

An assessment of the pollution load in Radha Kunda, District Mathura (India) and its effect on the population of selected planktons

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Abstract

'Radha Kunda', a holy water reservoir of religious importance in District Mathura (India). Millions of pilgrims visit this reservoir every year and take bath in it. The water of the reservoir is severely polluted especially due to domestic and sewage waste water. An attempt was therefore made to assess the pollution load in the Kunda and finding out its effect on some selected planktons during January to December 2016. Important key parameters such as BOD, ammonia, chlorides, sulphides, sulphates and coliform population was examined every month. Simultaneously the population of some planktons like, *Vorticella*, *Paramecium*, *Diffugia*, *Ulothrix* and *Spirogyra* was noted from the same water samples. A correlation was tried to develop between the degree of pollution load and fluctuations in the population of the test organisms. It was found that the 'Radha Kunda' reservoir is grossly polluted. The level of pollution becomes the most severe in summers. The test organisms, especially *Vorticella* and *Diffugia* spp. exhibited a severe negative trend with the rise in pollution load.

Keywords: Organic pollutants sewage B.O.D. Coliform ammonia.

Introduction

With the rapid increase in population, the problem of fresh drinking water is getting more and more deplorable. Increasing uncontrolled, unmanaged industrialization, improper disposal of wastes etc., have resulted in the massive pollution of our water bodies like rivers, ponds and lakes. The addition of sewage and other animal waste into the water stock has resulted in much severe problem of 'Eutrophication' which is harmful to aquatic fauna.

The 'Radha Kunda' pond located at Govardhan (Distt. Mathura, U.P.) is an important water reservoir of great religious importance. It is grossly polluted with disposed waste and sewage. Being related with the activities of Goddess Radha and Lord Krishna, this reservoir is visited by millions of pilgrims every year. Due to rituals and

beliefs, the pilgrims use to take bath in the reservoir and offer *pooja samagri*. They also offer milk to Lord Krishna, which directly goes into the reservoir. The sewage waste is also indirectly drained into the Kunda, which badly affects the water quality of the Kunda. The natural aquatic biota is adversely affected due to increasing organic load in the reservoir.

An attempt was therefore made to assess the pollution load of this reservoir and its impact on some selected protozoans.

Materials and Methods

The water sampling was done on 10th of each month in year 2016. The water was collected from the middle of the reservoir (using a small boat) in glass bottle with capacity 1000 ml. pH was noted on the spot with the help of portable

digital pH meter. Other parameters like B.O.D., sulphides, ammonia, T.D.S. and T.S.S. were tested in the laboratory according to standard methods, prescribed by APHA.

Coliform bacteria are key indicators for sewage and organic waste in the water. So, coliform population was also recorded using MPN number method. Simultaneously, some common planktons such as *Paramecium*, *Vorticella*, *Diffugia*, *Ulothrix* and *Spirogyra* were also considered as test organisms.

The water sample for determining the population of these organisms was taken separately in 1 litre glass bottles. Samples were preserved at 4°C in 4-5 % buffered formaline solution.

For the assessment of population, microscopical counting method was used. The

sample was concentrated using planktonic nets of different sizes and was then stored in a closed and labelled glass vials. It was mixed properly by thorough shaking and 0.2 ml of the sample was pipette with a fractional pipette on a clean glass slide. The slide was examined microscopically. Counting and enumeration was done with the help of an ocular micrometer.

The entire procedure was repeated thrice for each sample and then averages were noted for more reliable results.

Results and Discussion

The monthly observations for physico-chemical parameters and for population count have been shown in following table

Table - 1

Parameters/ Microbes	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	8.0	8.1	8.3	8.3	8.4	8.6	8.5	8.4	8.5	8.4	8.2	7.9
BOD (mg/L)	167	189	162	175	205	241	208	189	179	187	168	171
Ammonia contents (mg/L)	0.49	0.61	0.69	0.75	0.89	0.98	0.99	0.90	0.88	0.75	0.61	0.52
Chloride contents (mg/L)	84	79	82	98	127	115	120	98	91	87	71	75
Sulphides (mg/L)	12.4	22.1	18.6	19.8	20.5	24.5	22.4	19.7	20.4	16.8	14.7	13.9
Total Coliform (MPN) x1000	37.4	34.2	41.4	42.5	49.5	64.5	55.1	52.7	48.6	50.2	41.9	35.1
<i>Paramecium</i> <i>spp.</i>	66	43	57	48	27	22	38	39	42	52	41	45
<i>Diffugia spp.</i>	48	41	39	30	25	22	31	21	29	27	39	34
<i>Vorticella spp.</i>	37	29	25	21	17	14	18	16	21	28	35	31
<i>Ulothrix</i>	89	78	71	92	112	127	132	122	107	91	102	91
<i>Spirogyra</i>	28	19	32	22	47	38	40	35	40	29	34	26

Above data clearly indicates that the water of the Radha kunda is very badly polluted and rich in organic content. A very high BOD suggests a mild eutrophication and nutrient enrichment. This is due to the accumulation of un-decomposed sewage and domestic waste which is rich in organic material. High degree of BOD was found throughout the year, but in summers, it was the highest (241 mg/L). This very high BOD is directly linked with poor oxidation capacity or the water reservoir.

The reason for the accumulation of the high organic matter was found to be the addition of large amount of *pooja samigri* offered by the pilgrims and their mass bathing especially during summer festival (*Guru Poornima*). Furthermore, slight but regular mixing of sewage contents into the reservoir further adds to the organic pollutants.

Seasonally, the pollution load was higher during summer (i.e., May, June and July) . This may also be due to the presence of less amount of diluting water in the reservoir. Other parameters like ammonia, sulphides and chlorides were found to be directly related with pollution load (Sharma, 1981).

Ammonia contents exhibited a positive correlation with BOD values. This is because the production of ammonia occurs from un-oxidised organic matter when oxygen availability is very low. The values of ammonia ranged between 0.49 mg/l to 0.99 mg/l and maximum values were noted during summer because of accumulation of large amount of organic matter and less amount of water in the reservoir. High temperature in summer also augments the growth of anaerobic

microbes, which further add to ammonia production (Hynes, 1978).

The values of chlorides and sulphides were also found very high during summers. The high values of chlorides were because the ground water in the Mathura region is rich in chloride contents. But high values of sulphides are directly linked with the high sewage contents in the water of the reservoir (Gorbi et al, 2007).

For examination of the sewage load in the water, the population of Coliform bacteria was also noted using MPN method. The Coliform population showed a perfect positive correlation with the high BOD and ammonia values. Similar to BOD and ammonia values, the Coliform population was very high especially during summers (64.5 x 1000 units). This high Coliform population is a clear indication of high organic and sewage load (Verma et al, 1978).

The population of *Paramecium*, *Vorticella* and *Diffugia* exhibited a strong negative trend with high BOD and ammonia values. In summers, when the organic load was high, a minimum population was recorded. The *Paramecium* species were found to be more sensitive to high BOD and low oxygen availability. This clearly indicates that such organisms cannot survive in high BOD environment (Agrawal et al, 2000).

Organisms like *Ulothrix* and *Spirogyra* showed a positive correlation with the nutrient enrichment of the reservoir. The clear reason was that these organisms belong to algae group. The organic load supports their growth. Accordingly a more population of these organisms was recorded in summers than in winters.

Conclusion

From the above results it has been concluded that Radha Kunda is grossly polluted with unoxidised organic load. The situation becomes deplorable in summers.

The main reasons for this high organic load are

- a. High pilgrimage
- b. Mixing of *Pooja saamigri* offered by the pilgrims
- c. Mixing of milk offered by the pilgrims
- d. Mass bathing especially at festivals.
- e. Entry of a few drains carrying domestic sewage..

It is also concluded that the present condition of the reservoir is not suitable for the aquatic biota. Measures must be taken to ban the mixing of pooja samigri and milk etc. in the reservoir to maintain its healthy status.

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