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Water Quality Deterioration of Machna River due to Sewage Disposal, Betul,Madhya Pradesh, India

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ABSTRACT
In this study the Physico-chemical characteristics of Sewage waste water joining into Machna River at Betul were studied. The parameters pH, Total dissolved solids, Total suspended solids, Dissolved oxygen, BOD, COD, Nitrate, Chloride were assessed. The values of these parameters were found in excessive amounts as prescribed by World Health Organisation (WHO), which indicate towards the deterioration of water quality of water body after the joining of inlets into the river. The study emphasizes on the detrimental impact caused by the sewage water on Machna River.
Key words: Water pollution, pH, Dissolved oxygen, Alkalinity, Hardness

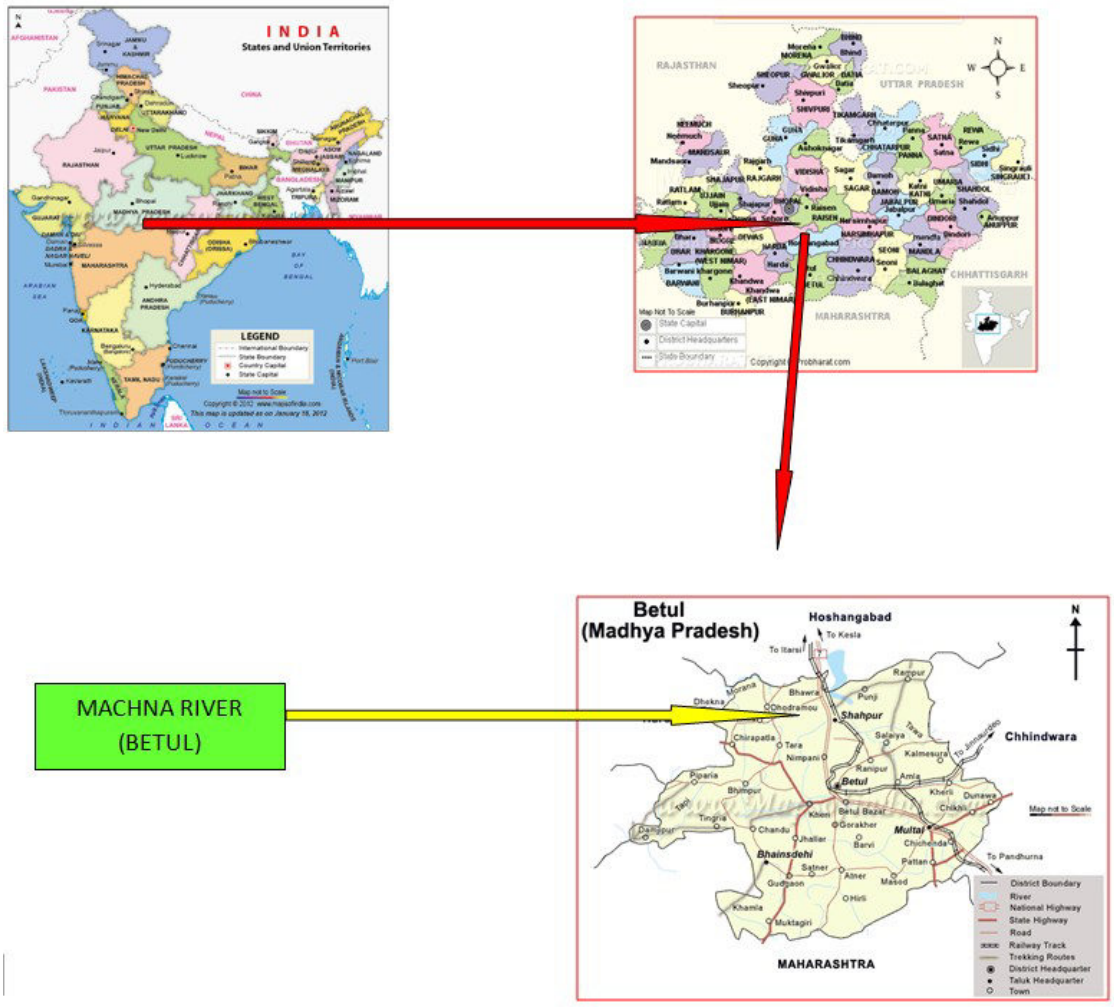
INTRODUCTION

Water is one of the most valuable resources that is widely distributed all over the world and is available to mankind for sustenance and survival (1, 2). Access to safe and potable water by the population is necessary to prevent health hazards (3). Clean, safe and pure water unfortunately exists briefly in nature before it becomes polluted by prevailing environmental factors and human activities. Rapid industrial development and growth of cities throughout the world have led to the recognition and increasing understanding of the inter relationship between pollution, environment and public health , The World Health Organization (WHO) estimated that about 4.6 million people die each year from causes directly attributed to air pollution .These factors results in the deterioration of water quality of the various water bodies .[4] studied that the impact of the industrial effluents and domestic sewage on river Ganga at Allahabad and reported that all the pollution parameters are beyond the permissible limits and unfit for human consumption. [5] Studied the pollution potential of river Pandu contaminated heavily by the discharge of various industries. Untreated sewage discharge not only damage to aquatic life but also hazardous to human health used for drinking purpose in the downstream areas of the river [6&7].

STUDY AREA

Madhya Pradesh situated between Satpura and Vindhyachal valleys in the catchment area of river Narmada which flows west to join the Arabian sea. On the opposite side river Betwa and Chambal flows towards north east and join the Ganga river system which joins the Bay of Bengal. In addition there are major reservoirs like Bargi, Barna, Tawa, Kolar, Halali etc.in Madhya Pradesh.The river Machna originates from Sasawad village near Amla District Betul (M.P.). The Machna river passes through Betul district.

It is mainly used for drinking purpose, for the city. It also passes through Shahpur and joins to Tawa river. The main cause of pollution in Machna river are the joining of domestic sewage of Betul city, industrial effluents coming from Kosami industrial area. The water of Machna river is also being used for irrigation purposes. The length of river is 77.95 km. (Total length) and total area is 82 square km.Machna river is known for the crop of water melon in the sand of this river. A water treatment plant is also located in Bhaggudhana and its capacity is 34 lakhs litre water per day. Betul town is situated on the co-ordinates of 21°55' 12"N 77°54' 0"E. Betul is the head quarter town of the district and it is situated on the small river Machna. The place is linked by rail with Delhi and Chennai. This city is easily approachable from anywhere in India because it is well connected by road and railway line. This town was called Badnur and from 1822 it has been the headquarter of the district. Betul city is famous for its historical and religious importance. The famous Khedla fort of historical importance is situated in the district.



METHODOLOGY

For quantitative analysis of Sewage water, various samples were collected from the station S3(Shankar nagar inlet),S4(Machna nagar inlet),S5(Ojha ward inlet),S6(Lohiya ward inlet),S7(Garg colony nalah),S8(Ramnagar area nalah),S9(Hathinalah).The study was carried out in premonsoon (March) and monsoon (July) and post monsoon period(Nov) in 2009. The Sewage water samples were collected from the sampling stations. For the analysis of physico- chemical Parameters, sewage water samples collected in new white colored 1L pearl pet bottles using clean buckets Preservation and transportation of the water samples to the laboratory were as per Standard methods[8&9]. The analysis is carried out for determination of physicochemical properties

1. pH: The pH is determined by Elico, model LI.120 Digital pH meter which gives direct value of pH.

2. Total Dissolved Solid: The 50 ml of water sample is filtered through ordinary filter paper and water is collected in the evaporating dish of known weight. Further it is heated and water is totally evaporated. Whatever dissolved solid matter is present gets accumulated at the bottom of evaporating dish. The evaporating dish is cooled and weighed. By weight difference method the total dissolved solid is determined.

3. Total Suspended Solid: This can be determined by the weight difference of total solid and total dissolved solid. TSS =TS –TDS

4. Dissolved Oxygen: Dissolved oxygen was determined by modified Winkler's method

5. Biochemical Oxygen Demand: Dissolved Oxygen is determined by Winkler method both at the start and after incubation at 200ºC in a BOD incubator.

6. Chemical Oxygen Demand:- Dichromate reflux method.

7. Nitrate

The values of nitrate were estimated by spectrophotometrically at 410 nm. The values of nitrate were calculated

with calibration curve. Results were expressed as mg/l.

8.Chloride content: The chloride content of water sample is determined by titrated the water sample against 0.02M silver nitrate solution using potassium chromate as an indicator.

Results and Discussion

pH

Aquatic organisms are affected by pH because most of their metabolic activities are pH dependent [10].Hydrogen ion concentration was found in the range from 7.4 to 10.0 which is well above the permissible limit [5.5 to 9.5] prescribed by CPCB [11]. Domestic sewage usually alkaline in nature due to the presence of ammonical compounds. The maximum pH value was recorded in the (monsoon).

CHLORIDE

The higher concentration of Cl^- is considered to be an indicator of higher pollution due to higher organic waste of animal origin. Chloride level was in the range of 224 to 320 mg/l which exceeds the desirable level (200mg/l) but below the permissible limit (600 mg/l) of WHO [12], [13]. The chloride level of Sewage water samples falls the within the permissible limit.

NITRATE

The nitrate values range from 23 to 65 mg/L which exceeded the desirable and permissible limit (45 mg/L) of WHO .Nitrate in natural waters can be traced to percolating nitrate from sources such as decaying plant and animals materials, agricultural fertilizers, domestic sewage [14],[15] . The nitrate content, more than 100 mg/l impact bitter taste to water and may cause physiological problem. Drinking water contains more than 500 mg/L nitrate can cause methamoglobinemia in infants [16]. Nitrate causes the overgrowth of algal, other organism and fouls the water system.

DO

DO is found to be increased in the monsoon season while in the pre-monsoon season it has low value This may be due to addition of more water during rainy season.. It ranged from 2.1mg/l to 4.2mg/l. Certain DO levels have to be maintained in the rivers for the aquatic life. Same results were reported [17],[18].

BOD & COD

BOD & COD determine the organic as well as inorganic content in the water have also increased in the post-monsoon season. High concentration of BOD & COD is due to heavy sediments, organic matter and Industrial pollutants added in during rainy days. Similar results were also found by [19]. Water quality of Machna river deteriorates due to mixing of untreated sewage which increases the concentration of BOD and COD [19].The BOD was found in the range of 123-166 mg/l while COD was reported from 321-420 mg/l. [20]

TDS

It was ranged from 145 to 220 mg/l.The concentration is high during the monsoon, which may be due to addition of solids from the runoff water. [21] has made the same observation.

TSS

The values were in the range from 105mg/l to 145mg/l .Higher values were found in monsoon season. The suspended solids determination is particularly useful in the analysis of sewage and other waste waters and is as significant as BOD determination. It is used to evaluate the strength of domestic Wastewaters and efficiency of treatment units. Suspended solids are objectionable in river for many reasons. Suspended Solids containing much organic matter may cause putrefaction and consequently the stream may be devoid of dissolved oxygen.

S.No.	Parameters	W.H.O Standard	Station No.S3	Station No.S4	Station No.S5	Station No.S6	Station No.S7	Station No.S8	Station No.S9
1	pH	6.5-8.5	8.0-9.8	7.6-9.7	7.4-9.8	7.5-9.9	8.1-9.9	7.8-9.0	9.2-10.0
2	TDS (mg/l)	500	150-186	146-189	152-182	148-185	145-186	140-180	160-220
3	TSS (mg/l)	-	112-143	105-136	114-132	109-134	114-135	116-130	123-145
4	DO (mg/l)	5.0	2.5-3.6	2.2-3.2	2.1-3.9	2.4-3.5	2.6-4.2	2.8-4.1	2.0-2.3
5	BOD (mg/l)	2	127-145	135-148	123-150	130-143	126-140	128-136	152-166
6	COD (mg/l)	10	345-370	350-365	343-368	340-364	321-358	326-352	380-420
7	Nitrate (mg/)	45	23-52	26-46	42-65	46-66	35-49	32-57	50-72
8	Chloride (mg/l)	200	225-268	240-274	242-273	232-259	227-258	224-252	250-320

Physico- Chemical Characteristics of Sewage Water Samples Joining into Machna River, Betul

Conclusion

A comparative study of water samples of Sewage water at different sampling stations for all three seasons Pre monsoon, monsoon and post monsoon carried out by taking certain important parameters like pH, total dissolved solid, TSS, dissolved oxygen, chloride, nitrate. The physicochemical analysis of sewage water samples concluded that the sewage quality at all the sampling point is above the permissible limit which may affect to the water quality of Machna River All these sewage inlets will make the water acceptable for drinking as well as for other purposes. A few parameters need to be close attention before using such as TDS, DO. The study revealed that during Post Monsoon season the quality of sewage water is slightly improved.

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