Effect of Construction of Bargi Dam on Water Quality of River Narmada, MP, India

Bikramaditya Chowdhury[1], Prof. R. K. Grover[2], Prof. R. K. Bhatia[3]

[1]M.E. Scholar, [2,3]Assistant Prof, Department of Civil Engineering, JEC, Jabalpur,M.P., India

Abstract--Narmada River is considered to be the holy river of the state Madhya Pradesh. A study was considered for the development of water quality index using ten parameters pH, turbidity, electrical conductivity, total hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride content, alkalinity and acidity. Water is one among the major necessities of life required for growth and activity of all living beings on globe. It is also known as blue gold. About 98% of planets water is salt water which is unusable for drinking, only 0.036% freshwater that is found in rivers and lakes. Colourless, tasteless, and odourless water is always pure. Most living organisms have 60% water in their body. Evolution of life on Earth was impossible without presence of water. The river Narmada is the third holy and seventh longest river of India among the fourteen major river basins. It originates from Amarkantak hills in the Mekhala range of Shahdol district, Madhya Pradesh.

Water quality analysis is one of the most important aspects in surface water studies. The present research has been focused on Narmada river in Bargi Basin Area . Sampling and analysis of water just up stream and down stream of Bargi Dam apart from monitoring dam water quality. In 5 selected sites in mandla region.

Keywords- Water quality index, Narmada river, Bargi Dam, Surface water studies, Water parameters, Analysis

I. INTRODUCTION

The Narmada River basin lies in the central part of India, between 72°32¢E–81°45¢E long and 21°20¢N–23°45¢N lat., with a drainage area of 98796 sq. km and a mean elevation of 760 m. The total length of the River is 1312 km. The catchment area of the River extends in the administrative States of Madhya Pradesh (MP; 86.18%), Gujarat (11.6%), Maharashtra (1.5%) and Chhattisgarh (0.72%).While Jabalpur is located at 23°10'N 79°57'E and 23.17°N 79.95°E. The city has an average elevation of 411 meters from sea level.

Narmada River water is the main resource for domestic and irrigation purposes in the study area. So it is very important to estimate the superiority of water in the study area.

In the present study water sample of Narmada River from different sites has been assessed Physicochemical to evaluate its suitability for domestic and irrigation purposes. Many researchers have done work on physicochemical evaluation of water. Also many good research papers have published on Narmada River.

All biological reactions occur in water and it is the integrated system of biological metabolic reactions in an aqueous solution that is essential for the maintenance of life. Most human activities involve the use of water in one way or other. It may be noted that man's early habitation and civilization sprang up along the banks of Rivers. Although the surface of our planet is nearly 71% water, only 3% of it is fresh. Of these 3% about 75% is tied up in glaciers and polar icebergs, 24% in groundwater and 1% is available in the form of fresh water in Rivers, lakes and ponds suitable for human consumption (Dugan, 1972). Due to increasing industrialization on one hand and exploding population on the other, the demands of water supply have been increasing tremendously.

II. OBJECTIVE OF THE STUDY

In the proposed research an experimental study has been done for the effect of construction of Bargi dam in assessment of water quality index of different sources of water. The present research has been focused on Narmada river in Bargi Basin Area . Sampling and analysis of water just up stream and down stream of Bargi Dam apart from monitoring dam water quality. In 5 selected sites in mandla region.

The specific objectives of the present study can be outlined as:

To conduct field visit and survey at different locations of raw water bodies.

To collect water samples at selected 5 locations.

To carry out test to determine physicochemical parameters of water samples like pH, turbidity, electrical conductivity, total hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride content, alkalinity and acidity.

To find out the Variation of water quality during different location.

To suggest some sustainable water quality management strategies after construction of Bargi Dam in Narmada River.

III. STUDY AREA AND METHODOLOGY

Jabalpur an important city in the Narmada (eastern) region of Madhya Pradesh is one of the fastest growing cities in the country. As per 2011 censes the population of Jabalpur district is 24.61 lakhs out of which 10.54 lakhs live in Jabalpur city, in 60 wards, covering a gross area of 224.47 sq. km.

Sampling Stations And Survey Of Different Location In Study Area

The present research has been focused on Narmada river in Bargi Basin Area . Sampling and analysis of water just up stream and down stream of Bargi Dam apart from monitoring dam water quality. In 5 selected sites in mandla region.

Sampling Stations Of Water Just Up Stream Side Of Bargi Dam

The study has been on the basis of the survey conducted for the collection of data. This study is based on the information collected through survey and inventorying the activities related to the different ghats of River Narmada in 5 selected sites in mandla region. Information estimated on the basis of the conducted test on water. Mandla is a town with municipality in Mandla district in the Indian state of Madhya Pradesh. It is the administrative headquarters of Mandla District. The town is situated in a loop of the Narmada River, which surrounds it on three sides, and for 15 miles between Mandla and Ramnagar, Madhya Pradesh the river flows in a deep bed unbroken by rocks. The Narmada is worshiped here, and many ghats have been constructed on the banks of the river. It was a capital of the Gondwana Kingdom who built a palace and a fort, which in the absence of proper care have gone to ruins.

Water Sampling Procedure And Analysis

The water samples were analyzed for various parameters in the laboratory of Pollution Control Board, Jabalpur, P.H.E. Lab Vijay Nagar, Jabalpur.

Various physical and chemical parameters like pH, turbidity, electrical conductivity, total hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride content, alkalinity and acidity have been monitored for the sampled water of different locations.

D.O. bottle of 300 ml and Plastic bottles of 1.0 liter capacity with stopper were used for collecting samples. Each bottle was washed with 2% Nitric acid and then rinsed three times with distilled water. The bottles were then preserved in a clean place. The bottles were filled leaving no air space, and then the bottle was sealed to prevent any leakage. Each container was clearly marked with the name and date of sampling.

IV. OBSERVATION AND RESULTS

Following observation were made after conducting the experiment on Physicochemical parameters like pH, turbidity, electrical conductivity, total hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride content, alkalinity and acidity.

Observation and Results

Following observation were made after conducting the experiment on Physicochemical parameters like pH, turbidity, electrical conductivity, total hardness, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, chloride content, alkalinity and acidity.

In this study for the calculation of water quality index twelve important parameters were chosen. The W.Q.I. has been calculated by using the standards of drinking water quality recommended by the World Health Organization (WHO), Bureau of Indian Standards (BIS) and Indian Council for Medical Research (ICMR). The weighted arithmetic index method (Brown et. al.) has been used for the calculation of WQI of the lake.

Further quality rating or sub index (qn) was calculated using the following expression.

Quality rating, Qi = 100 [(Vn -Vi) / (Vs -Vi)]

Table 4.1
Calculation of Water Quality Index for X-1 (just up-stream of Bargi Dam)

S. No.	Parameter	Composite Sample value (Vn)	(Wi x Qi)/ ∑Wi
01	pH	7.29	09.08
02	Turbidity	9.5	19.68
03	Conductivity	163.3	0.033
04	Hardness	114	0.133
05	D.O.	7.9	16.31
06	B.O.D	1.7	21.84
07	C.O.D	9	0.03
08	Chloride	23	0.0429
09	Alkalinity	97	0.283
10	Acidity	117	0.341
			67.7729

Where,

Vn : actual amount of nth parameter

Vi : the ideal value of this parameter

Vi = 0,

Except for pH and D.O. Vi = 7.0 for pH;

Vi = 14.6 mg/L for D.O.

Vs: recommended WHO standard of corresponding parameter

Table 4.2:
Calculation of Water Quality Index for X-2 (Basin Water of Bargi Dam)

S. No.	Parameter	Composite Sample value (Vn)	(Wi x Qi)/ ∑Wi
01	pH	7.31	9.633
02	Turbidity	6.0	12.43
03	Conductivity	164.7	0.0334
04	Hardness	96	0.112
05	D.O.	7.6	17.04
06	B.O.D	1.5	19.28
07	C.O.D	13	.038
08	Chloride	33	0.061
09	Alkalinity	81	0.24
10	Acidity	95	0.278
			59.1454

Relative weight (*Wi*) was calculated by a value inversely proportional to the recommended standard (*Si*) of the corresponding parameter: ***Wi* = 1/ *Si*** Generally, WQI are discussed for a specific and intended use of water. In this study the WQI for human consumption is considered and permissible WQI for the drinking water is taken as 100. The overall WQI was calculated by using Equation:

Water Quality index = (Qi x Wi) / ∑Wi

Table 4.3:
Calculation of Water Quality Index for X-3 (just down-stream of Bargi Dam)

S. No.	Parameter	Composite Sample value (Vn)	(Wi x Qi)/ ∑Wi
01	pH	7.40	12.43
02	Turbidity	5.3	10.98
03	Conductivity	158.6	0.032
04	Hardness	88	0.103
05	D.O.	8.0	16.06
06	B.O.D	1.3	16.71
07	C.O.D	19	0.056
08	Chloride	29	0.054
09	Alkalinity	69	0.20
10	Acidity	80	0.234
			56.859

V. CONCLUSION

In the present study fifteen sample sites were selected and water samples collected in locations at different study sites of Narmada River at Bargi Dam. The physicochemical parameters were identified from the laboratory of Pollution Control Board, Jabalpur. From the experimental work data interpretation was done and finally conclusion is derived with some recommendations.

In this study we found that Water Quality Index for X-1 (just up-stream of Bargi Dam) is 67.7729 and Water Quality Index for X-2 (Basin Water of Bargi Dam) is 59.1454 and at last Water Quality Index for X-3 (just down-stream of Bargi Dam) is 56.859 at Narmada River in Jabalpur. In this results we concluded that with the construction of Bargi Dam is very useful to control water parameters and its reduced Water Quality Index 67.7729 to 56.859. So the variation of value of Water Quality Index is 16.10%. Due to construction of Bargi Dam the Quality of Water is improved.

REFERENCES

[1] Anjum Praveen, Rajesh Kumar, Pratima and Rajat Kumar, Physio-Chemical Properties of the Water of River Ganga at Kanpur, International Journal of Computational Engineering Research, 03, 134-137 (2013)

[2] Burim Haxhibeqiri, Faton Maloku and Ferdi Brahushi (2014) Physicochemical and bacteriological Analysis of The River Drini 1 Bardhe. European Scientific Journal Special edition.

[3] Chaterjee, C and Raziuddin. (2002) Determination of of physico chemical parametersof a degraded River in Asanol industrial area, Raniganj, Burdwan, West Bengal. Nature, Environment and Pollution Technology 1, 181 – 189.

[4] Cude, C. (2001) Oregon water quality index: A tool for evaluating water quality management effectiveness. Journal of the American Water Resources Association 37, 125 – 137.

[5] Dara, S. S. (2001) A Textbook on Experiments and Calculations in Engineering Chemistry. S.Chand & Co. Lt.

[6] Dhirendra Mohan Joshi, Alok Kumar and Namita Agrawal (2009) Studies On Physicochemical Parameters to Assess the Water Quality Of River Ganga For Drinking Purpose In Haridwar District. Rasayan J. Chem2, 195-203.

[7] Dr. Leena Singh and S.K Choudhary (2013) Physicochemical Characteristics of River Water of Ganga in Middle Ganga Plains. International Journal of Innovative Research in Science, Engineering and Technology, 2.

[8] Geoffrey Waring Maw. Narmada, the life of a River. Marjorie Sykes, 1991.

[9] Guideline for Drinking Water, World Health Organization (1993). Geneva, 1: 52-82.

[10] Jadhav, S.D., Jadhav and Jawale, R.W. (2013) Physicochemical and bacteriological analysis of indrayani River Water Alandi, Pune District (Maharashtra) India. International Journal of Scientific & Engineering Research 4.