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LIMNOLOGICAL STUDIES TO ASSESS THE WATER QUALITY OF "TAPTI POND" AT MULTAI DISTRICT, BETUL (M.P.)

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ABSTRACT

A study on water quality of Tapti pond has been reported, which is based on the physico-chemical characteristics. It indicates the high degradation in level of water quality of Tapti pond. The parameters chosen are pH, DO BOD, COD, phosphate, nitrate. TDS, etc., which has impact of on water quality of this pond.

Key words: Water quality, BOD, COD, TDS, Nitrate, Phosphate.

INTRODUCTION

Water is god's gift to all living creatures from unicellular to multicellular and from plants to animals on earth. The quality of water is of vital concern for humans beings, since it is directly linked with human health. Water plays an important role in various life processes in the human body. In our daily life, water is used for drinking, bathing, cooking and washing purposes. Water is the best solvent also (also called a universal solvent) and it is used in many industries such boiler industry for steam generation, textile, paper, pharmaceutical industry etc. Water is the most abundant component on earth's surface comprising about 70% of earth's surface in liquid, solid and gaseous state. The impact of rapid urbanization on the water front is of great concern. Millions of people all over the world, particularly in the developing countries are loosing their lives every year from water borne-diseases[1]. Number of observations are reported on the pollution of water resources[2-4]. The anthropogenic activities and population pressure is the major cause of the degradation of water quality. Tapti ponds are the origin centres for Tapti river.

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Table 1: Salient features

Longitude	78°21’00”
Latitude	21°04’00”
Catchment area	632 sq Km
Submergence area of FTL	0.98 sq. Km
Storage capacity	15.67 M m^3
Maximum depth	20 m
Maximum water level (R.L.)	682 M
Main water uses	Portable water supply, religious activity & irrigation and recreational activities.
Main source of water	Rain water and sewage

Study area

Tapti pond is situated in Multai Distt., Betul, M. P. The history of Tapti pond starts with its origin in the Betul District. Tapti river rises from Tapti pond, Multai Distt., Betul of Madhya Pradesh and it flows between two spurs of the Satpura hills across the plateau of Khandesh and then, through the plain of Surat to the sea. It has a total length of around 724 Km and drainage area of 30,000 sq. Km for the last 32 Km. of its course, at its length. Tapti pond is situated in Multai. Multai is a Tehsil place and a small town. It was named on the name of Tapti pond; actually Multai was derived from Multapi, which is origin place of Tapti river. Now-a-days. Tapti river and its ponds located in Multai have been polluted by immersion of idols, washing, cleaning of clothes and vehicles, domestic sewage and other recreational activities.

Five sampling points have been selected in upper and lower ponds. Its catchment area in the Multai is 8 sq. Km and population of the city is 25,000. The latitude and longitude are 21°04’00” and 78°21’00”, respectively. The water of this ponds is supplied to the people of the city for drinking and irrigation purposes. The deterioration of water quality of this pond has posed a big problem for the living organism like human beings, animals and plants.

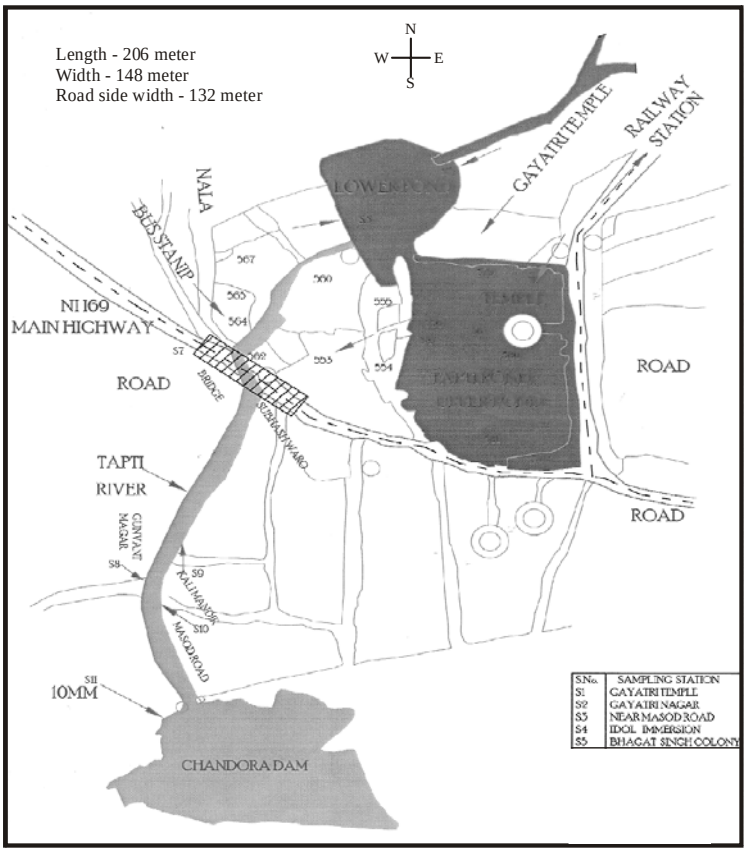

Fig. 1

Table 2: Sampling stations

S1	Sampling station near Gayatri temple (domestic sewage joins near this station).
S2	Sampling station near Gayatri nagar (Bathing and washing ghats)
S3	Sampling station in the down stream of Tapti (Near Masod road) in lower pond
S4	Sampling near Tapti temple (Idol immersion gat) in western side of the pond
S5	Sampling station at confluence point of nala carrying domestic sewage and waste water of vehicle washing

EXPERIMENTAL

Materials and methods

The Tapti pond has been polluted due to different human and religious activities round the year. The samples were collected from five sampling stations in pre-monsoon, during monsoon and post-monsoon. Then physico-chemical parameters were determined using following apparatus and standard methods.[5-13]

pH- It was determined by digital pH meter (Systronics)

BOD : The water sample was collected and incubated at 20^0C for 5 days. Then BOD was determined.

COD : COD was determined using open reflux method.

DO : The water sample was collected, fixed instantly on the spot and analysed as per Wrinkler method with azide modification.

Total Hardness: It was determined as per standard method APHA 1998.[5]

Nitrate and Phosphate: These were analysed using UV-Visible spectrophotometer.

RESULTS AND DISCUSSION

Table 3: Physico-chemical parameters of water in Tapti pond

Pre-monsoon -Monsoon and Post-monsoon, 2009

Parameter	S1			S2			S3		
	Pre	M	Post	Pre	M	Post	Pre	M	Post
pH	7.14	7.5	7.8	6.92	7.3	7.9	6.98	7.1	7.10
BOD	52	8	15	8	10	30	36	40	59
COD	142	32	109	24	46	69	98	110	139
Nitrate	1.014	0.369	0.647	1.065	0.541	0.874	0.958	1.010	0.669
Phosphate	5.458	4.398	3.669	4.352	5.402	3.668	5.685	4.670	5.769
TDS	7.381	183	4.369	420.8	176.9	266.6	683.2	584.5	682.5

Parameter	S4			S5		
	Pre	M	Post	Pre	M	Post
pH	6.92	7.5	7.9	6.8	7.2	7.8
BOD	24	6	41	4	10	32
COD	58	40	69	16	19	49
Nitrate	1.124	0.366	0.998	1.425	0.680	0.943
Phosphate	4.124	4.310	5.109	3.986	4.010	4.969
TDS	439.2	170.8	269.5	420.9	420.01	520.5

Pre-Pre-monsoon; M -Monsoon and Post-Post-monsoon

pH

pH value is the logarithm of reciprocal of hydrogen ion activity in moles per liter. In aqueous solution, variation in pH value from 7 is mainly due to hydrolysis of salts of strong bases and weak acids or vice versa. Dissolved gases such as carbon dioxide, hydrogen sulphide and ammonia also affect the pH of water. The overall pH range of natural water is generally between 6 and 8. Industrial wastes may be strongly acidic or basic and their effect on pH value of receiving water depends on the buffering capacity of water. pH lower than 4 will produce sour taste and higher value above 8.5, a bitter taste. Higher values of pH hasten the scale formation in water heating apparatus and reduce the germicidal potential of chlorine. pH below 6.5 starts corrosion in pipes; thereby releasing toxic metals such as Zn, Pb, Cd, Cu, etc. Maximum value for pH was observed at S4 in post-monsoon sample, which indicates the effect of the effluents of religious activities released by the temples located nearby the Tapti river. Minimum value was found at S5 during pre-monsoon season.

BOD

The Royal Commission on River Pollution, (Established in 1865) and the formation of the Royal Commission on Sewage Disposal (1898) led to the selection in 1908 of BOD as the definitive test for organic pollution of rivers. Highest value (59 mg/L) of BOD was recorded at S3 in post-monsoon sample. This may be due to joining of inlets into the down stream. The inlets carry domestic and other effluents, which are rich in organic substances. Minimum value (4 mg/L)) was found at S5 in pre-monsoon sample, which indicates that this point is comparatively less polluted.

BOD Level *(in ppm)*	**Water quality**
1 - 2	**Very good** There will not be much organic waste present in the water supply.
3 - 5	**Fair: Moderately clean**
6 - 9	**Poor: Somewhat polluted** Usually indicates organic matter is present and bacteria are decomposing this waste.
100 or greater	**Very Poor: Very polluted** Contains organic waste.

COD

Highest value of COD was recorded at S3 in post-monsoon sample while minimum value at S5 in pre-monsoon sample indicates that S5 of the pond is comparatively less polluted.

Nitrate and phosphate are two important nutrients. Excess of these two components decrease the concentration of oxygen in the water and clogging of water channel takes place. It results into fish mortality.[14]

Nitrate

Nitrates generally occurs in trace quantities in surface waters but may attain high levels in some ground waters. The presence of nitrite in water is either due to oxidation of ammonium compounds or due to reduction of nitrate. It can be toxic to certain aquatic organisms even at concentration of 1 mg/L. In excessive limits, it contributes to the illness known as methenoglobinemia in infants. It is an indicator of nutrient enrichment. Almost each station was found rich in nutrients. A very little variation was observed in all the sampling stations. Highest value of nitrate was recorded at S4 (1.425 mg/L) in pre-monsoon sample due to joining of sewage, while minimum value (0.366 mg/L) was found at S4 in monsoon season.

Phosphate

Phosphate is the indicator of presence of some algal growth, which is not good for the environment of the ponds. Maximum value of phosphate (5.658 mg/L) was recorded at S1 that may be due to water receiving raw or treated sewage, agricultural drainage, and certain industrial waters, which normally contain significant concentrations of phosphate. It

may be also due to joining of many inlets in the way of down stream. Minimum value was reported (3.986 mg/L) at S5 in pre-monsoon season.

Total dissolved solids (TDS)

Total dissolved solids is the term applied to the residue remaining in a weighed dish after the sample has been passed through a standard fiber glass filter and dried to constant mass at 103 – 105^{0}C or 179 – 181^{o}C. Many dissolved substances are undesirable in water. Dissolved minerals, gases and organic constituents may produce aesthetically displeasing color, taste and odour. Some dissolved organic chemicals may deplete the dissolved oxygen in the receiving waters and some may be inert to biological oxidation. The maximum value was reported about 683.2 mg/L at S3 and minimum of 7.381 mg/L at S1.

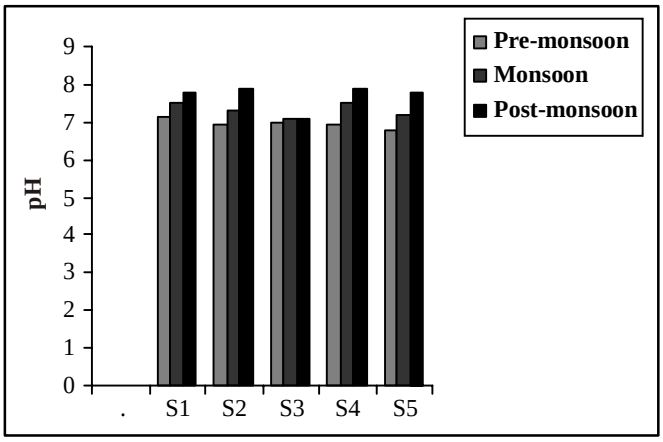

Fig. 2: Seasonal variation in pH

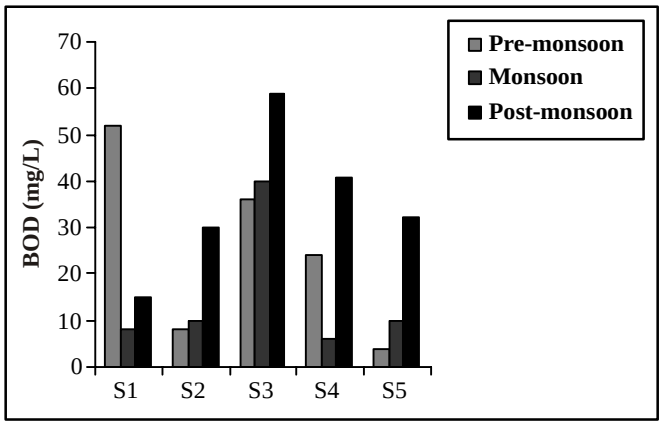

Fig. 3: Seasonal variation in BOD

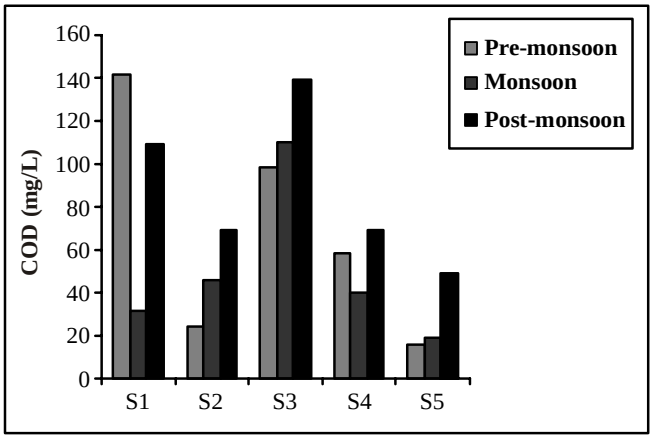

Fig. 4: Seasonal variation in COD

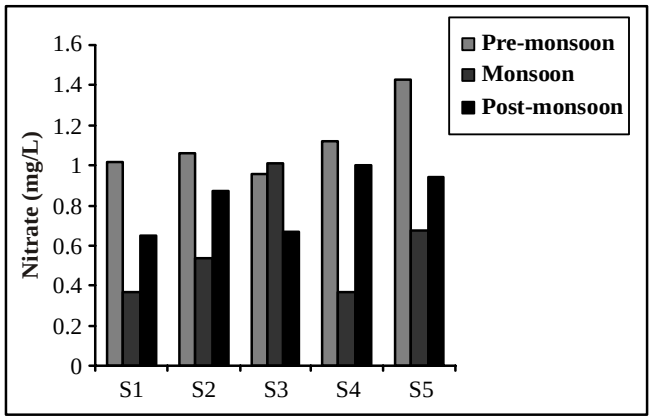

Fig. 5: Seasonal variation in nitrate

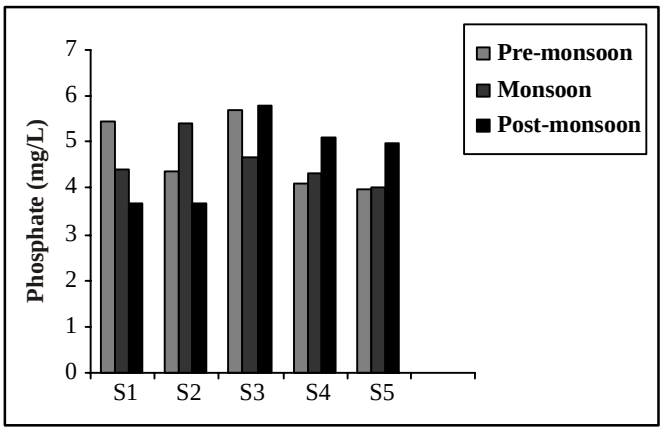

Fig. 6: Seasonal variation of phosphate

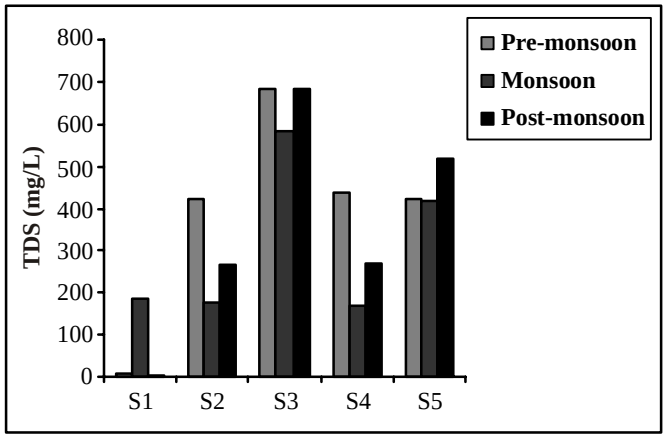

Fig. 7: Seasonal variation of TDS

CONCLUSION

Analysis of all the sampling stations reveal that both ponds have been polluted by the bathing, washing, religious and recreational activities. These ponds are the source of origin of Tapti river and hence, it is quite necessary to conserve these two ponds. Govt and society must take certain actions to prevent these ponds from being deteriorated further. Idol immersion is another big problem. Some alternative places must be identified to immerse the idol. Many temples are located nearby the ponds .They are also releasing effluents like jute, flower, agarbatti, match sticks, prasad etc. into these ponds.

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