

Determination of pH, Dissolved Oxygen, Sulphate, Phosphate and Total Hardness as of Some Physico-Chemical Parameters of Water Pollution in Kukkarahalli Lake in Mysore City-India

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Abstract: Sampling of the Physico-chemical factors from two stations on the surface water of Kukkarahalli Lake in Mysore City-India was carried out biweekly over a period of 3 months of 2014. The aims were to determine some Physico chemical parameters of water pollution. Temperature was measured using mercury in glass thermometer. Dissolved oxygen was determined by modified Winkler azide method while Phosphate was determined by Vendo Molybdate Method, Estimation of Sulphate as Sulphur in sample by Nephelometric Method, measurements of total hardness by Complexometric Method. The result revealed that the major causes of water quality deterioration were related to excess usage of fertilizers and chemicals for increasing yield of the crop or releasing the sewage into the lake, due to cumulative effect of human activities where in sewage disposal oxygen is used in decomposing these organic water, eutrophication which causes algal bloom and therefore inability of oxygen to adequately dissolved in the water or the lentic nature of the site where was no serious upturns. As this Lake also used to be a source of water supply to the city of Mysore, and today is a house of different variety of birds, animals, plants and fishes it is very essential to stop sewage disposal and illegal excessive land encroachments to eliminate the eutrophication of the lake, which this results of the Physico-chemical examination of this lake could be helpful in the management of the lake for its water quality and fisheries.

Keywords: Physico-chemical factors, Kukkarahalli Lake, Water pollution, Water quality.

I. INTRODUCTION

Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells) [1]. EPA's 2010 National Lakes Assessment found that almost 20 percent of the nation's lakes have high levels of nitrogen and phosphorus pollution. The report also showed that poor lake conditions related to nitrogen or phosphorus pollution doubled the likelihood of poor ecosystem health [2].

Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural communities. Water pollution may be occurred by point sources and non-point sources. Point source water pollution refers to contaminants that enter a waterway from a single, identifiable source, such as a pipe or ditch and Non-point source (NPS) pollution refers to diffuse contamination that does not originate from a single discrete source. NPS pollution is often the cumulative

effect of small amounts of contaminants gathered from a large area a common example is the leaching out of nitrogen compounds from fertilized agricultural lands [3]. Water is known to contain a large numbers of chemicals elements [4]. Physical parameters such as temperature, turbidity and current are also known to operate in Lake Ecosystem [5]. The interaction of both the physical and chemical properties of water play a significant role in the composition, distribution and abundance of aquatic organisms and gives an insight into the relationships between the organism and their environment and can be used in determining water quality, and productivity of the lake [6]. The physico-chemical study could also help in understanding of the structure and function of particular water body in relation to its inhabitants [6]. The some chemical elements found in water especially those studied in this work have effect on biological processes which lead to interconversion of energy, production of organic material and ultimately to production of aquatic resources such as fisheries and other biological components found in Lake Ecosystem. The proper balance of physical, chemical and biological properties of water in ponds, lakes and reservoirs is an essential ingredient for successful production of fish and other aquatic resources [6]. The presence or absence of chemical elements in a water body might be a limiting factor in the productivity of such water body. Also abundance of a particular element might suggest the types of organism that may be found as well as indication of ecologically unstable or unfavorable ecosystem which can have negative or positive impact on the population [6]. Studies have shown that water rich in silica will contain a high population of diatoms [7], while high species diversity of snail could be explained by high concentration calcium [8]. Also high concentration nitrogen and phosphate is indicative of eutrophication that may lead to Algal bloom and consequently deoxygenation and fish kill [6]. Physical parameters such as light penetration, temperature and water movements have been shown to play important roles in plankton's distribution and lake stratification [6]. The physical and chemical limnology of a lake is characterized by hydrologic impact, autogenic nutrient dynamics and biological aspects [6]. These factors combine with each other determine the water quality and consequently community of lake [9]. The Physico-Chemical characteristics of a lake can be significantly altered by human activities such as various agricultural practices and irrigation as well as natural dynamics which consequently affect the water quality and quantity, species distribution and diversity, production capacity, and even diversity, production capacity, and even disruption in the balance of ecological system operating in the lake [6]. The goal of this paper is to determine of some Physico-chemical parameters of water pollution in kukkarahalli lake of Mysore city with a view to revealing information about its water quality, the impact of water pollution on the aquatic ecosystem and public health of the kukkarahalli lake of Mysore city. It will also help in conservation, effective utilization, and sustainable exploitation of the vast aquatic resources that abound in the lake.

II. MATERIALS AND METHODS

A. DESCRIPTION OF THE STUDY SITE:

Mysore city is geographically located between 12° 18' 26 North Latitude and 76° 38' 59" East Longitude. It is located at an altitude of 2,427 feet. It encompasses an area of 6,268 sq. km., the temperature varying between 19oC and 30oC. The weather of Mysore is pleasant throughout the year. Mysore city is located in the southern part of the Deccan Plateau. It is a beautiful land bordered by luxuriant forests. Mysore is located 140 Kms from the city of gardens, Bangalore.

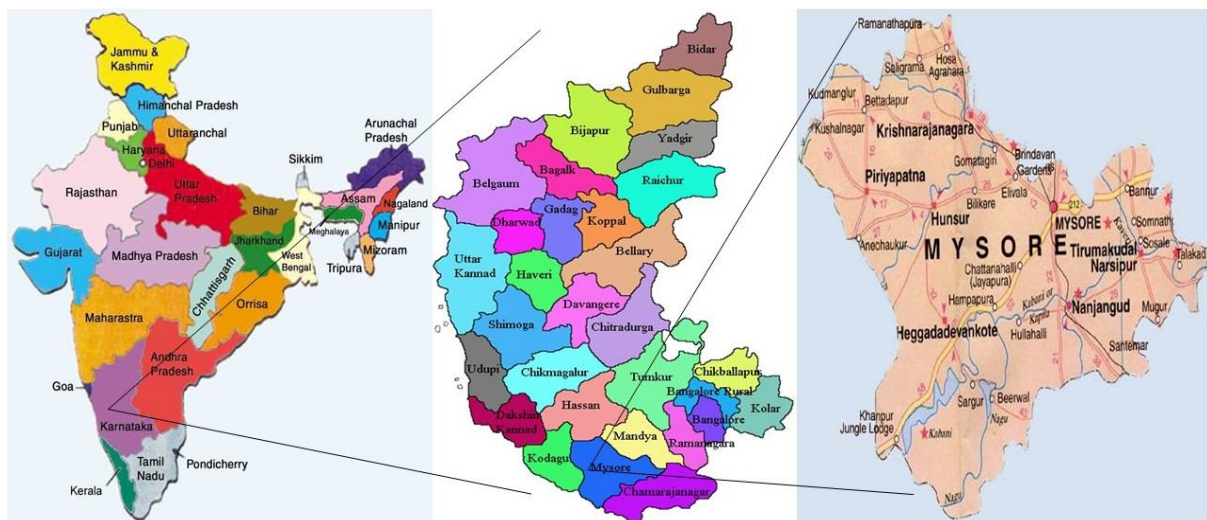


Fig. 1. Location of Mysore city-India

Kukkarahalli Lake located in the heart of the Mysore city, adjoins the Manasgangotri (University of Mysore), the Kalamandir (Rangyana) and the Central Food Technological Research Institute (CFTRI) campus (separated by the Hunsur Road). It provides lung-space to the city. Mummadi Krishnaraja Wodeyar, (1794–1868) of the Mysore Dynasty (Kingdom of Mysore) was responsible for getting the lake created, in the year 1864, to provide water for irrigation to about 4000 ha (10,000 acres) of land outside the city. The Lake also used to be a source of water supply to the city of Mysore but over the years, sewage and excessive land encroachments (mostly illegal) and blockage of water flow sources almost led to the eutrophication of the lake. The University of Mysore and the citizen forums of Mysore continue to make efforts to preserve the lake by implementing several remedial measures. The Lake drains a catchment area of more than 414 square kilometers (160 sq. mi) and the water body spreads over 62 hectares (150 acres). Dewan Poornaiah feeder canal, 27 km (17 mi) long, which passes through Hinkal, Bogadi, Kudremala and Manasgangotri outfalls into the Lake. The Lake is 'J' shaped. The maximum depth of lake is reported to be 5 m (16 ft.). The east-west bund holds water on one side. Sandy loams to clay loam form the dominant geological condition of the Lake. On the northern side another temporary bund hold back the direct flow of waste water into the lake. The highest flood level in the lake is 755.73 m (2,479.4 ft.). Two sampling station were chosen within the lake. The first station designated as station (A), was at the Upstream of the lake towards north western side while the second station, station (B), was at the Downstream of the lake towards south eastern side and about 1000m from station (A). The choice of the stations is to reflect influence of human activities such as washing, agriculture and fish landing, etc. on the lake ecosystem.



Fig. 2. Location of Stations A & B

B. SAMPLINGS:

Sampling for the Physico-chemical parameters were randomly done on each station for 3 months between February 2014, and April 2014, the surface water samples were collected in 2 lit. Plastic cans, early in the morning (6-8 am) from each site. Temperature was measured using mercury in glass thermometer accurate to 0.1°C. pH was determined immediately at the place of collection with the help of universal pH paper and was later confirmed in the laboratory using global digital pH meter (OPH 500). Dissolved oxygen was determined by modified Winkler azide method, while Phosphate was determined by Vendo Molybdate Method, Estimation of Sulphate as Sulphur in sample by Nephelometric Method, measurements of calcium and magnesium (total hardness) by Complexometric Method (EDTA titration).

C. RESULTS:

The results of the Physico-chemical parameters of two stations are presented in table 1 and 2 respectively. Temperature ranged Between 25 - 26.2. Higher values were obtained at station (A) during February and the lowest temperature of 25°C was obtained at station (B) in April. The present study showed that pH range of 8-9.8. Dissolved oxygen concentration showed a gradual decrease with time in both station. Station (A) has a higher value with maximum concentration of 9.30 mg/l recorded in February, while lowest value of 3.10 mg/l was obtained at station (B) in April. A sulphate value in station (B) was higher (30 mg/l - 78 mg/l) than in station (A) (24 mg/l - 68 mg/l). The concentration of Sulphate was found to increase from February to April. Of all the ions studied in the lake phosphate has the lowest concentration, it ranged between 0.60 -0.77 in both station and total hardness values in station (A) was higher (247 mg/l- 240 mg/l) than in station (B) (234 mg/l- 229mg/l).

TABLE I: THE MONTHLY MEAN VALUES OF PHYSICO – CHEMICAL PARAMETERS AT STATION (A) IN KUKKARAHALLI LAKE

PARAMETERS	PERIODS		
	February	March	April
Air temperature (°C)	26.3	24.5	22.3
Water temperature(°C)	26.2	25	25
pH	8.9	9.4	9.8
Dissolved oxygen (mg/l)	9.30	5.13	4.33
Sulphate (mg/l)	24	49	68
Phosphate (mg/l)	0.67	0.60	0.77
Total hardness (mg/l)	247	243	240

TABLE II: THE MONTHLY MEAN VALUES OF PHYSICO – CHEMICAL PARAMETERS AT STATION (B) IN KUKKARAHALLI LAKE

PARAMETERS	PERIODS		
	February	March	April
Air temperature (°C)	26.3	24.5	22.3
Water temperature(°C)	25.3	25	25
pH	9.3	8	9.7
Dissolved oxygen (mg/l)	3.21	6.17	3.10
Sulphate (mg/l)	30	39	78
Phosphate (mg/l)	0.65	0.62	0.71
Total hardness (mg/l)	234	230	229

III. DISCUSSION

The results of the Physico-chemical examination of this lake could be helpful in the management of the lake for its water quality and fisheries. Kukkarahalli Lake is the total richness of Sulphate, relatively high Phosphates and high pH, low Dissolved Oxygen and high total hardness may be due to excess usage of fertilizers and chemicals for increasing yield of the crop or releasing the sewage into the lake. The surface water, temperature of the lake follows closely that of the air temperature. The temperature variation recorded during the study was optimal for normal growth and survival of aquatic organisms [10]. The lower values of dissolved oxygen observed in station (B) could be due to cumulative effect of human activities such as sewage disposal where oxygen is used in decomposing these organic water, eutrophication which causes algal bloom and therefore inability of oxygen to adequately dissolved in the water or the lentic nature of the site where was no serious upturns [5]. Eutrophication could also lead to unpleasant taste and odour of the water when the algae die and decompose thus deteriorating the quality of the water [6]. Calcium and magnesium ions in the lake form the total hardness of the water. Water is considered soft if it contains 0 to 60 mg/L of hardness, moderately hard from 61 to 120 mg/L, hard between 121 and 180 mg/L, and very hard if more than 180 mg/L. Very hard water is not desirable for many domestic uses; it will leave a scaly deposit on the inside of pipes, boilers, and tanks (USEPA, U.S. Environmental Protection Agency, 2006). Calcium and magnesium ions in the lake form the total hardness of the water. Water is considered soft if it contains 0 to 60 mg/L of hardness, moderately hard from 61 to 120 mg/L, hard between 121 and 180 mg/L, and very hard if more than 180 mg/L. Very hard water is not desirable for many domestic uses; it will leave a scaly deposit on the inside of pipes, boilers, and tanks (USEPA, U.S. Environmental Protection Agency, 2006). The lake water could be classified as very hard water since its calcium and magnesium did exceed 180 mg/L. Sulphate is the most abundant ion in the lake. The source of the Sulphate could probably be from the mineral rocks that are presented around the lake [6]. The phosphate concentration is also higher (0.5 mg/L maximum) compared to its concentration in most freshwater lakes [11]. The high concentration could also be traced to leaching of phosphate fertilizer into the lake [6]. pH of water influences on the occurrence and growth of various organisms of water bodies [6]. The present study showed that pH range of 8-9.8 to be congenial for the growth and multiplication of fungi [6]. Generally, the lake water tends to move more into alkalinity. The trouble is, sewage is often released in much greater quantities than the natural environment can cope with. Chemical fertilizers also add nutrients to the soil, which drain into the water and add to the fertilizing effect of

the sewage. Together, sewage and fertilizers can cause a massive increase in the growth of algae or plankton that overwhelms huge areas of oceans, lakes, or rivers [12]. This is known as a harmful algal bloom because it removes oxygen from the water that kills other forms of life, leading to what is known as a dead zone. According to The National Oceanic and Atmospheric Administration (NOAA), Gulf of Mexico has one of the world's most spectacular dead zones that grows to an area of 14,000 sq.km annually which is about the same size as the state of Nagaland in Northeast India [13],[14]. Water pollution is the cause of our undisciplined actions and irresponsibility. We, humans are only creating problems that consequently we will also carry the burden of these problems. I found that water pollution is, without a doubt, a huge problem in today's society. If we do not take action now this could lead to a bad news for everyone in many ways. Our drinking water and our aquatic organism will be affected, which will eventually be a risk for humans in many ways.

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