality models are becoming necessary for most developing countries for the study of efficient environmental impact assessment.

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