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Some Physicochemical Characteristics of Wular Lake, Kashmir

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ABSTRACT

The present study deals with the water quality of Wular Lake and the work was under taken from March 2012 to December 2012.The study reveals the changing tropic status of the lake being attributed to the sewage disposal and agricultural runoff by the catchment areas. The physico-chemical parameters of Wular Lake studied included the atmospheric temperature (recorded between 9ºC to 27ºC), hydrogen ion concentration (ranged between 7.4 to 8.1), dissolved oxygen (varied from 7.0 mg/l to 8.1 mg/l), free CO_2 (ranged from 10 mg/L to 14mg/L) ; total alkalinity (varies from 125mg/l to 160mg/l) ; ammonical nitrogen (from 80 µg/L to 102 µg/L); nitrate nitrogen (from 150 µg/L to 230 µg/L), orthophosphate (31 µg/L to 65 µg/L) and total phosphate (ranged from 183 µg/L to 243 µg/L). The high values of the physico-chemical parameters of water obtained in the present study indicate the eutrophic status of the lake.

Keywords: Water chemistry, lake, Kashmir.

INTRODUCTION

The Wular Lake is the largest freshwater lake of the Kashmir valley and has been designated as a Ramsar site in 1992. It is situated in northwest of Srinagar at distance of 35km. At the turn of the 19th century the area of lake was reported to be 217.8 km^2, which has got reduced to 86.71 km^2 by the start of 21st Century. The shrinkage in lake area was mainly due to continuous siltation brought about by various tributaries (Erin,

Madhumati, Ashtung) besides river Jhelum. The water body is very shallow, with the maximum depth of 5.8m. The lake is surrounded by high mountainous ranges on the northeastern and northwestern sides, which drain their runoff through various *nallas*, prominent being Erin and Madhumati. Geographically the lake is located at an elevation of 1580m (a.m.s.l) between the coordinates of 34°
15' - 34° 25' N Latitude and 74° 33' - 74° 44' E longitude. The Lake is an important habitat for the fish fauna of the region. The dominant fish species found in the Wular are: *Nemacheilus* sp., *Cyprinus carpio, Barbus conchonius, Gambusia affinis, Crossocheilus diplochilus, Schizothorax curvifrons, S. esocinus, and S. niger.* Two species of *Triplophysa*, viz., *Triplophysa marmorata* and *T. kashmiriensis* have also been reported from this water body (Kullander *et al*, 1999).

Physico-Chemical parameters are highly important which directly or indirectly influence the distribution and abundance of species. Certain anthropogenic activities like discharge of domestic and agricultural wastes have increased the quantum of various chemicals that enter the receiving water, which considerably alter their physico-chemical characteristics. Phosphorous and nitrogen inputs from domestic wastes and fertilizers accelerate the processes of eutrophication (Rao and Valsaraj., 1984). Natural factors like dust, storm, runoff and weathering of minerals are slow processes in causing eutrophication (Kudari *et al*., 2006). Eutrophication has become a widely recognized problem of water quality deterioration. The present study was therefore undertaken to monitor the water chemistry of the lake.

MATERIALS AND METHODS

The physico-chemical parameters of water were analyzed on seasonal from March 2012 to December 2012. The parameters like pH, temperature were monitored on spot while the parameters like free carbon dioxide, and alkalinity values were determined by APHA (1998). Nitrogen and phosphorus were calculated by Spectrophotometric method (APHA, 1998). For the collection of water samples

from the lake site Ningli (near the out let channel) with latitude 34 °17′ 15. 8 ″ N and longitude 74 ° 30 ′24.9 ″E was selected. Its depth ranges from 0.3 to 4.4 m.

Fig 1. A wiew of Wular Lake near study site In Ningli area

RESULTS AND DISCUSSION

The mean values for various physic-chemical parameters taken monthly at different sites during the entire study period are expressed seasonally and are summarized in Table 1.

Table 1: Physico-chemical parameters of Wular Lake

Parameters	Spring	Summer	Autumn
Water Temp. ºC	9	23	17
pH	8.1	7.7	7.4
Dissolved Oxygen(mg/l)	7.6	7.0	8.1
Free Co_2 (mg/l)	12	14	10
Alkalinity(mg/l)	160	125	132
Ammonical-Nitrogen(□g/l	102	80	89
Nitrate-Nitrogen(□g/l)	150	200	230
Orthophosphorus(□g/l)	31	44	65
Total phosphorus (□g/l)	183	191	243

During the present study, water temperature fluctuated between a minimum of 9°C in the spring season to a maximum of 23 ° C in summer. Water temperature is the most important factor, which influences the chemical, bio-chemical and biological

characteristics of the water body. The variation in the water temperature of the present study is in broad agreement with the findings of Rao *et al.* (1982) for Nainital Lake (8 °C to 23 °C) and Billore and Vyas (1982) for Pichhola lake (0.6 to 26.3 °C).

The pH value was found to fluctuate from 7.4 to 8.1 at site Ningli in the season of autumn and spring respectively, indicating that the waters were neutral to alkaline. In case of Wular Lake, the high pH is due to the addition of hydroxyl, bicarbonate and carbonate anions10 .This is in conformity with the observations of Zutshi and Khan (1977) and Zutshi and Vass (1978).

In any aquatic ecosystem, dissolved oxygen (DO) is of paramount importance because it is critical to the survival of most forms of aquatic life besides being the most reliable criterion in assessing the tropic status and the magnitude of eutrophication (Edmondson, 1966). Dissolved oxygen revealed a definite seasonal trend registering high values in autumn (8.1mg/l) and low in summer (7.0 mg/l). Low values of DO imply higher trophic status (Naz and Turkmen, 2005). Similar types of results were observed in present study as dissolved oxygen decreased with increase in temperature. It is regulated primarily by free diffusion of oxygen air to water, production through photosynthesis, consumption by biota, dissolved oxygen affects the solubility and availability of many nutrients and therefore productivity of aquatic ecosystem (Wetzel, 1983). Highest value may be due to cooling (Hunnan, 1979). Reduction in the value observed with increase in temperature, which attributed to high microbial activity. Low content of dissolved oxygen though a sign of organic pollution is due to inorganic reductants like hydrogen sulphide, ammonia, nitrates and ferrous ions.

During the present study concentrations of free CO_2 were noticed which ranged

between 10 mg/l to 14 mg/l respectively in the autumn and summer season. The high value of the free carbon dioxide content is an indication of high degree of pollution, a fact also supported by Todda (1970) and Coole (1979) which related high value of free carbon dioxide content to high degree of pollution.

Alkalinity varies from 125 mg/l to 160 mg/l. It was maximum in the season of spring and minimum in the season summer. Alkalinity of water is a measure of weak acid present in it and of the cat ions balanced against them. Venkateswarlu (1969) attributed that there is an indication to suggest that alkalinity concentration is affected directly by rainfall.

Phosphorous, is generally recognized as one of the key nutrients in the productivity of freshwaters as it is essential element determining fertility of lakes. The concentration of orthophosphate phosphorus (OPP) during the study period ranged from a minimum of 31 µg/l in spring season to a maximum of 65 µg/l in autumn season. The low orthophosphate-phosphorous content in waters is due to the formation of an insoluble calcium-phosphate complex. Such a phenomenon functions as scavenger of some inorganic nutrients and also acts as a removal agent of dissolved organic matter by absorption (Otsuki and Wetzel, 1974).

The fluctuations regarding the total phosphate phosphorous (TPP) were irregular. In general, lower concentrations were observed during spring season (183µg/l) and higher concentrations during autumn season (243µg/l).The total phosphorus and the orthophosphate content in the Wular Lake fluctuated greatly during the course of the year. However, the average concentration of both total phosphorus and orthophosphate phosphorus revealed the water body belonging to the hypertrophic category of Wetzel (1983). This is substantiated by the fact that almost the whole water body is infested by the macrophytes, which is possible only when this important nutrient is available in ample quantities. Bandela *et al.* (1999) observed an increase in phosphate concentration in those water bodies that received domestic waste.

The values of Ammonical nitrogen ranged from 80 µg/l in summer season to 102 µg/l during spring season. Such fluctuations in the values of ammonical nitrogen may be due to decomposition of organic matter and bird droppings into the lake as it is visited by many aquatic birds (Zuber, 2007). Prasad (1990) pointed out that ammonical nitrogen increases during rainy seasons.

Nitrate nitrogen (NO3-N) was higher in the autumn season (with maximum value of 230 µg/l) while the lower values were recorded in the spring season (with minimum value of 150 µg/l). Ganapati (1960) pointed out that the concentration of nitrate-nitrogen (>150µg/l) is an indicative of eutrophication and as such the Wular lake falls in eutrophic category.

In conclusions it is inferred that the effluents and agricultural run off released and other anthropogenic disturbances are responsible for changing tropic status of the lake. Therefore preventive measures are required particularly at state level to safe guard this indispensible aquatic ecosystem.

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