An assessment of the primary productivity of two ponds in Adoor, Pathanamthitta District

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ABSTRACT

Quality of water is an important criterion for evaluating the suitability of water for irrigation and drinking. As of now only earth is the planet having about 70% of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied type of water borne diseases. This paper deals with the study of an evaluation of the primary productivity of two ponds in Adoor, Pathanamthitta district. The physico-chemical analysis of certain parameters such as temperature, pH, Dissolved oxygen, primary productivity, free carbondioxide were extensively carried out on each sample using known standard methods. In the present study the concentration of all the parameters in the ponds were found within the permissible limit as prescribed by BIS standards. Chempazham pond exhibited an acidic nature which would affect the survival of fishes and other aquatic organisms. Primary production was found to be higher in Chempazham pond than Kalapurakkal pond. This will create awareness among people to improve the water quality status and the need for the conservation of these natural resources.

1. INTRODUCTION

Ponds are considered as small shallow standing water bodies. They may be permanent or temporary. Thermal stratification is absent in ponds. Light penetration is possible up to a certain depth depending on the turbidity. Temperature varies seasonally and as per depth. The oxygen content of lentic water bodies is less than lotic ecosystem. The present investigation is an attempt as been made to study the intensity of pollution of two ponds. Pollution due to domestic and urban sewage and runoff from agriculture field has led to water quality deterioration, fish mortalities and toxicity to organism. The estimation of water quality can be determined through the estimation of dissolved oxygen, productivity, dissolved carbon dioxide, temperature, pH etc.

The two ponds selected for the study is situated in Adoor taluk. Both ponds were natural and surrounded by side walls. The name of the first pond selected for study is Chembazham pond. The first pond which is selected for this study has no regular inlets or outlets. It is somewhat square in shape. The slopes of the pond have a fair growth of vegetation. The colour of the water is yellowish green. The second pond selected (Kalapurakkal pond) for the study is almost square in shape. During monsoon, the surface of this pond extends to a greater area and has an outlet during the season. It is deeper in the middle and shallower along the margins. There are different causes that affect the water quality. The most serious water pollutants are the disease causing agents called pathogens. Pathogens include bacteria and other organism that enter water from domestic sewage and animal excreta. Human excreta contain bacteria such as *E coli* bacteria and *Streptococcus faecalis* which cause gastro intestinal diseases. The other major water pollutant is organic matter such as leaves, grass, trash etc. that pollute water as a consequence of runoff (Sahib, 2004). Exclusive phytoplankton growth within water is also a cause of water pollution. This water is biodegradable. It is difficult to understand the biological phenomenon fully because the chemistry of water revels much about the metabolism of the ecosystem and explain the general hydro- biological relationship (Basavaraja et al., 2011*)*.

Water quality analysis of our natural resources such as ponds helps to identify the status of these water bodies and to make aware the need for revitalizing them. Thus the fishery potential of these natural water bodies can be utilized to the optimum by implicating new environmental policies among the local people. Renovations of these ponds conserve our indigenous water resources at the same time provide employment to some. The study points out the need for exploiting the natural resources in a sustainable manner.

2. METHODOLOGY

Samples were collected from two different ponds. Water samples were collected in clean polyethylene bottles without air bubbles and brought to the laboratory. The hydrological parameters such as water temperature, pH, dissolved oxygen, carbon dioxide, productivity. The temperature of water samples were determined by an accurate centigrade thermometer. pH was estimated by digital pH meter. DO was estimating by Winkler's method. Carbon dioxide concentration was determined by titration with NaOH. Primary productivity was estimated by light and dark bottle method.

STATION 1: CHEMBAZHAM POND

STATION 2: KALAPURAKKAL POND

3. RESULTS AND DISCUSSION

In the present study,the parameters like DO, productivity, free carbon dioxide, temperature and pH of two ponds showed variations. In pond-1 the DO level is 5.2ppm, the DO carbon dioxide is 16.72ppm, temperature is 28 $^\circ$ Celsius, and pH is 5.52. In the case of pond-2 DO is 7.2ppm, DO carbon dioxide is 18.92ppm, temperature is 29 $^\circ$ Celsius, and pH is 6.5. The first pond is highly acidic and slightly polluted as compared to the second pond, due to the dumping of domestic waste, agricultural influence etc. In pond 1, gross production was 14.92mgC/l/day, net production about 8.9 mgC/l/day. Pond 2 exhibited gross and net production about5.96mgC/l/day and 2.98mgC/l/day respectively. Chempazham pond exhibited an acidic nature which would affect the survival of fishes and other aquatic organisms. Primary production was found to be higher in Chempazham pond than Kalapurakkal pond.

All metabolic and physiological activities of the aquatic organisms are greatly influenced by water temperature. A degree of variation in the temperature of the water body has great bearing up on its productivity potential also. The variation recorded in present study was not very great and as such it could not bring out any drastic fluctuation in the dynamics of the pond ecosystem of water study. Acid deposition influences mainly the pH of freshwater. Dissolved oxygen is essential for a healthy aquatic ecosystem. Fish and aquatic animals need the oxygen dissolved in the water to survive. The need for oxygen depends on the species and life stage; some organisms are adapted to lower oxygen conditions, while others require higher concentrations. Dissolved oxygen can affect the solubility and availability of nutrients, which can be released from sediments under conditions of low dissolved oxygen (MELP *et al*; 1998). As the amount of dissolved oxygen drops below normal levels in water bodies, the water quality is harmed and creatures begin to die off. Organic wastes are the remains of any living or once-living organism. Organic wastes that can enter a body of water include leaves, grass clippings, dead plants or animals, animal droppings, and sewage. Organic waste is decomposed by bacteria; these bacteria remove dissolved oxygen from the water when they breathe. If more food (organic waste) is available for the bacteria, more bacteria will grow and use oxygen, and the DO concentration will drop. The degree and extent of the DO depends on the Biological Oxygen Demand (BOD) of the effluent (Giller and Malmqvist, 1998). Pollution of a fresh water body first affects its chemical equality and then systematically destroys the community disrupting the delicate food web. Diverse uses of the rivers are seriously impaired due to pollution and even the polluters like industry suffer due to increased pollution of the rivers. River pollution has several dimensions and effective monitoring and control of river pollution requires the expertise from various disciplines (Trivedy et al, 1990). The disposal of waste leads to contamination of fres water sources chronically affecting the flora and fauna. The domestic sewage discharged from a pollution of about 2 millions gives rise to numerous water-borne and diseases like typhoid, cholera, dysentery, poliomyelitis and cysticercoids, thereby affecting the human health and deterioration of the water quality (Sharma et al, 1996). The chief source of pollution is defined as sewage constituting 84 to 92% of the waste water. Industrial waste water compressed 8 to 16%.The indiscriminate and large cycle deforestation and over grazing in the watershed areas of river basins have caused soil erosion resulting in considerable silting of dams and shrinkage of river falls. This leads to the flooding of the rivers at the time of excessive rains (Goel, 2006).

4. CONCLUSION

In the present study the concentration of all the parameters were found within the permissible limit as prescribed by BIS standard. As nutrient level rise, growth of phytoplankton is no longer nutrient-limited and algal blooms occurs. An acidic pH was encountered in one pond which would be harmful to the fishes and would reduce the amount of dissolved oxygen. Ponds exhibited a desirable rate of primary production. The Knowledge of water quality parameters will help aquaculturists determine the potential of a body of water to produce aquaculture species, to maintain or to improve water quality in the culture system, to minimize problems of fish stress and fish health, to produce high quality aquacultural products, to reduce impact of effluents, and to realize more efficient production and greater profits.

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Hydrographical parameters of selected two ponds

Serial number	Parameters	Pond-1	Pond-2
1	pH	5.52	6.5
2	Gross productivity	14.92mgC/l/day	5.96mgC/l/day
	Net productivity	8.9mgC/l/day	2.98mgC/l/day
3	Temperature	28^0C	29^0C
4	Free carbon dioxide	16.72ppm	18.92ppm
5	Dissolved oxygen	5.2ppm	7.2ppm

Figure 1

Graph showing variations of hydrographical parameters in two ponds.