Evaluation of Water Quality Index for River Mahananda West Bengal India

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***Abstract*: River Mahananda, flows through the Indian states of West Bengal, Bihar and Bangladesh, is being contaminated by discharge of sewage and other effluents as well as dumping of solid waste. An attempt was made to apply a Water Quality Index(WQI) for the station located in Siliguri, a district of Darjeeling using four water quality parameters pH, DO, BOD and temperature between 2008 and 2012. Rating Scale were applied based on OWQI and CPCB Index value to derive the status of water quality of Mahananda River.**

Index Terms*: *Water quality parameters, Water Quality Index, Rating Scale.

I. INTRODUCTION

Amongst three basic required natural resources for sustaining any life, water is one of the prime natural resource as well as important constituent of life support system [1] which can be contaminated easily. Water not only get contaminated from a solitary source but also due to multiple sources. Contaminated water not just influences the life of present age yet its effect influences the life of future generations too. The pollution potential in the water body is sorted into two groups based on anthropogenic activities: (a) point sources of contamination due to industrial and domestic effluent and (b) non-point sources due to contamination from showering, agricultural runoff, washing clothes etc.

The river Mahananda plays a critical part in human existence of Siliguri Municipal Corporation areas situated at its bank. It is being polluted at few places due to industrial development, unplanned urbanization, discharge of untreated sewage and domestic wastes, industrial effluents etc. Moreover, discharge from urban zones, factories, farms and individuals families – also contribute to the contamination of Mahananda river.

A water quality index is a tool to provide information about water quality in a form of single data. The Water Quality Index is widely used to evaluate the water quality profile along the entire stretch of river bank and to find out the pollutions level in water bodies. Water Quality Index (WQI) of the river was determined and analyzed in order to know the pollution level of the river and to know if it is fit for desirable use. WQI is usually utilized for the identification and assessment of water pollution and might be characterized as an impression of composite impact of various quality parameters on the overall quality of water. In this study, Oregon Water Quality Index (OWQI) and Central Pollution Control Board (CPCB) were employed to find the water quality status of Mahananda river.

II. STUDY AREA

The Mahananda river flows through the Indian states of West Bengal, Bihar and Bangladesh. The eastern and western region of Mahananda divides the district into two region. Old alluvial and relatively infertile soil are found in eastern region where as river Kalindri subdivides the western region into two namely, “Tal” and “Diara” where Tal is low lying northern area and during rainy season it is vulnerable to inundation; fertile region Diara is thickly populated located on the southern side [3].

The total stretch of Mahananda river is 360 km out of which 324 km is in India and the rest is in Bangladesh. Mahananda river have a total drainage area of 20,600 km2. Siliguri located near the foot of southern Himalayas lies on the bank of Mahananda river. Siliguri is a metropolis, which span between two districts namely Darjeeling and Jalpaiguri in West Bengal state. The latitude of Siliguri, is 26° 42' 57" N and the longitude is 88° 25' 24" E.

III. METHODOLOGY

For the present investigation water quality data pertaining to Mahananda river were derived from CPCB website [10,11]. Table 1 and Table 2 details physico-chemical parameter collected from the CPCB website viz. temperature, pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), fecal coliform for two years 2008 and 2012 respectively. OWQI and CPCB index for Mahananda river were arrived by adopting the following procedure.

The OWQI helps in evaluating water quality status and was developed in the year 1970s. A water quality index is a tool to provide information about water quality in a form of single data.

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The overall water quality is expressed in a form of digit by integrating measurements of four different water quality variables namely pH, DO, BOD and fecal coliform [4].

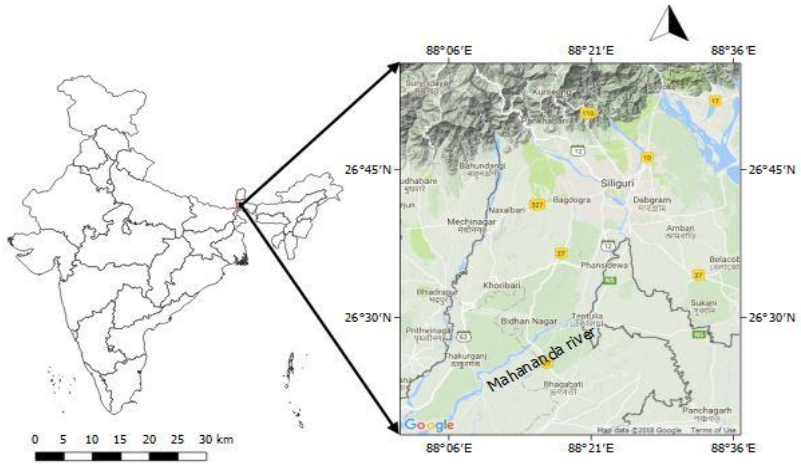

Fig 1. Description of the study area. (Source: Google maps)

The unweighted harmonic square mean formulae expressed as:

$$WQI = \sqrt{\frac{n}{\sum_{i=1}^{n} \frac{1}{(S_i)^2}}}$$

Where, WQI is the water quality index result, n is the number of sub-indice and Si is the sub-index i. Ved Prakash et al. (1990) developed CPCB index and it is basically based on four important parameters namely DO, BOD, pH and fecal coliform [4]. The index is expressed as:

$$WQI = \sum_{i=1}^{P} w_i \times I_i$$

Where Ii = sub index for the ith water quality parameter; wi = weight associated with the ith water quality parameter; P = number of water quality parameters.

TABLE 1. Statistical data of Water Quality Parameters

Year	2008
Station Code	1946
Location	Mahananda at Siliguri
State Name	West Bengal
Temperature (°c)	29
pH	7.3
Dissolved Oxygen (D.O.) (mg/l)	6.8
Biochemical Oxygen Demand (B.O.D.) (mg/l)	2.7
Fecal Coliform (MPN/100ml)	65667
OWQI	15.69
CPCB Index	30.94

TABLE 2. Statistical data of Water Quality Parameters

Year	2012
Station Code	1946
Location	Mahananda at Siliguri
State Name	West Bengal
Temperature (°c)	26.17
pH	7.3
Dissolved Oxygen (D.O.) (mg/l)	6.83
Biochemical Oxygen Demand (B.O.D.) (mg/l)	2.98
Fecal Coliform (MPN/100ml)	21416.7
OWQI	21.85
CPCB Index	31.70

Statistical summary of data obtained from CPCB

TABLE 3. : Water Quality Classification Based on OWQI value

WQI Value	Water Quality
90-100	Excellent
85-89	Good
80-54	Fair
60-79	Poor
10-59	Very Poor

TABLE 4. Water Quality Classification Based on CPCB value

WQI Value	Water Quality
63-100	Good to excellent
50-63	Medium to good
38-50	Bad
<38	Bad to very bad

IV. RESULT AND DISCUSSION

In general, river water is a good source for drinking and domestic purpose, but with recent time, it is being polluted with growth of urbanization. Temperature of Mahananda river was not in the desirable range (10-25°C) as per Indian standard. The pH of water is 7.3, which remained same for two years (2008 & 2012) and was within the tolerance range between 6.5 and 8.5. However, a very special attention has to be given for bacteriological parameter (fecal coliform), since the present range is not within the desirable limit in the river. The DO values were in the range of 6.8 mg/lit for the year 2008 and 6.83 mg/lit for the year 2012. The OWQI value for Mahananda river was 15.69 and 21.85 for two years (2008 and 2012) which was in the range of 10-59, hence the status of water quality is characterised to be very poor as defined in Table 3. The CPCB value for Mahananda river was 30.94 and 31.70 for two years (2008 and 2012) which was less than 38, hence the status of water quality is characterised to be in the range of bad to very bad as defined in Table 4. The present status of water pollution of Mahananda river is due to anthropogenic activities like discharging of untreated municipal and industrial waste. If the present status of water pollution is continued, the river will be of no use in future further to make the river water fit for its desired end use suitable water treatment plant units need to be adopted.

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12. Study area map at https://earth.google.com/web/

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