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ASSESSMENT OF MICROBIAL POLLUTION IN BICHHIYA RIVER WATER DISTRICT REWA MADHYA PRADESH, INDIA

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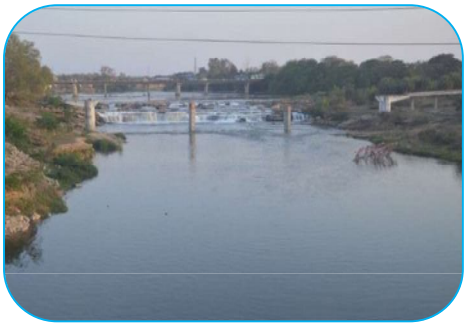
ABSTRACT:



Water is one of the best gifts to all living creature, given by nature. It is compulsory for the growth and maintenance of human body and also for many biological activities. It plays a vital role for the survival of all forms of life of earth and works as a universal solvent. Pollution is caused when a change in the physical, chemical or biological condition in the environment harmfully affect quality of human life including other animal's life and plant The quality of water is typically determined by monitoring microbial presence, especially total coliforms, fecal coliforms and fecal streptococci. In the present study, surface water samples were collected during three seasons (summer, monsoon and winter) from four different study sites (Near White Tiger Safari, Rewa city, Near Vikram bridge Ghoghar, village Mankahari, Tehsil Huzurand Beehar barrage Sirmour) of Bichhiya River at Rewa, Madhya Pradesh, and variousbacterial parameters were analyzed based on standard methods. However, exceptfor fecal coliform, other bacterial parameters such as total heterotrophic bacteria, total coliform and Vibrio choleraecountsshowed significant differences ($p < 0.05$) among the seasons, while difference among the sites was insignificant ($p < 0.05$). Theresult also showed that all the bacterial parameters were maximum during summer and minimum during monsoon season.Untreated sewage and industrial effluents together with reduced water flow and water level were found to increase bacterialcounts during summer. Although the present situation is not serious and alarming enough, the riverwater requires intensive monitoring to improve its quality for better and sustainable management.

KEYWORDS: *Microbial, pollution, coliforms, environment, water qualityBichhiya River.*

INTRODUCTION

Water is one of the most important strategic natural resourcesfor mankind throughout history. However, the world's waterresources are under pressure and in danger because of potentialpollution and contamination risks due to over use and misuse ofthe resources. People strive to sustain their lives under inappropriate environmental conditions.

Global freshwater scarcity due to the pollution of waterdemands for integrating water management and monitoringall over the world (Dahunsi et al. 2014). Physicochemicaland microbial quality of river water is now in great stress bygulping a huge amount of industrial and household disposal(Koshy and Nayar 1999). Therefore, assessment of waterquality in terms of physicochemical

and microbial aspectscan help to take effective management decision to preventthose (Behbahaninia et al. 2009).

India is a large country, where a large number of big andsmall rivers are present, some of them are travelling long distancesand connecting one part of the country with other. Some of theserivers such as Ganga, Yamuna, Saryu, Narmada, Caveri, Mahanadi, Mandakini etc. are considered sacred and worshiped by peoples.Several villages, towns, cities are located on the banks of theserivers from ancient times. The high incidence of severecontamination near urban areas indicates the industrial anddomestic sectors contribution to water pollution is much highlythan their relative importance implied in the Indian economy.

Water as an environmental resource is regenerative and itcould absorb pollution loads up to certain levels without affectingits quality, but there could be a problem if pollution loads exceedfrom the natural regenerative capacity of a water resource. Thebenefits of the water quality are many such as control of landdegradation and development of fishes, and other benefits to saveaquatic life and biodiversity.

River Beehar is a source of fresh water for Rewa district. The total length of the river is about 84.3 km and flows from PratapgarhAmarpatan in Satna district to Tamra, Ghoghar, Amriti, Ravsar, Bansghat, Kitwariya, Vikramghat, Karahiya and Chachaivilleges of rewa district. TrivediAndKataria (2012), through their study stated that Fresh Water is essential to existence of life. Water of acceptable quality is essential not only for drinking and domestic purposes but also for agriculture, industrial and commercial uses. Surface water is collection of water on the ground or in a stream, river, lake, wetland, or ocean. Surface water is naturally replenished by precipitation and naturally lost through discharge to evaporation and sub-surface seepage into the groundwater. A lake is a large body of water surrounded by land and inhabited by various aquatic life forms. Lakes are subjected to various natural processes taking place in the environment, such as the hydrological cycle. Due to tremendous population growth of the city (from just over 0.1million in 1951 to about 1.8 millions in 2000) and rapid urban development, lakes are facing various environmental problems resulting in deterioration of its w wasteful water consumption and improper waste disposal practices have led to deterioration in the water quality be it surface or ground water.

Pollution is caused when a change in the physical, chemical or biological con Uncontrolled domestic wastewater discharge into pond as resulted in eutrophication of ponds as evidence by substantial algal bloom, dissolve oxygen depletion in the subsurface water leads to large fish kill and other oxygen requiring organism (G.C. Pandey., 2003). Effluent is discharge into environment with enhanced concentration of nutrient, sediment and toxic substances may have a serious negative impact on the quality and life forms of the receiving water condition in the environment harmfully affect quality of human life including other animal's life and plant. Industrial, sewage, municipal wastes are been continuously added to water bodies hence affect the physiochemical quality of water making them unfit for use of livestock and other organisms water quality.

Organic pollutants from industrial waste water from pulp and paper mills, textiles and leather factories, steel foundries and petrochemical refineries are a major cause of illness in parts of the world where regulations do not necessarily protect the people from such industrial outflows. The EM approach to water purification could help in preventing diseases and poisoning for potentially millions of people. Use of EM is considered to be economical, energy efficient and environmental friendly with minimal disposal problems. Effective microbes can completely degrade and oxidizes toxic organic compounds; are characterized by low cost and offer the possibility of *in-situ* treatment.

Certain water borne diseases like Cholera, Dysentery, Typhoid are caused by bacteria which are developed when the water is polluted by different sources like- industries, agriculture, sewage, tannery etc. Water is physically characterized polluted by deposited silt and sludge in the water bodies.

Rapid industrialization resultingin dischargingof untreatedwaste water,coupledwith massive abstractionofwaterforirrigation,industrial and domesticuse,aremain causeofwaterquality degradation. About 12,222MLD of domeṣtic and 2500 ML Do findustrial was tewater is generated per dayintheentire Gangabasin. Pollutionofrivers in India has now reachedtoa point of cris is due to unplanned

urbanization and rapid industrialization Present study is going to centralize on Bichhiya river Rewa which is one of the main tributaries of Beeharriver. During their flow in township, industrial, domestic and municipal discharges merge into it at different points. The water of the river is used by urban and peripheral rural population directly at many stations for domestic and agriculture uses. Presently, the utility of river aeration technology has relatively been mature in many countries. Research and practical applications showed that the artificial aeration can improve water quality effectively. Practically, Aeration systems can be utilized as stand-alone systems or as a support for other treatment facilities

OBJECTIVES OF STUDY:-

The objectives of the present study are following:

1. To the study of microbiological status of the river.
2. To find out the trophic status of river.
3. Level of water pollution and their impact the aquatic life.

MATERIAL AND METHODS

Study area and sampling stations

Bichhiyariver is one of the main tributary of Beeharriver. It arises from the village Khaira near Kund ofKaimore range and flowing 58 Km. Its location in Rewadistrict is 24°10' latitude North and 81°15' longitude last.The river originates from Khaira village of Gurh Tehsiland joins in Bihar river behind Rewa fort. The confluenceplace is known as Rajghat. At the upstream of theBichhiya river municipal water treatment station is situatedafter, which it meets with another river called Beehar ofRajghat. Their flows in township, industrial, domestic and municipal discharge merge into it at different points. Thewater of the river is used by urban and peripheral ruralpopulation directly at many stations for domestic andagriculture uses.Samplings were conducted during January 2018 to December 2018, at different stations during the winter, and summer seasons. Water samples were collected from the surface and subsurface layers (30 cm below the surface) from each site and brought to the laboratory under ice-cold condition for bacteriological analysis. All the samples were refrigerated at 4^0C in the laboratory(K.Bhanja et. al.,**2000,** M.C. Arthur et. al., **2000**, S. Jain et. al., **2007,** and N. J. Ashbolt.,**2004)** and procedures were followed as per the standard methods (Rompre et.al., 2002).

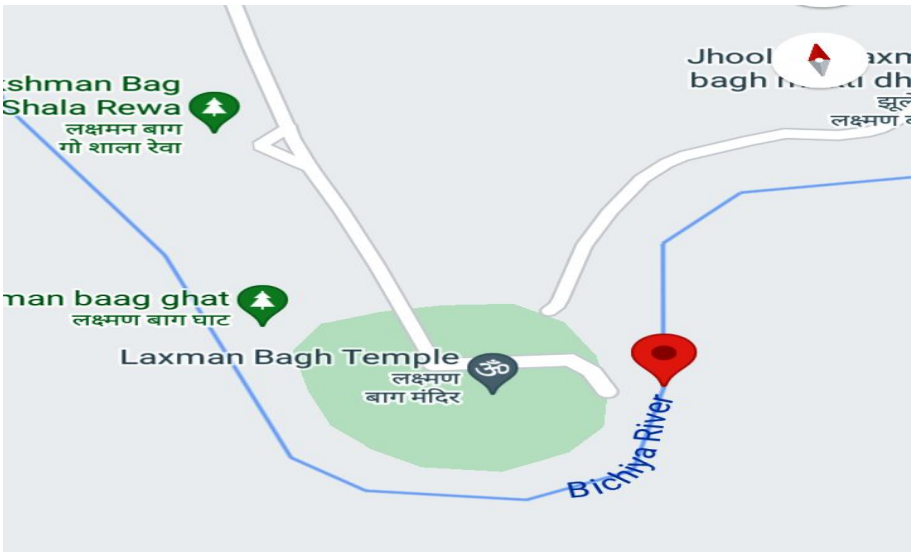


Fig. 1.Location map of Bichhiya River Rewa M.P.

SAMPLE COLLECTION

From January 2018 to December 2018, water samples (2000 ml/ sampling site) were collected in presterilized bottles from the surface and 1.5 ft below the surface from all the sampling sites of river Bichhiyaon seasonal basis i.e. during winter , summer and rainy seasons. Samples were brought to the laboratory under ice-cold conditions and processed immediately.

Statistical Analysis

The data were analyzed by the use of Statistical Packagefor Social Science (SPSS software Version 20.0). Two-wayANOVA was used to show the interactions between the sitesand the seasons at significance level of $p < 0.05$.

RESULTS AND DISCUSSION

The microbial population in a natural water body, to a large extent, is governed by its physical and chemical condition, which prevails in that habitat. In developing and underdeveloped countries with inadequate sanitation, fecal contamination of fresh water by enteric pathogens is very common or widespread, as a consequence plethora of enteric pathogen in a fresh water system play a vital role in causing pathogenic diseases in humans and bovines.

Microbial pollution of surface water can be detected by thechanges in abundance of bacterial population (Kavka andPoetsch 2002). The presence of bacteria in surface water notonly indicates the fecal contamination of water but also thepotential human health risks (Baghel et al. 2005). Duringthe study period, the microbial pollution of surface water ofBichhiya River was assessed by monitoring both indicator andpathogenic bacteria (Table 1).

THB impaired the quality of the river water by depletingoxygen immediately from the water during the decompositionof the incoming effluents (Garnier et al. 1991). Significantlyhigher cell counts of THB during summer may be dueto the higher water temperature that increases the enzymaticactivity of microbes to heavily proliferate during this season(El-Fadaly et al. 2001; Sabae et al. 2014). Therefore,temperature as well as seasonal variation can be recognizedas an important factor that influences the bacterial growth(WHO 2003; Neumann et al. 1972; Al-Kareem et al. 2015).

Followed by THB, TC count was also significantly higherduring summer at Site C (192.00 × 103 MPN/100 ml) and lowerduring monsoon at Site B (50.20 × 103 MPN/100 ml). In general,the higher counts of coliform bacteria at Site C were attributedto the rapid growth of the population in that area thatwas encouraged by discharging of domestic wastes containingfecal matters through city drains and open defecation along thebanks of the river. On the other hand, cold climatic conditionof winter season was not supportive for bacterial duplicationand makes the lower count of total coliform during winter(Tiefenthaler et al. 2008). Generally, the number of total TCsduring the study period was higher than FC, which might be due to the fact that FC is a subset of TC (Prescott et al. 1996).

FC count was highest during summer at Site A (90.90 × 102MPN/100 ml) and lowest at Site 4 (60.04 × 102 MPN/100 ml)during monsoon season. Most of the septic tanks of city are connected with municipal drains, which are one ofthe major sources of fecal coliform bacteria inBichhiya River.Most of the household garbage and industrial garbage flow into the Bichhiya River through the drains located at Site A, whichcontributed to the higher fecal coliform level at this location.It is a common practice for people living along the river todischarge their domestic and agricultural wastes as well ashuman excreta into river directly which are also responsiblefor bringing about higher FC counts at Site A.

Another study revealed that higher TC and FC werestrongly associated with rainfall and sewage sources (Crowtheret al. 2001; Vincent et al. 2006). However, the higher concentrationof fecal coliform during summer season might bethe reason for low water level, high organic matter, low bacterivoresand optimum growth-supporting nutrient that favorbacterial growth. Similar result was also reported by Jitheshand Radhakrishnan (2015) in water of Chaliyar River, Kerala,India. They also reported higher cell count of fecal coliformduring summer season. Higher temperature is also attributedto high load of indicator bacteria which was early reportedby Isobe et al. (2004). There was

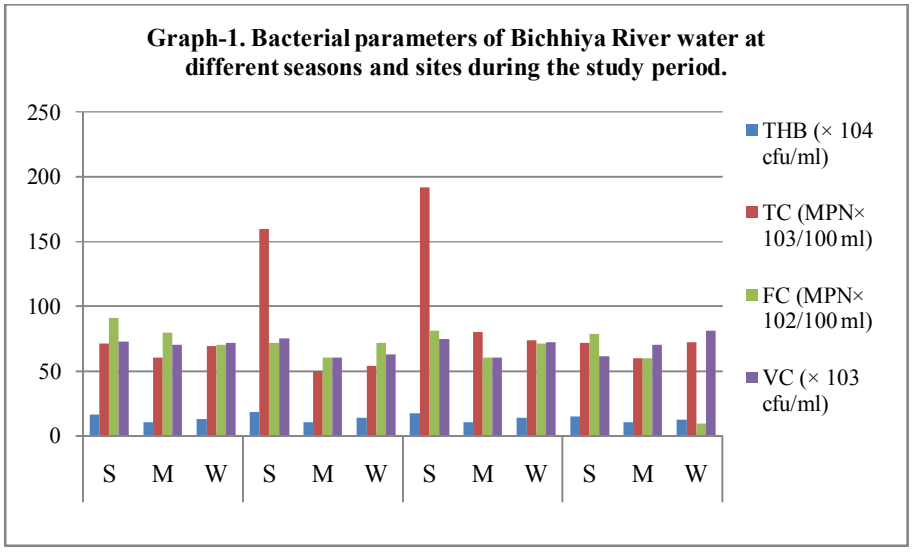
also a significant difference($p < 0.05$) of FC counts among seasons while differencesamong sites were insignificant (Table 1).

In the present study, significantly higher VC count wasalso recorded during summer at Site D (81.12 × 103 cfu/ml)and the lowest at Site C (60.30 × 103 cfu/ml) during monsoonseason. The possible reason for higher VC during summermight also be due to low water level and sewage contaminationwhich is in agreement with Kenyon et al. (1984).

Table 1. Bacterial parameters of Bichhiya River water at different seasons and sites during the study period.

Parameters	Samp. St. A			Samp. St. B			Samp. St. C			Samp. St. D			Season effect (*F* value)	Season effect (*F* value)
	S	M	W	S	M	W	S	M	W	S	M	W		
THB (× 104 cfu/ml)	16.42	10.76	13.02	18.78	10.83	14.06	17.12	10.78	13.95	14.76	10.85	12.47	58.709*	4.565(NS)
TC (MPN× 103/100 ml)	71.0	60.21	69.40	160	50.20	54.0	192.0	80.24	74.0	72.20	60.14	72.60	5.090	3.138(NS)
FC (MPN× 102/100 ml)	90.90	80.10	70.20	72.20	60.20	71.40	81.30	60.20	71.20	78.40	60.04	9.10	8.325**	5.266(NS)
VC (× 103 cfu/ml)	72.75	70.29	71.79	75.21	60.35	62.51	74.70	60.30	72.67	61.48	70.36	81.12	14.271*	3.515(NS)

THB total heterotrophic bacteria, *TC* total coliform, *FC* fecal coliform, *VC V. cholerae*, *cfu*colony forming unit, *MPN* most probable number, *S* summer, *M* monsoon, *W* winter, *NS* not significant
*Significant at $p < 0.01$ and **significant at $p < 0.05$ using two-way Analysis of Variance (ANOVA)



VIII. CONCLUSION

The quality of water is typically determined by monitoring microbial presence, especially total coliforms, fecal coliforms and fecal streptococci. It can be concluded that the water of the Bichhiya River is contaminated with domestic waste, fecal materials andindustrial wastewater. The counts of THB, TC, FC and VC were highest during summer seasonwhich indicates household and recreational activitiesshould be in control during this season. The present studysuggests a regular monitoring and effective managementstrategy to be taken to protect this water body from further pollution. The bacteriological parameters investigated during the present course of study indicated that the pollution level has reached to its soar. Results indicated that water is not potable for drinking and other recreational purposes.

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