IMPACT OF FERTILIZER USE ON THE PHYSIO-CHEMICAL CHARACTERISTICS OF DAL LAKE WATER

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ABSTRACT

The present study was carried out for a period of one year. During the study, impact of fertilizers used in the agricultural fields in the catchment area of the lake and floating gardens within the lake on physio-chemical characteristics of water was studied. An increase in water temperature, PH, total alkalinity, calcium, magnesium, chloride, silicate, nitrate phosphate and free ammonia but decreased in DO level was revealed in the regions receiving fertilizers as compared to open water areas.

Keywords- Dal Lake, Fertilizers, Impact, physio-chemical characteristics.

1. INTRODUCTION

The Dal Lake, situated in the North-East of Srinagar at an altitude of 1584m, is a multi basined Water body having a large catchment area of about 315 km², where intensive agricultural activities are performed. Its Area has also got shrinked as a result of encroachment of its shallow zone for the construction of floating gardens. These floating gardens (locally called Radhs) are made from decayed vegetation into the shape f long strips floating on the surface of water. The floating gardens are used by the people for the cultivation of different vegetables and several fertilizers are used on them in order to get more production. A significant quantity of these fertilizers from agricultural fields and floating gardens get washed into surrounding water, thereby changing the ecology of the lake. It was with this aim that the present investigation on the impact fertilizers on pysio-chemical feature of Dal Lake was undertaken.

2. MATERIAL AND METHODS

The data on various physio-chemical parameters was collected on monthly basis from three different sampling sites. Fig. I. site I, was located close to the point where Telbala Nallah opens into the lake. Site II was selected at the centre of the lake in the open water area and site III was located near the floating vegetable gardens. Sampling from all the sites was done at least once in a month. Water samples were analyzed for physio-chemical characteristics as per the standard methods suggested by [1]; [2].

3. RESULTS AND DISCUSSIONS

Physio-chemical characteristics of water of an aquatic system reflect not only the quantity of the system but also the type and density of its biota. Analysis of such characters generates information regarding pollution pattern of magnitude of pollutant loading of aquatic system.

One of the physical parameter which is directly related with chemical and biochemical reactions is temperature. The high temperature at site III remained comparatively higher from other sites throughout the period of investigation. Site III received fertilizers from floating gardens which induce luxuriant growth of macrophytes. High temperature at this site was probably due to the release of heat energy of macrophytes as a result of high rate of respiration. Jolly and Chapman [3] also observed similarly and explained that fertilizers when discharged onto water, react with each other generating heat and thus bringing about on increase in water temperature. (Table 1).

Transparency values ranged between 0.98-2.5m low values was recorded at site I & II. Low transparency at site I & III was due to silt content in water which comes from the channels that connect the lake with Telbal nallah and nutrient influx from floating gardens which trigger growth of submerged macrophytes and phytoplankton. Saran [4] also found decreased valves of transparency associated with phytoplankton maxima.

PH values were recorded to be lower at site II and higher at site III Chandra et al also reported an increase in pH values at sites where fertilizers were discharged into the water. Similarly, site III showed higher values of total alkalinity and the same was also observed by [5] and [6] at places were fertilizers were discharged into water.

Dissolved oxygen varied from 5.2 mgl^{-1} to 10.2mgl^{-1}. Low DO content was observed at fertilizer affected sites which intern raised the temperature of the water body and thus decrease the DO content though a sign of organic pollution is also due to the inorganic reductants like sulphates, ammonia and nitrates. Calcium and magnesium values ranged from 15.0-36.5 mgl^{-1} and 7.5-9.2 mgl^{-1} respectively. Calcium being predominant lime rich rocks in catchment area of the lake. However, it was found in higher quantity at site III & I which is related to agricultural fertilizers received from the catchment area. But magnesium content remained lowest at site III which is attributed to the uptake of Mg^{2+} by plants in the formation of Chlorophyll porphyrin metal complex and in enzymatic transformation. Chloride and silicate valves ranged between 16.0-27.5mgl^{-1} and 1.2-2.6mgl^{-1} respectively. Chlorides were found to be increased after the use of fertilizers in the floating gardens and in paddy fields indicating the presence of salts of chloride in the fertilizers. The main source of silica for the aquatic systems is aluminosilicates of the rocks in catchment area and death and decay of diatoms [7].

Ammonial-N values ranged between 225-625ugl^{-1}. The lowest value was recorded at site II and highest at site III. The high content of ammonical-N at site I and III due to the too much use of nitrogen fertilizers in the floating vegetable gardens and heavy anthropogenic pressure in the catchment area resulting in organic pollution, which intern further adds ammonia by undergoing bacterial decomposition of the organic matter.

The Nitrate-N and Nitrite-N values fluctuated from 120-310 ugl^{-1} and 13.5-20.0ugl^{-1}. The main source of elevated nitrate concentration may be the inorganic fertilizers used indiscriminately in and around the lake. Direct relation exists between the degree of pollution and concentration of nitrates, [8].

Inorganic phosphorus in the form of orthophosphate plays a dynamic role in Lake Ecosystem as it is rapidly taken up phytoplankton or lost to the sediment. The values varied between 9.5-35.5 ugl^{-}. Highest value is due to the run-off from surrounding crop fields and floating gardens and landmass within the lake fertilized with phosphate. Increase may also be due to decayed phytoplankton and concentration of zooplankton excretes [9]. Use of detergents with long chain phosphate compounds and use of lake as receptacle for waste disposal have also resulted in excessive phosphorus loading.

Table 1. Average values of physio-chemical parameters recorded in Dal Lake

PARAMETER	SITE I	SITE II	SITE III
Water temperature (c°)	18.5°c	15.8	19.0
Transparency (m)	2.0	0.98	2.5
Conductivity($uscm^{-1}$)	150	172	390
Dissolved oxygen (mgl^{-1})	9.0	10.2	7.2
Free co_2(mgl^{-1})	8.8	7.5	8.0
Alkalinity(mgl^{-1})	80.0	76.1	110.0
Calcium(mgl^{-1})	25.5	15.0	36.5
Chloride(mgl^{-1})	25.0	16.0	27.5
Silicate(mgl^{-1})	2.2	1.2	2.6
Ammonical nitrogen(ugl^{-1})	230	225	625

Nitrate nitrogen(ugl^{-1})	201	120	310
Nitrate nitrogen(ugl^{-1})	13.5	15.5	20
Orthophosphorus (ugl^{-1})	32.2	9.5	35.5
Total phosphorus(ugl^{-1})	152	132.5	215
Potassium(mgl^{-1})	5.0	2.0	7.0
Sodium(mgl^{-1})	9.0	7.5	12.0

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