

# **STUDY OF PHYSICO-CHEMICAL PARAMETER OF DEEPANG LAKE IN POKHARA VALLEY, NEPAL**

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## **ABSTRACT**

*The present study on Physico-chemical Parameter of Deepang lake in Pokhara valley, Nepal was performed for six months from August 2009 to January 2010. The study included various physico-chemistry parameter like transparency, temperature, PH, free carbondioxide, dissolve oxygen and total alkalinity. The maximum transparency 2.5 m was recorded in January and minimum 1.4 m in August. In other months the transparency were slightly changeable. The maximum temperature 25.6°C was recorded in August and minimum 17.7°C in January. The temperature gradually decreased. The PH values were found mostly alkaline and were generally between 6.7 and 7.5 during the investigation period. The highest PH 7.5 was recorded in January and lowest 6.7 in August. Dissolved oxygen value gradually increased from 6.4 mg/l in August to 8.7 mg/l in January. The concentration of free CO<sub>2</sub> ranged between 1.8 mg/l and 5.6 mg/l during the investigation period. The maximum value was 5.6 mg/l in August and 1.8 mg/l in January. The maximum alkaline value 114 mg/l was recorded in January and minimum value 105 mg/l in August. All these Physico-chemical parameter meet WHO Standard of Water Quality.*

**Keywords :** Parameter, Phytoplankton, Macrozoobenthos, Limnology, Metrology.

## **Introduction**

Water is one of the most significant natural resources. It is a single worldwide natural resources distributed in all land, sea and atmosphere and unified by the hydrological cycle. It is the most important factor in the life on an organism as it is the major constituent of the protoplasm, plant, animals, microorganisms and aquatic life, all need water for their existence. In plants all physiological process like respiration, photosynthesis, absorption of nutrients and other metabolic processes are influenced by the amount of water available. There is about 1.36 billion cubic km water in which 37.5 million cubic km is fresh water (Subramnyam 1986). Water covers about three fourth of the Earth's surface of the total water about 70% is in the sea and oceans which is unfit for human consumption and remaining 3 percent of water occurs as fresh water

out of 3% about 2 percent existing as ice in polar caps and permanent glaciers and only 1% is available as fresh water in rivers, lakes, stream, reservoir and underground water. The determination of depth, transparency, temperature, pH, free carbondioxide dissolve oxygen and total alkalinity were taken into account following the standard method APHA (1989), Boyd (1979) Trivedy and Goel (1986), Polythene bottles were used to collect the water sample. The objectives of this investigation is to analyze the physico-chemical nature of the lake water.

## Materials and Methods

In an aquatic environment the water quality and living organisms directly depend on physico-chemical parameter. The determination of depth, transparency, temperature, pH, free carbondioxide, dissolved oxygen and total alkalinity were taken into account following the standard methods APHA (1989), Boyd (1979) Trivedy and Goel (1986), Polythene bottles were used to collect the water sample. The physico-chemical parameter were identified by using the methods mentioned below.

### Transparency

The transparency of water was measured in the field by immersing a Secchi Disc of 20 cm diameter in water and observing it visually. The mean of “Just disappearance and reappearance” of the disc under the water was calculated with the help of equation given below.

$$\text{Secchi Disc light penetration} = \frac{A+B}{2}$$

Where,

A = Depth of which Disc disappeared

B = Depth of which Secchi Disc reappeared

The extinction co-efficient was calculated by using the following formula

$$K = 1.7 D$$

Where,

K = Extinction co-efficient

D = Secchi-Disc reading and

1.7 = constant factor

### Temperature

The water temperature was recorded with the help of standard mercury thermometer (graduated) with a precision of  $\pm 0.1^\circ\text{C}$ ). The measurement was simply carried out by dipping the thermometer bulb directly upto water surface and the reading was taken down.

### Hydrogen ion concentration (PH)

Hydrogen ion concentration (PH) of water determines the acidity, alkalinity and neutrality of water. The PH of water sample was determined by using an electronic pocket PH meter (Hanna-Instrument)

### Dissolved oxygen (DO)

For the determination of dissolved oxygen, winkler’s method was used. For this, BOD bottle (300 ml) was filled with water sample. During the placing of stopper on the bottle

care was taken to avoid trapping air in the bottle. In BOD bottle, 2 ml of manganous sulphate ( $MnSO_4$ ) solution and 2 ml of alkaline potassium iodide (KI) solution were added at the interval of few seconds, with the help of separate pipette after removing stopper. The stopper was placed carefully to exclude air bubbles and the solution was mixed thoroughly by inverting the bottle for a few minutes. After the precipitate had settled sufficiently than 2 ml of conc.  $H_2SO_4$  was added to it. The stopper was replaced back carefully and the bottle was inverted for several time until the dissolution of precipitate was completed. 100 ml of this sample was taken in a conical flask and titrated against sodium thiosulphate solution  $Na_2S_2O_3$  (0.025 N) using starch as indicator until a light coffee brown colour was appeared. Three readings were noted and their mean was taken out to dissolved oxygen (DO) in mg/l by using the formula.

$$\frac{ml \times N \text{ of titrant} \times 8 \times 1000}{V_2 V_1 - V_1}$$

$$\text{Dissolved oxygen (mg/l)} = \frac{V_2 V_1 - V_1}{V_1}$$

Where,

N = Normality

V = Volume of  $MnSO_4$  and Potassium iodide used

$V_1$  = Volume of bottle after placing the stopper

$V_2$  = Volume of the part of the contents titrated

### Free Carbon Dioxide ( $CO_2$ )

Free carbondioxide was determined by the simple titrimetric method. 50 ml of sample was taken in a conical flask and 2-3 drops of Phenolphthalein was added as indicator. If the sample does not become pink and remain colourless it indicates the presence of  $CO_2$  in the water sample. Immediately the sample was titrated against sodium hydroxide (NaOH) solution (0.05 N) until a faint pink colour appeared at the end point. The amount of free  $CO_2$  is the volume of NaOH consumed. Three readings of burette were noted and mean was taken which later on calculated by using the following equation as mg/l.

$$\text{Free carbondioxide (CO}_2\text{)} = \frac{ml \times N \text{ of NaOH} \times 1000}{44 \text{ ml of sample}}$$

Where, N = Normality

### Total Alkalinity

For total alkalinity, 100 ml of water sample was taken in a conical flask and added two drops of phenolphthalein indicator. The resulting sample remained pink indicating the presence Phenolphthalein alkalinity. Then it was titrated with hydrochloric acid (0.1 N) until the pink colour just disappeared. Then 2 or 3 drops methyl orange indicator was added to the same sample and titrated with hydrochloric acid of same normality (0.1 N) until the yellow colour changed to pink. The volume of total hydrochloric acid was noted. Three reading were taken to determine the mean. The following formula was used to convert total alkalinity later in mg/liter.

$$\text{PA as CaCO}_3, \text{ mg/l} = \frac{A \times N \text{ of titrant} \times 1000}{50 \text{ ml of sample}}$$

$$\text{TA as CaCO}_3, \text{ mg/l} = \frac{\text{B} \times \text{N of titrant} \times 1000}{\text{ml of sample}} - 50$$

Where,

A = ml of HCl used with only phenolphthalein indicator

B = ml of HCl used with phenolphthalein and methyl orange

PA = phenolphthalein alkalinity

TA = total alkalinity

### Results and Discussion

The results of physico-chemical analysis of water samples collected from Deepang lake during the study period.

Table 1: Physico-chemical parameter of Deepang lake during the study period

S.N.	Parameters	Aug	Sep	Oct	Nov	Dec	Jan	Average
1.	Transparency (m)	1.4	1.6	1.9	2.0	2.3	2.5	1.9
2.	Temperature (°C)	25	24.8	22	21.5	18	17.2	21.4
3.	PH	6.7	6.9	7.1	7.1	7.2	7.5	7.0
4.	Dissolve oxygen (mg/l)	6.4	6.8	7.1	7.3	7.5	8.7	7.3
5.	Carbondioxide (mg/l)	5.6	4.1	2.8	3.9	2.7	1.8	3.4
6.	Alkalinity (mg/l)	105	107	113	113	113	114	110.8

#### Transparency

The transparency was found comparatively lower in August, September and October and higher in November, December and January. The transparency was highest in January (2-5m) and lowest in August (1-2m). The increase values in November, December and January may be due to the growth of planktons during that period.

#### Temperature

The highest temperature recorded was 25°C which gradually declined to the lowest 17.2°C in January. The water temperature of the lake seems to be related with the atmospheric temperature. The water temperature largely influence the physical, chemical and biological factors of an aquatic ecosystem. An increase in temperature may lead to the increase in photosynthesis thereby changing the total biomass of aquatic macrophytes, periphytic algae and phytoplankton. The solubility of gases in water is also affected by temperature. The oxygen retaining capacity of water diminishes and biological oxygen demand increases with the rise in water temperature (Holden and Armstrong, 1980).

### **Dissolved oxygen**

The concentration of dissolved oxygen (DO) was found lowest (6.5 mg/l) in August which gradually increased to reach the highest value 8.7 mg/l in January. The concentration of DO below single is considered to be insufficient for the survivability of many aquatic organisms (WHO 1996) and DO volume below 2.5 mg/l is lethal to the fish community (Oli, 1990). A low concentration of DO in an aquatic ecosystem indicates the organic pollution of water quality (Verma and Agrawal, 1989).

### **Hydrogen-ion Concentration**

The hydrogen ion concentration (PH) recorded were in the normal range. The lowest PH recorded 6.7 in August and gradually increased to reach 7.5 in January. The PH of water below 5 and above 11 has been described as toxic and unsuitable for various groups of aquatic fauna.

### **Carbondioxide**

The free carbondioxide concentration was variable. The highest concentration 5.6 mg/l in August and lowest 1.8mg/l in January. CO<sub>2</sub> is very soluble in water. The photosynthetic activity of planktons in an aquatic environment is considered as an important critical factor for the fluctuation of CO<sub>2</sub> and PH level. Free CO<sub>2</sub> of water from carbonic acid (H<sub>2</sub>CO<sub>3</sub>) which dissociates into H<sup>+</sup> and HCO<sub>3</sub><sup>-</sup> ions. This brings change in PH of water (Rutter, 1953). The highest concentration of CO<sub>2</sub> may be produced by the decomposition of organic matter and respiratory activity of aquatic plant and animals which are the principal governing factors of CO<sub>2</sub> fluctuations.

### **Total alkalinity**

The total alkalinity of Deepang lake water were 105 mg/l and 114 mg/l in August and January. The maximum value (114 mg/l) was recorded in January and minimum value presence of total Alkalinity was mainly due to carbonate and bicarbonate ions. Although the carbonate alkalinity occurs only in the absence of carbondioxide and the PH greater than 8.3 mg/l. In Deepang lake total alkalinity was mainly due to the presence of bicarbonates.

The physic chemical parameter in an aquatic medium exhibit as influencing limnoogical factors of the quality and quantity of the total biota and their life processor. The existing metrological condition and chemical properties largely regulated the physical properties largely regulated the physical properties of water in an aquatic system. The interaction of these creates favourable, or unfavourable circumstance or the growth and development of biotic component. Abundance, composition, diversity and distribution of macrozoobenthos are related to various physicochemical and biotic characteristic (Dutta and Molhotra, 1986)

The presence of suspended and dissolved organic and inorganic materials, phytoplanktons and turbidity of water diminishes the secchi disc transparency status is essentially a function of the reflection of light and restriction of the penetration of light in an aquatic environment (stepanek, 1959). The values of secchi disc transparency showed much fluctuation during the present study period.

All above physico-chemical parameter meet WHO standard of water quality. Dissolve oxygen which is the most important parameter in lake ecosystem was found above the permitted level of 5 mg/l throughout the study period.

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