RESEARCH ARTICLE

Studies on Increasing Organic Load and its Effect on the Survival of Selected Protozoans in the Syama Kunda, District Mathura (India)

P. K. Agrawal*
Department of Zoology, B. S. A. College, Mathura, U.P., India

Address for Correspondence: Dr. P. K. Agrawal, Associate Professor, Department of Zoology, B. S. A. College, Mathura, U.P., India

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ABSTRACT- An attempt was made to study the increasing organic pollutants in the 'Syama Kunda', a holy water reservoir of religious importance in District Mathura, India. Various key physico-chemical parameters of water of the reservoir were tested over an entire year from January 2016 to December 2016. The populations of some test organisms were also 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 'Syama Kunda' reservoir is grossly polluted. The level of pollution becomes the most severe in summers. The test organisms, especially Arcella and *Paramecium* spp. exhibited a severe negative trend with the rise in pollution load.

Key-words- Organic pollutants, Sewage, B.O.D, Coliform, Ammonia

INTRODUCTION

The 'Syama Kund' 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 lord Krishna or Syama, 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 puja 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 [2].

So, need of assessing the un-decomposed organic load in the Kunda was felt. So, an attempt was made to find out various key physico chemical parameters of this reservoir over an entire year period. Study of the effects of these pollutants on the natural biota of the reservoir was also necessary, so impact of these pollutants on some selected protozoans such as *Vorticella*, *Difflugia*, *Paranema, Arcella* and *Paramecium* was also assessed in the form of changes in the population number. Protozoans are selected because they are more susceptible to organic pollutants [2].

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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. The 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 [3].

Coliform bacteria are a key indicator for sewage and organic waste in the water [4]. So, coliform population was also recorded using MPN number method. Some common protozoans, present in the reservoir were also considered as test organisms. These included species of *Vorticella*, *Difflugia*, *Paranema, Arcella* and *Paramecium*. The water sample for determining the population of these organisms was taken separately in 1 litre glass bottles. Samples were preserved at 4ºC 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 pipetted 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 given below Table 1.

Table 1: Physico chemical parameters and population count of selected protozoans in the Syama Kunda

Parameters/ Microbes	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	7.9	8.1	8.2	8.1	8.0	8.5	8.4	8.3	8.6	8.2	8.2	7.9
BOD (mg/L)	141	152	139	166	198	206	175	168	149	157	140	129
Ammonia contents (mg/L)	0.48	0.69	0.58	0.68	0.79	0.95	0.89	0.92	0.78	0.71	0.68	0.58
Chloride contents (mg/L)	75	68	67	79	85	89	73	87	74	75	63	65
Sulphates (mg/L)	658	714	784	698	849	984	878	814	954	847	779	678
Total Coliform (MPN) x1000	19.5	18.6	22.4	24.5	28.4	31.5	35.2	29.5	25.4	22.6	24.9	19.1
Vorticella spp.	38	42	63	35	39	28	18	31	28	46	35	48
Difflugia spp.	35	28	34	31	28	19	16	22	29	27	39	31
Paranema spp.	22	31	28	29	35	38	44	35	39	24	31	29
Arcella spp.	15	14	11	08	11	09	07	11	13	17	11	14
Paramecium	29	22	19	16	18	08	12	28	20	16	29	21

From the above data it is very clear that the water of the Syama kund is severely polluted and rich in organic content. A very high BOD was noted. High degree of BOD is directly linked with poor oxidation capacity and rich organic matter [5]. The reason for the high organic matter was found to be the addition of large amount of puja samagri offered by the pilgrims. Furthermore, regular mixing of sewage contents into the reservoir further adds to organic pollutants.

Seasonally, the pollution load was higher during summer (i.e., May, June and July). This may be due to the presence of less amount of diluting water in the reservoir [5].

Parameters like BOD, ammonia, sulphides and chlorides were found to be directly related with pollution load. The values of BOD were very high indicated a very small amount of oxygen available in the water body [6]. BOD ranged between 129 mg/L to 206 mg/L. The highest BOD values (206 mg/L) were observed during June.

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 [7]. The values of ammonia ranged between 0.48 mg/l to 0.95 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 contents.

The values of chlorides and sulphides were also found very high especially 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 [8].

For further 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 [9]. Similar to BOD and ammonia values, the Coliform population was very high especially during summers (35.2 x 1000 units). This high Coliform population is a clear indication of high organic and sewage load [6].

The population of *Vorticella*, *Difflugia, Arcella* and *Paramecium* 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* and *Arcella* 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 [1].

Paranema population however did not exhibit any clear trend. Probably high organic load is favourable for its growth because in summers it showed a rise in the population count.

CONCLUSIONS

From the above results it has been concluded that Syama Kunda is grossly polluted with un-oxidised organic load. The situation becomes deplorable in summers. The main reasons for this high organic load were found to be very high pilgrimage, bathing of pilgrims, mixing of Puja samagri offered by the pilgrims, mixing of milk offered by the pilgrims and entry of a few drains carrying domestic sewage. All these factors greatly enhance the organic load of the river leading to rise in BOD values. It is also concluded that the present condition of the reservoir is not suitable for the aquatic biota. Out of five protozoan species considered in this work, all showed a serious decline in population when the pollution level was higher. The *Paramecium* and *Arcella* species were found to be more sensitive to these pollutants. Decrease in the population count of protozoan species clearly indicates the poor biotic status of the reservoir. Measures must be taken to ban the mixing of puja samagri and milk etc. in the reservoir to maintain its healthy status.

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