Environment Conservation Journal 13(1&2) 93-96, 2012
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

Physico-chemical and microbial aspects of Mansi Ganga water

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Received: 15.01.2011 **Revised: 16.05.2011** **Accepted: 15.06.2011**

Abstract

Physico-chemical and microbial characteristics of water of Mansi Ganga at Goverdhan (District Mathura) were studied during July 2009 to June 2010. Three sites of the reservoir were selected for sampling. The water was found to be severely polluted. The parameters like pH, BOD, COD and ammonical contents were found to be very high but the microbial population and DO was far below the expected.

Keywords:*Pollution, Pollutants, D.O., B.O.D., C.O.D., Fecal coliform, Effluents, Ammonical contents.*

Introduction

Water is a prime necessity of life. It is used for a number of purposes like drinking, bathing, cooking and disposal of waste and sewage. Due to increasing population,industrialization,urbanization and other developmental activities most of our water bodies such as ponds,lakes, sarovars, rivers and streams have become polluted. Today every water body receives high amount of effluents, sewage and domestic wastes. These pollutants cause degradation of water quality.Mansi Ganga at Goverdhan (Mathura) is a holiest reservoir of 'BrijKshetra'. It has great religious importance. So, it is visited every year by millions of pilgrims from every corner of world and performs various religious activities like 'Snan', Dhyan, 'Parikrima', 'Achmana', 'Darshan', 'Pooja', 'Archana' *etc*. These religious activities make the water of Mansi Ganga polluted. Furthermore, the domestic and industrial effluent from the town is also being drained into it and makes it severely polluted.

Materials and Method

The water sampling was done in the first week of each month in glass bottle with capacity 300 ml. The physico-chemical characters of the water were determined on the spot, with the help of 'Portable water detection kit' (Model no. CK-710, Manu. by 'Century Instruments Pvt. Ltd., Chandigarh).

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The temperature was measured on the spot by using temperature sensitive electrodes of the portable kit. Other parameters were determined in the laboratory. For the estimation of microbial population, the 'Most Probable Number' (MPN) technique was used. The results were compared with standard permitting parameters (APHA, 1992; WHO, 1984). The correlation between physico-chemical and microbial population was also determined by using Karl Pearson's coefficient of correlation method.

Results and Discussion

Temperature is one of the most important physical factors which regulate the natural processes in the environment. It was found in accordance with the seasonal changes. It ranged between 14.2-33.0^{o}C. It was higher in May, June and July and lower during winter months.Turbidity is one of the common ways to measure the extent of pollution. It is generally caused by untreated and un-decomposed organic matter, sewage and industrial waste. It was very high in November, December and June because of the AghoiAshtami, Deepawali and BhaiyaDooj festivals when there is a mass gathering in the town and millions of pilgrims take bath in the Mansi Ganga. It ranged between 124 NTU to 191 NTU. pH is an important valuable indicator, which shows the acidic or alkaline nature of water. The water of Mansi Ganga was found slightly alkaline. It ranged between 7.5 – 8.7. Itshowed positive correlation with all the parameters except the D.O.(Dakshini and

Soni,1979; Khan and Khan, 1985; Singh *et al*., 1988).

Dissolved Oxygen

Oxygen is the important factor that supports the aquatic life. It is equally essential for the decomposition of chemical waste and dead matter. D.O. showed highly fluctuating trend. It was maximum in winter but lower in summer. It ranged between 1.80-11.90 mg/l.

Table1: Physico- chemical parameters of Mansi Ganga

Parameters	Rains				Winters				Summers				Max	Min	Avg
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun			
Temp.	31.0	30.5	27.7	27.3	24.9	19.5	14.2	17.4	22.3	28.0	30.2	33.0	33.0	14.2	25.50
Turbidity	124	151	152	178	191	155	139	151	145	161	149	161	191.0	124.0	154.75
pH	8.3	7.8	7.9	7.9	8.4	8.5	8.5	8.6	8.0	7.5	8.5	8.7	8.7	7.5	8.22
D.O.	1.8	2.5	4.9	4.0	2.1	4.5	8.6	8.9	7.7	11.9	8.6	1.8	11.9	1.8	5.61
B.O.D.	55.0	35.5	34.5	45.5	68.1	35.0	17.2	14.3	28.0	19.2	24.1	52.2	68.1	14.3	35.72
C.O.D.	72.3	44.3	27.9	51.0	62.1	37.9	21.4	16.0	33.3	15.4	17.9	48.8	72.3	15.4	37.36
Ammonia	2.33	1.41	0.91	2.31	3.11	2.74	3.42	3.33	1.90	1.45	2.84	2.01	3.4	0.9	2.31

All parameters are in mg/l except pH, Temp (^oC), and Turbidity (NTU)

BOD is the direct measure of the extent of pollution in the water body. It is the amount of O_2 required by living aquatic organisms for their physiological process and also for bio-degradation. It was found very high in summer and comparatively low in winter. It ranged between 14.30 – 68.10 mg/l.It is the amount of oxygen required for the decomposition of chemical waste. A high value of COD shows a higher accumulation of organic waste in the river. It was found high during summer and low during winter. It was maximum (72.30 mg/l) in the month of June and July (Singh and Gupta, 2003; Shankar *et al*., 1986). Organic nitrogenous matter is destroyed by microbial activity with the production of ammonia. Higher concentration of ammonia shows a high degree of sewage pollution. The values of ammonia exhibited tremendous fluctuations. It ranged between 0.91 – 3.42 mg/l. Ammonia represents the negative trend with the dissolved oxygen. This is due to the fact that ammonia production takes place from non-oxidised accumulated garbage (Sharma *et al*., 1983; Shekhar, 1985).

Total Coliforms and Fecal Coliforms

Coliforms are Gram negative bacteria, which are lactose fermenting, rod shaped and usually inhabit the gastro-intestinal tract. The Coliforms which are present in the fecal waste are called the Fecal Coliforms. Fecal and Non-fecal Coliforms are together called Total Coliforms. A high number of coliforms indicate a high degree of sewagepollution.The highest population of total Coliforms was 93546units/L and thelowest was 12532 units/L. The highest population of Fecal coliforms was 84524 unit/L and lowest was 29745 units/L. Presence of large population indicates a very high degree of fecal pollution. These values

are very high and indicate high pollution in the river. The population of Coliforms exhibited the positive trends with temperature, turbidity, BOD, COD and ammonia but no significant relationship was observed with pH. The reason for the high degree of positive relation with temperature is quite obvious. The temperature causes the accumulation of waste by enhancing the evaporation of water, which promotes the growth of coliforms. The Coliforms represent a strong negative relation with dissolved oxygen probably because, the absence of oxygen leaves the waste untreated which is again favorable for the bacterial growth (Aranzo*et al*., 1998; Doctor *et al*., 1998; Kumaresan and Bhagwati, 1996; Manian*et al*., 1989).

Table1: Physico- chemical parameters of Mansi Ganga

Micro-organism	Rains				Winters				Summers				Max	Min	Avg
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun			
Total coliforms	14121	86265	69524	63125	93546	12532	53265	60121	49213	55214	74556	90102	93546	12532	60132
Fecal coliforms	84524	61254	44564	40125	61254	83589	32789	41587	29745	33546	54912	59451	84524	29745	52278
Euglena	133	121	131	139	141	131	131	117	152	109	95	106	152.0	95.0	125.5
Parameciu m	69	89	121	153	132	99	152	105	141	133	114	83	153.0	69.0	115.9
Ulothrix	291	267	274	233	254	298	222	264	271	261	291	307	307.0	222.0	269.4

Euglena is solitary and free living fresh water flagellate. Its body is elongated, tapering and provided with long flagella. The population of *euglena* was found to be ranging between 95 units/L and 152 units/L. The organism exhibited positive relationship with DO. The negative relation was observed with BOD, COD and Ammonia. With pH and hardness no significant relationship could be observed. *Paramecium* is a ciliated protozoan. Its population highest was 153 units/L and lowest was 69 units/L. Its population was high when there was less pollution in river. It showed a strong positive relationship with DO. But a negative trend was noticed with BOD, COD, ammonia and turbidity.*Ulothrix* is a filamentous alga. Broadly the population was as higher as 307 units/L and as lower as 222 units/L.*Ulothrix* represented a positive relationship with BOD, COD, ammonia and turbidity and no significant relationship with temperature and pH.

Summary and Conclusion –

From the above observations it has been concluded that the water of Mansi Ganga is grossly polluted. The use of water may cause skin diseases and gastro-intestinal problems. Remedial measures are required immediately to sustain the good quality of water and to save the life of livestock.

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