Microbial ecology of Nachne lake, Ratnagiri, Maharashtra.

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Abstract - Nachne Lake of Ratnagiri city was chosen for this study. The water samples were collected from the lake in sterile containers. Water samples were tested for BOD, COD, pH, temperature and other physicochemical parameters. The water samples were filtered and the solid content was estimated. Microbiological load in the water was analyzed by standard microbiological techniques. It was found that bacteria > algae > fungi. Gram negative bacteria were dominant among the bacterial population. Bacterial cultures were further characterized and the results discussed. The pond receives runoff only during rains and no waste discharge takes place throughout the year. Results indicate that the water source receives domestic sewage runoff and water is unsafe for household use.

Index terms**:** aquatic, faecal contamination, lake, microbial flora, phytoplanktons

I. INTRODUCTION

Aquatic life in lakes is very important for a number of our native fish species. This is particularly so for small fingerlings whose regular diets comprise of zooplankton and phytoplankton found in ponds. The food that is available in ponds can be divided into three broad categories these being plant material, animal material and detritus (decomposing fragments of organic material derived from both plants and animals). The most important form of animal material comes from the aquatic insects and zooplankton (tiny aquatic animals). There are a number of different species of animals that inhabit the pond. Zooplanktons are an important part of the diet of all freshwater fish.

The tiny fragments of plant material and the microscopic plants, animals, bacteria and fungi associated with them are known as 'detritus'. The micro-organisms associated with the tiny fragments are a readily digestible, nutritious, protein rich food source. Phytoplankton in the water eventually die and settle to the bottom to form detritus [1].

Though the aquatic microorganisms form a part of the food chain, they may also affect the health of humans and other animals. Overloading the water body with organic and inorganic nutrients results in the deterioration of water quality. Lakes form a closed system in which addition of nutrients results in accumulation of the same and eventually leading to eutrophication. Inflow of domestic sewage either through runoff or groundwater seepage, creates a hazardous situation. Such a water body cannot be recommended for use by human being and even animals. Outbreaks of water borne diseases occur due to pathogenic microorganisms thriving in such water bodies [2]. Presence of fecal coliforms, total coliforms and fecal streptococci in the water is an indication of fecal contamination [3, 4]. The present study was undertaken to analyze the microbial ecology of the Nachne lake during monsoon.

II. MATERIALS AND METHODS

A. *Collection of water sample*

Water samples were collected from four sites around the lake during rainy saeson. The samples were collected in plastic bottles sterilised using alcohol. The bottles were kept in ice and tranported to the laboratory. Analysis of the water samples was carried out within 8 hours. Temperature and pH measurements were done at the site.

B. Microbiological studies

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Enumeration and isolation of the heterotrophic aerobes was carried out by plating 0.1 ml of water sample on nutrient agar medium. Mac Conkey's agar, SS agar, CLED agar media were used for the isolation of enteric bacteria. TCBS media was used for isolation of V*ibrio* species. For checking the presence of *Staphylococcus* and *Pseudomonas*, salt mannitol agar and cetrimide agar were used, respectively. The inoculated plates were incubated at 37 ^{o}C in inverted position for 48 hrs.

C. *Study of planktonic species*

For the determination of phytoplanktons, water was collected in a 5 litre can and fixed at site immediately using Lugol's iodine. Similarly, 5% neutralized formalin was added to preserve the zooplanktons in a separate can. The water sample was then filtered through a bolting silk cloth of mesh size 20 µs. Preserved samples (1 ml) were used for species identification and counting on a Sedgwick-Rafter cell at 45x and 100x magnification [5].

III. RESULTS AND DISCUSSION

Temperature of the pond water at the time of sampling was 27.4 ^{o}C while the pH was found to be 6.6. Since the water sample was collected in July *i.e* during the rains, it may be on the lower side. Colour of the water was pale brown which may be due to the mixing of mud carried in the water due to terrestrial runoff.

Total viable count of the heterotrophic aerobic bacteria, as obtained on nutrient agar was 1.75 x 10^4 cfu/ml. Presence of significant number of heterotrophs in lake water has been reported by other workers [6, 7]. The growth on nutrient agar shows a wide variety of colonial morphology indicating the diversity in the bacterial population (Fig. 1a). Similarly two types of cream coloured colonies were obtained on Sabauraud's agar along with while fungal colonies (Fig. 1b).

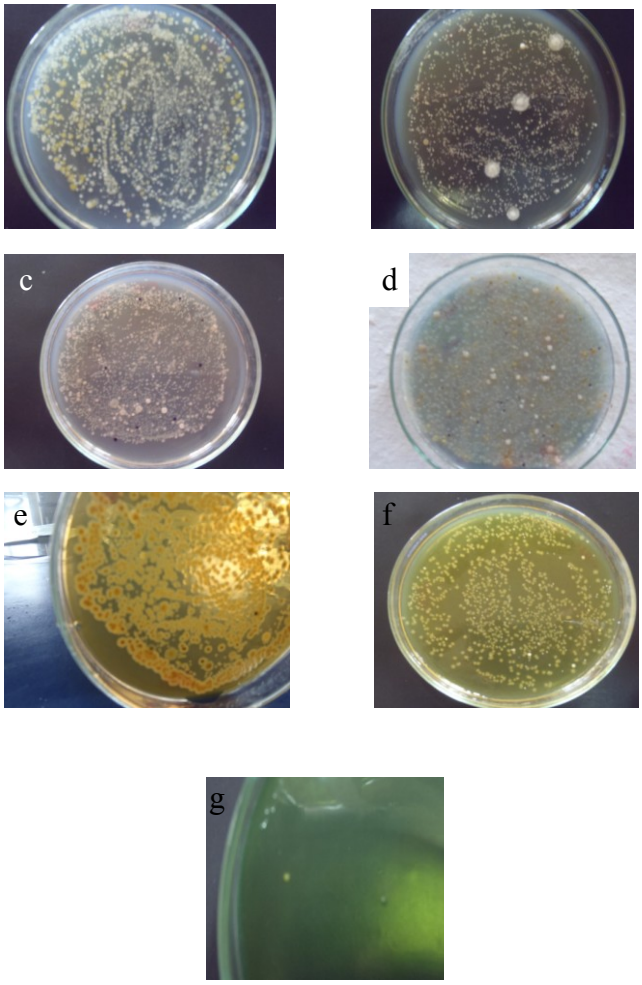

Figure 1: Isolation of bacteria from Nachne lake water on different specific culture media

Wet mount of the cream colonies indicated the presence of yeast like cells. Therefore we can say that apart from a rich bacterial diversity, the water body also harbours yeast and fungal population. Enteric coliform growth was luxurious on Mac Conkey's agar and CLED agar media. Depending on the colony morphology and colour, both lactose fermenters as well as lactose non-fermenters were found present. Among these, *E. coli* giving pink coloured colonies with bile precipitation, *Enterococcus faecalis* form pale pink colonies while colourless colonies are produced by *Proteus vulgaris*, *Salmonella* species and *Shigella* species, on Mac Conkey's agar media (Fig. 1c). The growth obtained on CLED agar support the previous observations. It showed the presence of enteric bacteria such as *E.coli, Enterococcus faecalis, Enterobacter aerogenes* and non-enteric *Staphylococcus aureus* (Fig. 1d) Presence of *Salmonalla* and

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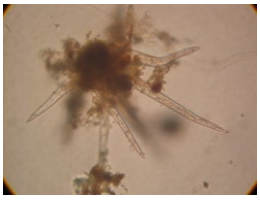
Shigella species in the water was confirmed by the growth obtained on SS agar media (Fig. 1e). *Salmonalla* species produce colourless colonies with black centre while *Shigella* species produce colourless colonies on SS agar [8].

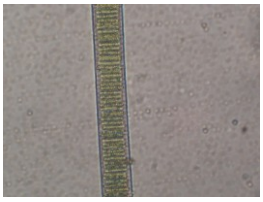
Dark pink colonies on SS agar were found to be due to *E.coli*, while creamish pink colonies show presence of *Enterobacter aerogenes*. Golden yellow and pale yellow colonies on Salt mannitol agar medium confirm the presence of *Staphylococcus aureus* and other *Staphylococcus* species in the water sample (Fig. 1f). Growth on Cetrimide agar and yellow coloured colonies on TCBS agar (Fig. 1g) show presence of *Pseudomonas* species and *Vibrio* species in the media. *Vibrio cholerae* and *V. fluvialis* produce yellow colonies on TCBS agar while bluish green colonies on the same media are produced by *V. parahaemolyticus* and *V. vulnificus* [8]. Thus, Gram negative isolates were found to be dominant in the lake water sample as compared to its Gram positive counterparts.

E.coli and *Enterobacter* sp. are considered indicators of fecal contamination. Pseudomonas is an indicator of sewage pollution [3]. Presence of these organisms in the lake indicates pollution of both fecal and sewage origin. Microbiological studies on numerous lakes show similar findings [3, 4, 6, 9, 10]. The reason for this may be that most of the water bodies in India and other developing countries are not protected or maintained. There is indiscriminate addition of sewage, domestic waste, industrial waste and so on, in these water bodies. They are looked upon as dumping grounds. During rains, the condition worsens due to surface runoff, which carries agricultural as well as domestic discharge into the water.

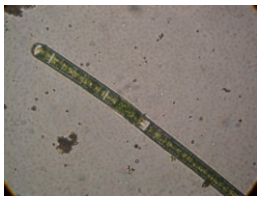
Studies on the planktonic composition showed low numbers of both phytoplankton and zooplanktons. Mostly unicellular and filamentous phytoplanktons were observed in the filtered water samples (Fig. 2).



Actinestrum sp.



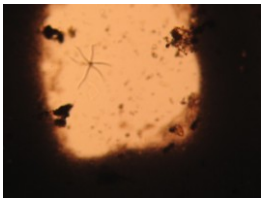
Oscillatoria sp.



Stigeoclonium sp.

Closterium sp.

Binuclearia sp.



Asterionella sp.

Figure 2: The planktonic diversity in Nachne lake water

Among the zooplanktons, a few copepods were observed while the rotifer number was negligible. The low number of phytoplankton may be due to the heavy rainfall and thus the dilution of water occurring therein. Previous studies on plankton abundance show a fall in the number of plankton during rains [5]. Another contributing factor to this may be the presence of the abundant bacterial population.

The lake under study is not being used for drinking, bathing or swimming purposes. However, there is danger to the cattle and animals drinking the polluted water. Thus, the presence of the coliforms as well as non-coliforms in the Nachne lake shows significant microbial pollution which needs to be attended.

IV. REFERENCES

[1] K. Cox, "Farm pond ecology". Pond Ecology Fact Sheet, Vermont Agency of Natural Resources, pp. 1-5, 1995.

[2] www.who.int/water_sanitation_health/dwq/2edvol1i.pdf

[3] A. F. Godfree, D. Kay and M. D. Wyer, "Faecal streptococci as indicators of faecal contamination in water", J. Appl. Microbiol. Symp. Suppl., vol. 83, pp. 110-119, 1997.

ISSN: 2278 – 7798

[4] A. K. Patra, B. C. Acharya and A. Mohapatra, "Occurrence and distribution of bacterial indicators and pathogens in coastal waters of Orissa", Ind. J. Mar. Sci., vol. 38, pp. 474-480, 2009.

[5] B. Mukherjee, M. Nivedita and D. Mukherjee, "Plankton diversity and dynamics in a polluted eutrophic lake, Ranchi", J. Envn. Biol., vol. 31, pp. 827-839, 2010.

[6] M. H. Saha, T. Bari, M. R. Khan and S. Hoque, "Bacteriological and physico-chemical properties of the Gulshan Lake, Dhaka", Bangladesh J. Bot., vol. 40, pp. 105-111, 2011.

[7] S. Niewolak, "Total Viable Count and Concentration of Enteric Bacteria in Bottom sediments from the Czarna Hańcza River, Northeast Poland" Polish J. Environ. Studies, vol. 7, pp. 295-306, 1998.

[8] The HiMedia Manual. (2009). Hi Media Laboratories Pvt. Ltd., India.

[9] H. Kelsey, D. E. Porter, G. Scott, M. Neet and D. White, "Using geographic information systems and regression analysis to evaluate relationships between land use and fecal coliform bacterial pollution", J. Exp. Mar. Biol. Ecol., vol. 298, pp. 197-209, 2004.

[10] M. Khondkar and L. Parveen, "Study on the physico-chemical limnology of a shallow, hypertrophic artificial lake", Bangladesh J. Sci. Res., vol. 10, pp. 9-16, 1992.

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