



A Statistical Assessment of Mahananda River Water Quality Parameters

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Abstract: The River Mahananda, which runs past Siliguri City, WB, is at present one of the most polluted rivers in North Bengal. Presently Siliguri is a very densely populated and will be one of the important cosmopolitan cities of West Bengal. However, only a small fraction of the total wastewater being generated in the city is treated. Consequently, the amount of untreated wastes, both domestic and industrial, being released into the Mahananda is tremendous and is increasing day by day. Therefore, the objectives of this study were to investigate the status of the river water quality by using mathematical modeling [1] in terms of some cardinal water quality parameters, and to simulate the dissolved oxygen (DO) level. In order to fulfil the objectives, a comprehensive data were collected from West Bengal Pollution Control Board (W.B.P.C.B). Then, a one-dimensional water quality model was developed for the Mahananda river system for a dry and monsoon period of last ten years.. In this paper an attempt has been taken to study and simulate the environmental condition along the river by mathematical tools and predict the pollution status.

Keywords: Siliguri City; River Mahananda; pollution; mathematical model; DO, dry season, monsoon season.

I. Introduction

The use of statistical techniques [2] in aquatic environmental monitoring is considered invaluable in the design and analysis of the results of monitoring programs. The AM (arithmetic mean), SD (standard deviation), Variance, correlation coefficient and regression lines calculation and analysis of the parameters are considered for prediction of future pollution scenario of this river. Water quality data were obtained from the library division of WBPCB, Salt Lake, Kolkata, office as accumulated in their published annual project report of various years. The water quality data were taken of Mahananda river at two important station named Siliguri and Malda (English Bazar). Only DO (dissolved oxygen), BOD (biological oxygen demand) & COD (chemical oxygen demand) were taken into account as major water quality parameters. Most of the rivers in North Bengal area are flowing from North to South we denoted E for East river bank, M for middle of the river and W for the other side of the river bank. All the sample sites and other positions are taken in the river and catchments area of the region.

II. Modeling and forecasting by using the statistical tools

Table 1: Statistical Analysis of water quality parameters of River Mahananda at Siliguri during 2001-2010

Parameters	DO		BOD		COD	
	Dry	Monsoon	Dry	Monsoon	Dry	Monsoon
Mean	3.83	6.92	4.43	2.72	27.07	30.83
Standard Deviation (SD)	1.42	2.04	3.09	1.31	7.68	8.87
Variance	2.01	4.16	9.56	1.72	58.92	78.68
Min	1.40	2.03	1.33	0.90	24.43	13.01
Max	5.77	8.36	6.13	3.60	40.72	30.24

Table 2: Statistical Analysis of water quality parameters of River Mahananda at Malda during 2001-2010

Parameters	DO		BOD		COD	
	Dry	Monsoon	Dry	Monsoon	Dry	Monsoon
Mean	4.92	8.22	1.197	1.43	17.85	27.12
S.D	1.05	2.44	0.81	0.69	10.22	11.62
Variance	1.11	5.94	0.66	0.48	104.59	135.09
Min	3.10	5.10	0.36	0.73	10.90	19.97
Max	6.50	10.97	3.26	2.27	22.80	51.58

All units are at mg/L and 26°C

Table 3a: Calculation of correlation Coefficient: Between BOD and COD

Place	SILIGURI			MALDA(English Bazar)		
	Sampling points			Sampling points		
	A	B	C	A	B	C
Value of Correlation Coefficient(r)	0.7428	0.8343	0.7270	0.3534	0.9957	0.2841

Table 3b: Calculation of correlation Coefficient: Between DO and BOD

Place	SILIGURI			MALDA(English Bazar)		
	Sampling points			Sampling points		
	A	B	C	A	B	C
Value of Correlation Coefficient(r)	0.7159	0.9916	0.7379	0.8330	0.1671	0.9173

Table 3c: Calculation of correlation Coefficient: Between DO and COD

Place	SILIGURI			MALDA(English Bazar)		
	Sampling points			Sampling points		
	A	B	C	A	B	C
Value of Correlation Coefficient(r)	0.7862	0.8978	0.9610	0.0315	0.1416	0.0293

III. Result & Discussion

Statistical analyses were conducted for the purpose of identifying water quality trends in the Mahananda River. It is a presentation and discussion of the results from both the standard regression analysis [3] and comparative discussion of arithmetic mean, standard deviation and variance on the individual water quality variables at each of the monitoring stations from 2001 to 2010 (as per the WBPCB data). The Karl-Pearson correlation coefficient values, the regression slope for each water quality parameter at each of the stations are presented in 3.7 and 3.8.

It should be reiterated at this point that the results of the regression analysis[4] are applied with great caution. This is because the data were characterized by skewness, nonlinearity, non-normality and a possible lack of independence and thus violated the assumptions required for linear regression.

The results from statistical analysis show that, the water is certainly unfit for drinking purposes without any form of treatment, but for various other surface water usage purposes, it still could be considered quite acceptable. But as it is known, once a trend in pollution sets in, it generally accelerates to cause greater deterioration. So few years from now, serious water quality deterioration could take place.

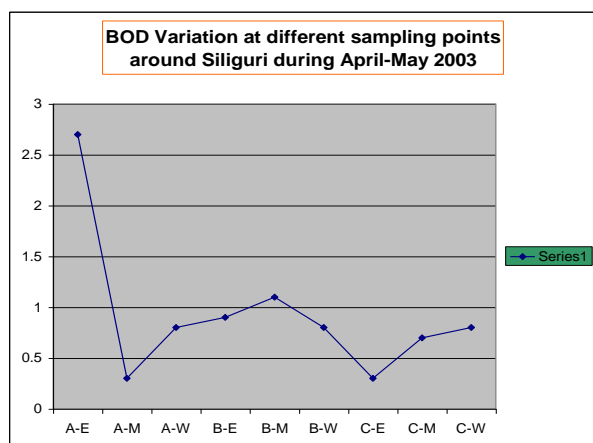


Fig. 1: BOD variation around Siliguri

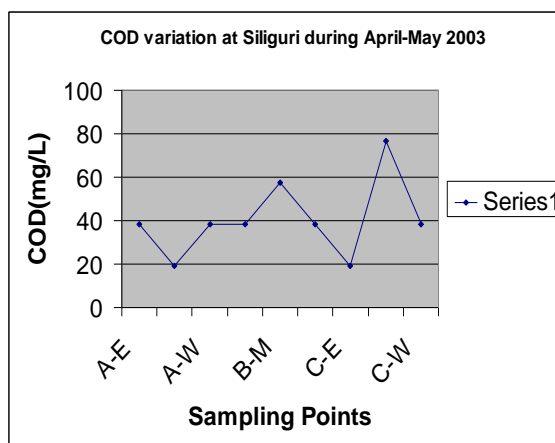


Fig.2: COD variation around Siliguri

As per the water quality data during 2005-2006 (March-July) the statistical analysis of mean value (ref. below mentioned statistical results table.) and the result of DO shows that in dry season it is just 3.83 mg/L i.e the water becomes so polluted at this period at Siliguri .Since the river Mahananda is totally rain fed so in rainy season the DO value goes up to 6.92mg/L and it becomes low polluted then i.e this statistical result collinear with the physical and natural phenomena of this river.

The difference pollution situation can be understood from the results of BOD and COD also. The result of standard deviation and variance[5] of these parameters also show the rate of pollution load at dry and monsoon season. Since the soil of this region is highly porous and temperature goes up in summer then it flows very slowly and it becomes highly polluted.

Table 4: Summer Average Values for Water Quality of River Mahananda

Station Name	Dissolved Oxygen(mg/l)		Bio Chemical Oxygen Demand(mg/l)		Chemical Oxygen Demand(mg/l)	
	2001	2006	2001	2006	2001	2006
A.Siliguri	7.47	3.08	1.53	20.79	22.24	52.47
B.Malda	6.90	2.96	1.94	22.78	19.67	53.77

Above table 4 shows the overall rate of depletion of water quality of the river Mahananda over the period of five years. In one side DO falls, another side BOD, COD values are raised which clearly indicate the total pollution scenario of this river.

This paper provides information regarding fruitful application of Mathematical Modeling for river water quality parameters viz.DO, BOD, COD and pH by using graphical model, curve fitting and correlation -regression analysis.In future using time series forecasting model we can get better real scenario. This is not the ultimate study but an attempt to assess the water quality and its pollution scenario by using mathematical tools.

IV. Reference

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