

# ASSESSMENT AND STATUS OF CHEMICAL PARAMETERS OF KHUSHALSAR LAKE SRINAGAR, INDIA

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**Abstract:** Study on the chemical status of Khushalsar Lake one of the important lake in the valley. The study was carried out to ascertain the health and status of the lake. The study revealed eutropic condition in the lake. The outcome of the study has an implication on the long-term management of the Khushalsar Lake.

**Key Words:** Khushalsar, lake, chemical parameters,

## 1. INTRODUCTION:

The Kashmir valley ( $32^{\circ} 17' - 37^{\circ} 5'N$  and  $72^{\circ} 40' - 80^{\circ} 30'E$ ) occupies central position at an average elevation of 1600 m.a.s.l within the state of Jammu and Kashmir. It is an oval "dun" of tectonic origin surrounded by the great Himalayas and the Pir Panjal ranges. These lofty mountains include large glaciers between their spurs and are covered by snow for about eight months in the year. According to Hugal (1845) these mountains form a regular oval of snowy summits. The J&K measures area of about 2,25,000 Sq.Km. In the middle of the valley is an extensive level alluvial tract intersected by river Jehlum and its numerous tributaries. All the streams find their way by the sole channel of Jehlum through the Baramullah pass to the plains of Punjab.

Khushalsar lake connected to the Gilsar lake is situated to the north west of Srinagar. In the 19<sup>th</sup> century the two lakes actually formed one continuous body of water, which was known as Gilsar, although a narrow path ran across the lake. According to gazetteer of Kashmir and Ladakh (1974) the Khushalsar is the southern extension of the Anchar lake Koul (1956) holds the same view.

## 2. MATERIALS AND METHODS:

**Dissolved Oxygen:** Unmodified Winkler's method has been follow for the estimation of dissolved oxygen (Mackereth 1963).

Samples were collected in 125ml capacity bottles fitted with air tight stoppers, avoiding the trapper of any air bottles. The samples were fixed in the field with 0.5ml of manganous chloride solution (pure crystalli  $MnCl_2 \cdot 4H_2O$  dissolved in distilled water) and 0.5ml of Winkler's reagent (potassium hydroxide and potassium iodide dissolved in distilled water), The bottles were taken to the laboratory where precipitate of manganous hydroxide was allowed to settle down. The settled precipitate was dissolved by adding 0.5ml of concentrated sulphuric acid, resulting in liberation of the iodine. 50ml of this sample was titrated against .01 N Sodium thiosulphate using starch as an indicator. The amount of Sodium thiosulphate used in the titration was multiplied by the normality factor of 1.6, to obtain dissolved oxygen in  $mg\ l^{-1}$ .

**Total alkalinity:** Alkanity was obtained by titrating 100ml of water sample against .02N of  $H_2SO_4$  using phenolphthalein and methyl orange as indicators. The total alkanity was calculated by multiplying total amount of acid used in the titration by a factor of 10. The results are expressed as  $mg\ l^{-1} CaCO_3$  (Saunders et al. 1962).

**Chloride:** 100 ml of the water sample was titrated against N/35.46 silver nitrate using Potassium chromate as an indicator. The chloride content was calculated by multiplying amount of Silver nitrate used by a factor of 10. The results are expressed as  $mg\ l^{-1}$ .

1ml of Silver nitrate used by 100ml of smample is equal to 100 mg of Chloride.

**Calcium:** To 25ml of water sample, 5ml of N/10 NaCH was added so as to precipitate magnesium from the sample. This enables estimation of calcium alone. Then sample was then titrated against EDTA (  $Na_2 EDTA =$  disodium dihydrogen ethylenediaminetetra acetate) using solo chrome dark blue as an indicator. The quantity of calcium was calculated from the amount of  $Na_2 EDTA$  used. 1ml of EDTA = .01mg Ca. the results are expressed as  $mg\ l^{-1}$ .

**Magnesium:** 25ml of the sample was titrated against EDTA using Erichrome black T as an indicator for calculating total quantity of calcium and magnesium present, The amount of EDTA used for  $Mg^{++}$  titration alone was calculated by subtracting the volume of EDTA used in calcium titratic from the volume of EDTA used in EDT titration. The content of magnesium is calculated in  $Mgl^{-1}$ .

**Sodium and potassium:** sodium and potassium were estimated by flame photometry (systronics type 121). The standard solution was made with sodium chloride and potassium chloride. Before use the instruments was calibrated. The standard solution were held close to the intake tube so that it is atomized into flame. Sodium filter was used during the estimation of sodium and potassium filter for potassium estimation. The result are expressed as mg/lit.

**Phosphate- phosphorus (PO<sub>4</sub>-P):** the concentration of orthophosphate was estimated by adding 1ml of vogler reagent (12.5g Ammonium molybdate, 10g Ammoniosulfonic acid and 700ml bid stiller water and 144ml concentrated H<sub>2</sub>SO<sub>4</sub> mixed with 0.54g Antimony potassium titrate) and 0.25ml Ascorbic acid (5g dissolved in 50ml bidistilled water ) to the water sample. The intensity of blue colour developed was measured after 20 minutes with help of a Systronics Double Cell Colorimeter (type 102) using red filter with maximum transmittance at 700 mu. The blank was run with 1ml 2NH<sub>2</sub>SO<sub>4</sub> – KH<sub>2</sub>PO<sub>4</sub> (Potassium dihydrogen phosphate) was used for making various standards. The results are expressed as ug/lit

**Total Phosphorus:** Total phosphorus was calculated by evaporating 25ml of water sample in a silica dish. The residue was treated with 1ml of 70% perchloric acid and organic matter destroyed on heating. On cooling 10ml of distilled water and 0.5ml of Acid molybdate solution were added to the dish. The blue colour was developed by reducing phosphate molybdate complex with one drop of stannous chloride. The colour intensity was measured after fifteen minutes with the help of systronics Double cell Colorimeter ( type102) using red filter. The results are represented in ug/lit.

**Nitrate- Nitrogen (NO<sub>3</sub>-N)** it was estimated by Diphenylamine sulfuric acid method using potassium nitrate (KNO<sub>3</sub>) as the standard. 1 ml of the water sample was treated with a drop of concentrated NaCl and 4ml of nitrate reagent (2.2g of Diphenylamine dissolved in a mixture of 150 ml H<sub>2</sub>SO<sub>4</sub> (NO<sub>3</sub> –free) and 58 ml of bid stiller water) in a test tube. The contents of the tube were shaken vigorously. Cooled at once in cold water and the intensity of the colour developed was measured on the systronics colorimeter using red filter. The results are expressed in ug/lit.

**Ammonium- Nitrogen (NH<sub>4</sub>-N):** Nessler's method was used for the estimation of NH<sub>4</sub>-N 25ml of Nessler's reagent. The intensity of yellow colour was measured calorimetrically after 30 minutes, using blue filter with maximum transmitted at 480ug. Ammonium chloride was used for preparing standard solution. The results are expressed in ug/lit.

**Silicate :** it was estimated by molybdate method. 2ml of Molybdate reagent (10g Ammonium molybdate, 90ml distilled water and 100 ml 2NH<sub>2</sub>SO<sub>4</sub>) were added to 25ml of lake water. The intensity of yellow colour was measured by a photoelectrical colorimeter, using blue filter. The standard were prepared from Na<sub>2</sub> –SiO<sub>3</sub>.5H<sub>2</sub>O. the blank was run with 1 ml 2NH<sub>2</sub>SO<sub>4</sub>. the result are expressed as mg/lit<sup>-1</sup>.

**Iron :** it was estimated by KSCN method. To 25ml of water sample, 0.5ml of Hcl (1:1) a drop of bromine water and 0.5ml of KSCN (8N) were added. Absorbance of red colour developed was measured calorimetrically. The standards were prepared from NH<sub>4</sub>Fe ( SO<sub>4</sub>) 212H<sub>2</sub>O and the blank was run with 0.5ml of 1:1 Hcl. The results are expressed as ug/lit.

### 3. RESULTS:

- a) **Dissolved oxygen:-** Dissolved oxygen content of water ranged from 2.70 to 10.40mg/lit. the minimum concentration was recorded at site 1 (Ashia Bagh)
- b) **Hydrogen Ion Concentration:-** pH of the surface water was found have a range value between 125.00 - 175.00. The maximum of 175.00 was recorded at site 4( Nallah Amir Khan) and minimum of 125.00 units was recorded at site 2( Central Site)
- c) **Alkalinity (Carbonate and bicarbonate) :-** Carbonate alkalinity was found to be absent so total alkalinity was mainly due to bicarbonate ions which ranges from 125-175 mg/lit. the minimum concentration was recorded at site I ( Ashia Bagh) and maximum concentration was recorded at site 2 (Amir Khan Nallah)
- d) **Chloride:-** The chloride in the Khushalsar lake varied between 15-25 mg/lit. 25mg/lit as Maximum content was recorded at site 1(Ashia Bagh) and Minimum concentration of 15 mg/lit. was noted at site 2 and 3 (viz. central site and sudrabal respectively)
- e) **Calcium and magnesium Hardness:-** Calcium ion was found to lie between 53.70-68.80 mg/lit. with minimum content being recorded at site 1 ( Ashia Bagh) and the maximum at site 3 (Amir Khan Nallah). While magnesium content varied between 1.50- 5.10 mg/lit. the minimum concentration of 1.50mg/lit was observed at site 3 (Sudrabal) and maximum concentration of 5.10 mg/lit . was recorded at site 1 (Amir Khan Nallah)
- f) **Conductivity:-** The conductivity value ranged between 387-672EC 25<sup>0</sup>C. the minimum conductivity of 387EC25<sup>0</sup>C was recorded at site 3 ( Amir Khan Nallah) and maximum of 672 EC 25<sup>0</sup>C at site 1 (Near sudrabal)
- g) **Sodium and Potassium Ions:-** Sodium in surface water ranged between 5-14 mg/lit. the minimum value at 5 mg/lit was recorded at site 2 ( Sudrabal) and maximum of 14 mg/lit at site 1 ( Amir Khan Nallah)

- h) **Total Dissolved Solids:** Total dissolved solids in the water ranged between 193- 336 mg/ Lt being recorded at minimum and maximum at site 3 and 1 ( Sudrabal Amir Khan Nallah)
- i) **Silicate:-** Silicate in the form of SiO<sub>2</sub> ranged between 0.40-4.60 mg/lit the minimum concentration was recorded at site 2 (centre site ) and maximum at site 1(Amir Khan Nallah)
- j) **Phosphate phosphorus and total phosphorous:-** Phosphate phosphorous recorded a range lie from 45-187 µg/lit. having its minimum concentration at site 2 ( centre site) and maximum concentration at site 4 (Amir Khan Nallah). Total Phosphorus ranged between 606-2687µg/lit. the minimum concentration of 606µg/lit was recorded at site 2 ( centre site) and maximum concentration of 2687µg/lit. at site 4 (Amir Khan Nallah)
- k) **Iron:-** Soluble iron ranged from 267-1919µg/lit. minimum value was recorded at site 1 (Ashia Bagh) and Maximum value at site 1
- l) **Nitrate Nitrogen and Ammonical Nitrogen:-** Nitrate nitrogen values ranged between 81- 146 µg/lit the minimum concentration was recoded at site 2 and maximum 59µg/ Lt at site 4 (Centre site). Ammonical Nitrogen range value was between 120-181µg/lit. the minimum concentration of 120 µg/lit. was recorded at site 4 ( Nallah Khan)

**Table. 1 Chemical parameters of different sites of Khushalsar lake**

Chemical Parameters	1	2	3	4
D.O.(mg/l)	2.70	9.30	10.40	3.60
pH		8.60	8.30	8.10
HCO <sub>3</sub>	150.00	125.00	140.00	175.00
Total alkalinity	150.00	125.00	140.00	175.00
Cl <sub>2</sub>	25.00	15.00	16.00	24.00
Ca <sup>++</sup>	68.80	64.20	53.70	58.90
Sp.Condec.( 25 <sup>0</sup> C)	672.00	470.00	387.00	565.00
Mg <sup>++</sup>	5.10	4.20	1.50	3.30
K+(mg/l)	6.00	2.00	4.00	1.00
Na+(mg/l)	14.00	5.00	10.00	5.00
TDS(mg/l)	336.00	335.00	193.00	218.00
SiO <sub>2</sub> (mg/l)	4.60	0.40	0.70	2.10
PO <sub>4</sub> -P(µg/l)	187.00	45.00	52.00	78.00
TP( µg/l)	2687.00	664.00	1212.00	606.00
Fe( µg/l)	1919.00	267.00	335.00	744.00
NO <sub>3</sub> -N (µg/l)	57.00	32.00	39.00	59.00
NH <sub>4</sub> -N (µg/l)	581.00	284.00	120.00	195.00

#### 4. DISCUSSION:

The study of Ecological status of Khushalsar lake having the attitude 1583cm as the representative water body. The present study on the Khushalsar lake has been taken up to asses the nutrient overload and phytoplankton population in the lake environment.

The Khushalsar lake water oxygen raning between 2.70- 10.40 mg/l the bottom on comparing the dissolved oxygen the Khushalsar lake have quite less do than the Dal lake which is due to the richness in biota due the nutrient load.

The PH of Khushalsar lake was found to oscillated between 8.10-8.80. Rippey ( 1976) reported that higher PH level of water resulted in high relase of phosphate. The lake shows higher value of alkalinity ranging from 125-175 mg/l at different sites. So the lake is highly alkaline in nature in spite of higher nutrient conc. And anthropenic activities noticed for the lake.

Qadri and Yousf (1978) while studing the physico – chemical features of Mansbal lake, a warm monomitic lake of Kashmir reported that the lake water was hard with bi carbonate, negligible carbonate, high alkalinity and high Ph values . qadri (1981) while investigation the phyico-chemical feature of two trout streams the earth and madutmati of Kashmir had reported that the Madumati remained soft water type through out the year.

The concentration of divalent cations such as Ca<sup>++</sup> and Mg<sup>++</sup> in the Khushalsar lake varied between 53.70-68.80 mg/l and 1.50-5.10 mg/ l respectively during 2006 as shown in table (2) so the higher values recorded is in the high state of trophic level on the basis of high calcium and alkalinity values the water body can be included within the hard water type and according to Wetzel (1983) may characteristically backscatter light in blues and green and give predominantly a blue green colour to this body.

The lake shows higher values of silicate ranging from 0.40mg/l at site 2 . 4.60mg/l at site 1. the higher values is an indication of an increased eutrophy.

The lake shows higher values of nitrate nitrogen ranging from 32mg/l at site 2 to 59 mg/l at site 4 due to anthropogenic pressure the lake recorded in indicative of eutrophication.

The phosphorus values are high vanging from 120mg/l to 581mg/l at different sites.

Nitrogen and phosphurs are the limiting nutrient elements and phosphorus is the most important nutrient for the productivity in water. Hutchinson (1941) also suggested that in small stratified lakes, phosphorus is continuously passing from mud to the water and at the same time. it is removed from the water by entering into the bodies of plankton. Which settle down when they are turned to facial pellets or others wise die.

The other classes of zooplankton in the lake which were observed during the study in the month of Febuary 2006 are cladocera and copepoda.

Thus, from the mentioned discussion one can conclude that ecological status of Khushalsar is that the the lake is calcium rich with hard water. High range of some other paramanters from the investigation of the lake, it may be finalized that the lake is receiving the bluk quantities of nutrients, whic has resulted in the pollulion of the lake, which in turn leads to rapid eutrophication.

By studing the parameter of other lakes like Dal lake it was observed that the Khushalsar lake is more polluted than the Dal lake due to more addition of agriculture runoff, sewage etc.

It was estimated that the phosphouus and nitrogen load in two lakes reported 46kg/ yr in Dal lake 78 Kg's / yr. in Khushalsar and 840 Kg / yr in Dal lake 1150 kg / yr in Khushalsar respectively.

## 5. CONCLUSION:

Khushalsar Lake is supportive ground for diverse organisms. Due to heavy load of wastes the lake is under dyeing process the waste include Organic wastes like nitrogen, phosphorus which results in algal bloom and ultimately forms the food sources for zooplanktons and benthos. Khushalsar lake needs immediate measures to restore its glory of past.

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