"DETERMINATION OF WATER QUALITY PARAMETERS BY USING PHYSIC-CHEMICAL PROPERTIES OF NARMDA RIVER WATER"

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Abstract - The river Narmada also known as the "Rewa" is the third holy and fifth largest west flowing river of India and biggest west flowing river of the state M.P. Festivals are very important and heartiest to every person of India. Most of the festivals are associated with bathing in rivers, idol immersion, Jaware visarjan, float traditional oil lamps etc. They through some materials like food, waste or leaves in the river for spiritualistic reasons Religious human activities also add to the river pollution. Due to mismanagement of these waste and contaminated water all the areas near the river are polluted. In Jabalpur city one can find number of Narmada river ghats like Jelehri-ghat, Gwari-ghat, Tilwaraghat, Bhedaghat Barmanghat visited by thousands of people every day. In the present study water samples were collected from these ghats of narmada from Jabalpur on four different season from summer and winter have been considered.

For the assessment of water quality the experiments have been done for physico-chemical parameters are pH, Total Hardness, D.O., B.O.D, Alkalinity as per the standard methods in the shri ram group Jabalpur.

It is evident from the above data analysis that the worship remains is being done at important Ghats and its value is significant increased during the festivals. This study provides an informative data on water quality and helps to understand the pollution in various ghats of river Narmada at season. In the present study it was found that physico-chemical characteristics of a few of the river water samples crossed the maximum permissible limit, during the different season due to the religious activities.

Keyword: physico- chemical, parameters, pH , Total Hardness, D.O., B.O.D, Alkalinity

1 INTRODUCTION

1.1 General

Water is a transparent fluid which forms the world's streams, lakes, oceans and rain, and is the major constituent of the fluids of living things. As a chemical compound, a water molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Water is a liquid at standard ambient temperature and pressure, but it often co-exists on Earth with its solid state, ice and gaseous state, steam (water vapor). It also exists as snow, fog, dew and cloud.

Water is a basic need of life and is the foundation for human survival and development. Water is the most common substance on earth, covering seven tenths of the world's surface, and that is why earth is also called the blue planet. Life first started in water and 96% of the composition of all living cells is water. Water is one of the prime needs of life. We can hardly live for few days without water. Since time immemorial fresh water has always been of vital importance to man as his early habituations were within easy reach of rivers, tanks, dams, ponds and lakes. The importance of freshwater resources, their conservation and utilization has attained almost utmost importance during the present time.

The Earth's Surface covers 71% of Water. It is vital for all known forms of life. On Earth, 96.5% of the planet's water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapor, clouds (formed of ice and liquid water suspended in air), and precipitation. Only 2.5% of the Earth's water is freshwater, and 98.8% of that water is in ice (excepting ice in clouds) and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products.

1.2 The pressure on water demand

The large scale rapid and unplanned urban growth due to increase in population or migration of people from rural areas to urban areas , changed life

style has increased pressure on domestic water demand. Man's greed for luxury and comfort resulted in the rapid deterioration of the environment. Population growth will continuously increase the demand for water thereby forcing water agencies to look for alternative ways to manage the available resources. It is well known that most of the projected global population increases will take place in the third world countries that already suffer from land, water, food and health problems.

Therefore, the key challenge facing many countries is to develop strategies to meet the increasing water demands of society but which do not further degrade the integrity of the environment that leads to the sustainable development of water in terms of quantity and quality. The degradation of quality of water threatens the sustainability of water resources.

1.3 Sources of Pollution on Surface Water

Pollution of surface and ground water is largely a problem due to rapid urbanization, and industrialization. The large scale urban growth due migration of people from rural areas to urban areas has increased domestic effluents, while industrial development manifested either due to setting up of new industries or expansion of the existing industrial establishments resulting in generation copious volume of industrial effluents. Once the contaminants enter the water source it is a difficult and expensive to remove them. Water pollution has been seriously affecting the life of humans, plants as well as animals. The eco-system of rivers, streams, lakes, seas and oceans is also getting deteriorated due to the contamination of water, through various sources. Discharges from power stations reduce the availability of oxygen in the water body, in which they are dumped. The flora and fauna of rivers, sea and oceans is adversely affected by water pollution. A number of waterborne diseases are produced by the pathogens present in polluted water, affecting humans and animals**.** Marine life becomes deteriorated due to water pollution Unplanned and injudicious disposal of municipal waste causing pollution of water bodies.

Festivals are very important and heartiest to every person of India. Religious human activities also add to the river pollution. Mehta (2014) stated that with growing magnitude of the religious activities pollution load is bound to be increased in many folds. The rivers in India have been considered sacred from ancient times. People take holy dip in river with the faith that the water washes away their sin. (#)[ ] After death of the people dump their asthia in the river, This obviously causes significant impact on the quality of the rivers in India. "Higher the BOD level worse it is for one's skin," said a CPCB expert. High exposure to dirty water can result in skin rashness and allergie. Exposure factors such as washing clothes, bathing and lack of sewerage, toilets at residence, children defecating outdoors, poor sanitation, low income and low education levels also showed significant associations with enteric disease outcome. Basant Rai (2013) have done a study o water quality of river Gana and found that on tracting dysentery, cholera, hepatitis, as well as severe diarrhea which continue to be one of the leading causes of death of children in India.

2 LITERATURE REVIEW

2.1 Introduction

A review on previous work & research has been carried out on the physico-chemical parameter analysis of water quality at different festivals on rivers in India. A Series of research papers and the results of studies carried on River Narmada were reviewed.

2.2 Research Papers related to Surface water quality during festivals

According to Sharma et al (2011) During main festive occasions, cases of water borne diseases like diarrhoea, dysentery, jaundice, typhoid, cholera, and many other types of liver and Gastro Intestinal disorders increase due to burden on civic facilities, on account of enhanced pressure of Tourists/ Pilgrims in Haridwar. The pilgrims also bring a lot of offering in the form of flowers, cloths, old icons of Gods and Goddess, besides last remains (ashes) of their loved ones- to

dispose in the river . The middle section of Haridwar city turns into a giant cesspool of solid and semi solid waste material, including the night soil, the human faecal matter. During the festive occasions, the residents of this city face the problem of noise pollution due to the use of loudy horns. The study reveals that tourism needs to be sensitive to local cultural norms and beliefs for it to be accepted by local people and to promote a sustainable development. This is possible if all the stakeholders (government, operators and localnpeople) collaborate in policy formulation, implementation and monitoring. The appropriate strategy can minimize the negative cultural impacts and promotes the Eco-Pilgrimage in Haridwar.

According to **Telang et al (2009)** have done an experimental study on effect of mass bathing on the water quality of Narmada river at district Hoshangabad, (M.P.) India. In the present study the variation in pH values was varied between 7.20 to 7.61. They found the decline in DO due to consumption of oxygen in decomposition of organic matter present in the water due to various religious activates as well as due to mixing of domestic waste. BOD results ranged between < 1 to 20 mg/L at the study site. Due to mass gathering and improper sanitation facilities, the human excreta and other waste increase the Coliform numbers alarmingly. He concluded that there is need to educated the people through mass awareness programs for bringing the awareness among the common citizens about water pollution and its possible impact on the environment and mankind. Washing of cloths and vehicles, bathing of cattle and other such activities should be stopped at bank of the river to reduce the water pollution.

Mehta (2014) have done study on water quality parameters due to festivals wastes immersion and consequential impacts in different lakes of Jodhpur city. He stated that with growing magnitude of the religious activities pollution load is bound to be increased in manifolds. The water quality parameters like TSS, TDS, TS, turbidity, conductivity, hardness, DO, BOD, and COD have shown significant increase during and after immersion of idols and then declined in the post immersion period.

3 STUDY AREA

1.General

Jabalpur is a major city in Madhya Pradesh state in India. It is the third largest urban agglomeration in Madhya Pradesh and the 26th largest urban agglomeration in India as per the 2011 census statistics.

Jabalpur is the administrative headquarters of the Jabalpur district (the second most populous district of Madhya Pradesh) and the Jabalpur division. Historically, a center of the Kalchuri and Gond dynasties, Jabalpur developed a syncretic culture influenced by the intermittent reigns of the Mughal and Maratha. In the early nineteenth century, it was gradually annexed in British India as Jubbulpore and incorporated as a major cantonment town. After the independence of India, there have been demands for a separate state of Mahakoshal with Jabalpur as its capital.

2. Location

Jabalpur is located at 23°10′N 79°56′E. The central point of India is in Jabalpur district. It has an average elevation of 411 metres (1,348 feet).

3. Geology

The hills of Jabalpur, with varied mineral content are a popular destination for geologists and archaeologists. The city is surrounded by low, rocky, and barren hillocks. The town is surrounded by several lakes and water tanks. The area is rich in limestone, refractory clay, bauxite, iron ore, manganese and other deposits. There are few industries connected with above minerals in the area.

4. Water sampling

Location of sampling points were selected during field visits of the site. The present study was conducted at six important sites namely Jelehri-ghat, Gwari-ghat, Tilwaraghat, Bhedaghat Barmanghat which were renamed as A – 1, A – 2, A – 3, A – 4, and A-5 and respectively for limnological purpose. (Table 4.1) These study areas are situated in a stretch of 20-30 kms of the eastern zone of Narmada river of Jabalpur

Table 1 Sample station name and number

Sample Station Name	Sample Station Number
Jelehri-ghat	A-1
GwariGhat	A-2
Tilwaraghat	A-3
Bhedaghat	A-4
Barmanghat	A-5

3.1 Observations & Calculations

Following observations were made after conducting the experiments on physic-chemcal parameters like ph, Total Hardness, Alkalinity, Chlorides D.O. and B.O.D.

Table 2 The values of pH at different study sites of Narmada river

Sample Location		pH
	summer	Winter
Jelehri-ghat	6.2	6.9
GwariGhat	6.8	7
TilwaraGhat	6.7	6.8
Bhedaghat	6.9	7.2
Barmanghat	7.2	7.2

Tables 3 The values of Total Hardness of Narmada river

Sample	Total Hardness (Mg/l as	
		$CaCO_3$)
Location	summer	Winter
Jelehri-ghat	180.6	178.6
GwariGhat	197	190.5
TilwaraGhat	158.5	165.5
Bhedaghat	170.5	180.8
Barmanghat	190.2	191

Table 4 The values of Bicarbonate Alkalinit of Narmada river

	Bicarbonate Alkalinity(Mg/l as	
Sample	$CaCO_3$)	
Location	summer	winter
Jelehri-ghat	195	182
GwariGhat	190	185
TilwaraGhat	155	160
Bhedaghat	185	190
Barmanghat	192	195

Table 5 The values of Chloride Content in water of Narmada river

	Chloride Content (Mg/l)	
Sample Point	summer	winter
Jelehri-ghat	14.5	15
GwariGhat	15.5	17.2
TilwaraGhat	18	17.5
Bhedaghat	21	20.5
Barmanghat	24	21

Table 6 The values of DO Content in water of Narmada river

	DO Content (Mg/l)	
Sample Point	Summer	Winter
Jelehri-ghat	7	9.4
GwariGhat	7.6	10.4
TilwaraGhat	7.2	9.3
Bhedaghat	6.2	7.1
Barmanghat	6.3	7.4

Table 7 The values BOD Values in Water of Narmada river

	BOD Content (Mg/l)	
Sample Location	Summer	Winter
Jelehri-ghat	6	4
GwariGhat	7	6
TilwaraGhat	4	3.5
Bhedaghat	4.8	4.3
Barmanghat	4.9	4.5

Fig. 1. pH change during Summer and Winter for different location

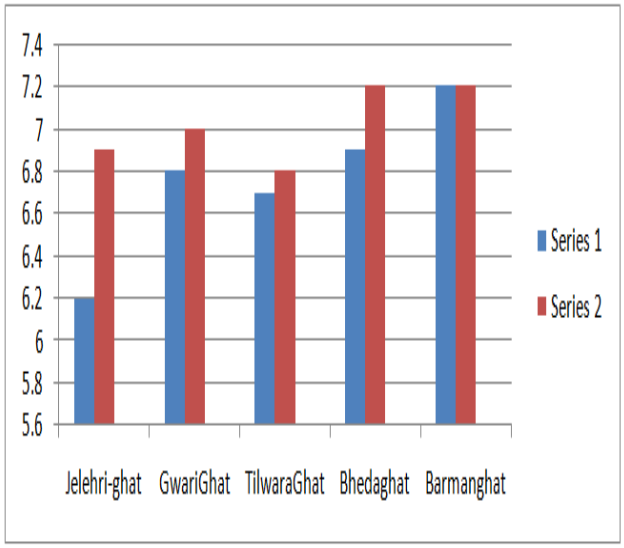


Fig. 2 Total Hardness change during Summer and Winter for different location

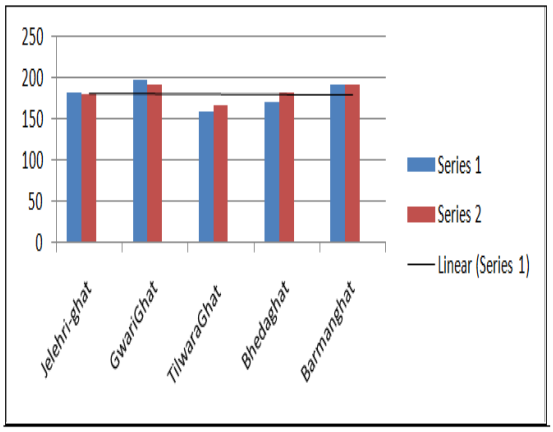


Fig. 3 The values of Bicarbonate Alkalinit during Summer and Winter for different location

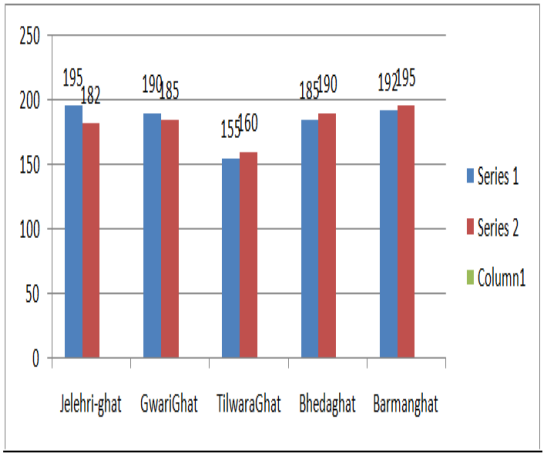


Fig. 4 The values of Chloride Content during Summer and Winter for different location

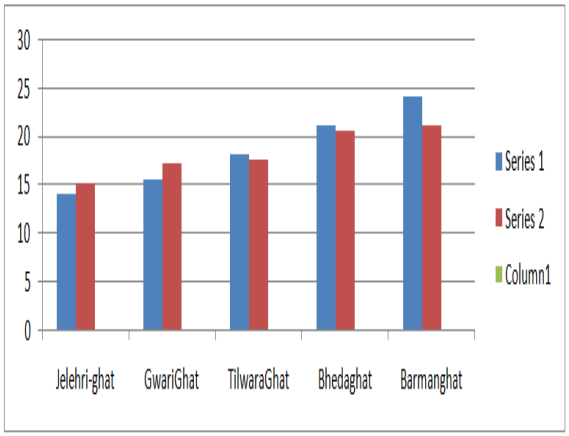


Fig. 5 The values of DO Content during Summer and Winter for different location

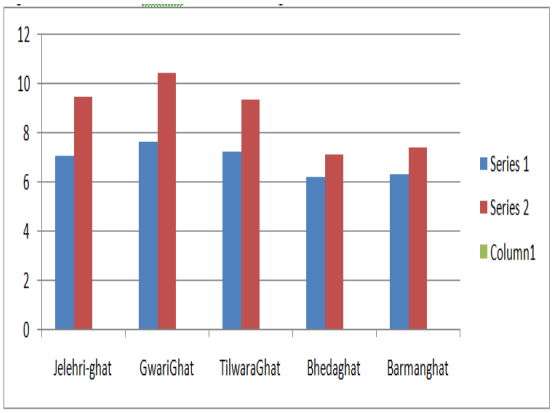
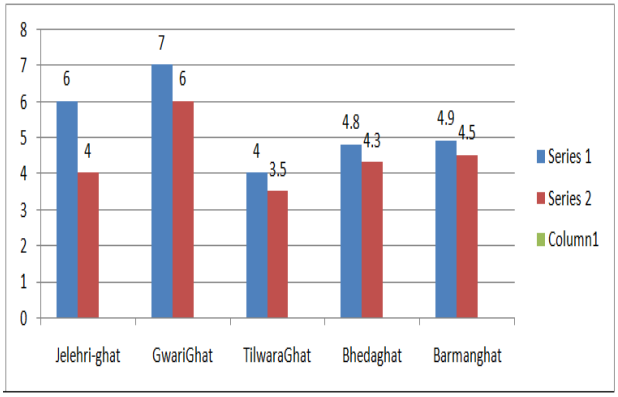


Fig. 6 The values of BOD Content during Summer and Winter for different location



4 RESULT AND DISCUSSION

Following observations were made after conducting the experiments on physic-chemical parameters like ph, Total Hardness, Alkalinity, Chlorides D.O. and B.O.D.

4.1 pH

pH of water is important as it governs the solubility of nutrients in water body. The variation of ph is shown in Figure 4.1 in the summer and winter of the selected Ghats of Narmada river. The determination of pH shows the alkaline and acidic nature of the waters. In the present study the variation of pH values of river water was varied between 6.2 to 8.2. The lowest value is 6.2 at lelehrighat in summer season of whereas the maximum value is 7.2 at Baemanghat in same summer and winter season.

4.2 Total Hardness

The total hardness was found to be high in all water bodies since the river passes through or over deposits such as limestone, the levels of Ca^{2+}, Mg^{2+} and HCO_3^- ions present in the water can greatly increase and cause the water to be classified as hard water. Figure 5.2 represents the variation of total hardness during the morning and evening of the festivals at the selected ghats of Narmada river Jabapur It can be seen that total hardness is highest (220 mg/1 of $CaCO_3$) in Gwarighat site during evening season of Ramnavmijavharevisarjan and lowest (158.5 mg/1 of $CaCO_3$) at Saraswatighat in morning. Water ranged between hard to very hard.

The hardness is decresed at Tilwaraghat, Gwarighat, and Lamhetaghat in the evening of MakarSankranti where as it increases at Saraswatighat and panchwatiGhat. It is because of the more bathing with religious activities in morning sessions than the religious worship in evening session. The value is increases in Jilahrighat as due to the crowd the pilgrims of Gwarighat also take bath in Jilahrighat as it becomes highly crowded area in afternoon and evening. Pilgrims from rural area are more in Panchwatighat and so due to lack of awareness about soap consumption and pollution due to other religious and tourism activities the value in increasing in evening hours.Although as compared to other religious ghats it it less polluted. The maximum value is found on JawareVisarjan in Gwarighat as this ghat has much religious value that the Panchwati Ghat, which is developed mainly for tourism purpose. Sarswati Ghat is far away from city area and the rural crowd do visits in other famous ghats and tamples of the City, so here the value of hardness is lowest at Narmada Jayanti.

4.3 Alkalinity

Alkalinity is total measure of the substances in water that have acid neutralizing ability. Its level showed greater variation at all sites. The amount of alkalinity depends on the nature of materials discharged in water bodies. The variations of alkalinity is shown in Fig 5.3.

The Alkalinity ranged between 135 mg/1 of $CaCO_3$ to250 mg/1 as $CaCO_3$. The highest alkalinity was reported from the site of Gwari-ghat study site during day time in Makar-sankranti, whereas the lowest (135 mg/1 as $CaCO_3$) was found to be at Saraswatighat during the evening of Makar-sankranti. The reason is obvious that Gwarighat has more religious values than other ghats of the city.

4.4 Chloride Content

Chlorides may get into surface water from several sources such as rocks agricultural runoff, wastewater from industries, oil well wastes, effluent wastewater from wastewater treatment plants, and road salting etc. The chloride contents indicate domestic as well as industrial pollution. The values ofchloride contents ranged between 15 mg/1 to 22 mg/1 at all sites, respectively (Figure 5.4). The recommended maximum level of chloride indrinking water is 250 mg/L as per the Indian Standards. It can be seen from the Figure 5.4 that Chloride is minimum 14.5 mg/1 at TilwaraGhat and maximum 24 mg/1 at Jilahrighat at Narmada Jayanti. It is more in PunchwatiGhat.

4.5 Dissolved Oxygen

Dissolved oxygen (DO) is probably the most crucial and important water quality variable in freshwater body. The variation of D.O. is presented as bar chart in Figure 5.5.

In present study, dissolved oxygen fluctuated in the range of 6.1 mg/1 at Lamhetaghat in morning and JilahriGhat in morning at Jawarevisarjan whereas maximum 11 mg/1 in Gwarighatin evening at Narmada Jyanti. The W.H.O suggested the standard D.O. should be more than the 5 mg/1. The D.O. value is maximum at Gwarighat because of more aeration, as depth of the river is lowest at Gwarighat. It is lowest in Punchwatighat, since the water depth is very high as compared to other ghats.

4.6 Biochemical Oxygen Demand

The Biochemical oxygen demand also indicates the amount of organic compounds in water as measured by the volume of oxygen required by the bacteria

to metabolise it under aerobic condition. For more organic matter, more oxygen is required by bacteria for its decomposition. This results in release of organic nutrients in water bodies resulting in death of organisms thriving on water. BOD ranged from 3.5 mg/l to 8.2 mg/l, which is more than the standard value 3 mg/l as specified by Indian standard. Variations in BOD at different ghat at different festivals are sown in Fig. 5.6 The highest degree of biochemical oxygen demand (8.2 mg/l) was reported from GwariGhat study site in the evening of Jawarevisarjan whereas while lowest level (3.5 mg/l) was observed from SarswatiGhat study site in the evening of MakarSankranti. This is due to the dumping of of lot of organic contents, flowers, oillamps due to religious activity of Jawarevisarjan in Gwarighat as compared to other ghats.

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