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"Assessment Of Water Quality Status Of Lake Water In North Western Himalayan Region"

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ABSTRACT

The proportion of freshwater on earth's surface is only 2.5% of which only 1% is accessible for use. In this context, lakes are one of the most important resources of water and have been used as a source of water_supply for human consumption and in general accounts for about 0.3% of the total surface water resources. As such, the conditions of lakes have been in constant deterioration due to increased anthropogenic activities surrounding them. In the present study an attempt has been made to access the water quality using physico-chemical parameters with heavy metals of the Rewalsar Lake in north west Himalayan region. For this study three sampling sites were identified and samples from different sites were collected in winter season, summer season and rainy season and important water quality parameters with heavy metals were analyzed. Water quality parameters and heavy metals were Water Temperature, Color, pH, Conductivity, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Chloride, Total Alkalinity, Total Hardness, Calcium hardness, Magnesium Hardness, Viscosity, surface tension, Dissolved Carbon Dioxide (CO_2), Total Dissolved Solid (TDS), Lead (Pb), Cadmium (Cd), The results revealed that the different conditions of Rewalsar Lake in different sampling stations showed fluctuations in some physico-chemical parameters and also in heavy metals. These result depicted that water of lake was polluted in the form of nutrient enrichment which is due to agricultural activities and its runoff in and around catchment area of the lake. There are other many ways that things can end up in the lake as the free style way of disposal of industrial and domestic effluents etc. Results of studies on heavy metals in pollution are well documented revealing the toxic effects of these metals on aquatic organisms.

Kerwords: Physico-chemical, water quality, Water resources, APHA, Lake water.

Introduction:

Water contains many nutrients and minerals and is of primary importance in human life. It is an essential component for survival of life on earth, which contains minerals, important for humans as well as for earth and aquatic life [1]. In the past few years strict regulations and control have increased rapidly in monitoring of surface water bodies due to deteriorating environmental concerns. The quality of the lake water is dependent on the geological structure of earth and also on the anthropogenic activities surrounding it such as construction, waste dumping, agriculture and other associated activities. Water has important social and economic benefits as a result of tourism and recreation, and is culturally and aesthetically important for people throughout the world. Water also plays an equally important role in flood control [2]. However, the remarkable increase in population resulted in a considerable consumption of the water reserves world wide [3]. The quality of surface water is largely affected by natural processes (weathering and soil erosion) as well as anthropogenic inputs (municipal and industrial wastewater discharge). The anthropogenic discharges represent a constant polluting source, whereas surface runoff is a seasonal phenomenon, largely affected by climatic conditions [4-6]. The free style way of disposal of agricultural, industrial and domestic effluents into natural water bodies may cause serious contamination. Run-off from agricultural land and saline seeps subject the most vulnerable water pollution to increased salinity, so the freshwater lakes are highly affected. Extensive evaporation of water from the lake due to

high temperature and low rain enhances the amount of salts, heavy metals and other pollutants, which are conscientious factors for the poor quality of the lake ecosystem [7]. Among environmental pollutants, metals are of particular concern, due to their potential toxic effect and ability to bioaccumulation in aquatic ecosystems; therefore, it has public interest [8, 9, 10 and 11]. The serious environmental problems have been faced in developing as well as developed countries [12]. Dissolved constituents of water bodies are often determined as a major component for baseline limnological studies. The major ions Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, $SO4^{2-}$, HCO_3^{-}, and CO_3^{2-} are essential constitute of water and responsible for ionic salinity as compared with other ions [13]. Contamination of aquatic ecosystems with heavy metals is a serious problem, all over the world [14, 15]. In this regard, tremendous work has been carried out for assessing physico chemical parameters of various lakes throughout India [16-21]. Despite such an exhaustive work, up to now, there was no systematic study carried out for the physico-chemical analysis and quality control assessment of Rewalsar of Himachal Pradesh, India. Therefore, the present work requires to be undertaken.

MATERIAL AND METHODS

1. **Study Area -** Rewalsar Lake in North West Himalayan region.

1.1 Lakes of H.P. in North West Himalayan region: The state of Himachal Pradesh has 27 natural lakes covering an area of 15 hectares and manmade lakes covering an area of 712 hectares. They are spread over an altitude range of 450 to 5093 mtrs. Above sea level and cover tropical, sub-tropical and the alpine regions of the state. One percent mass of Himachal is under some form of water-lake and rivers and glaciers, of the lakes, some are natural bequests that date back millions of years to the time when the region was a vast inland sea and today, they are fed by streams of pure snow melt or by ground water springs. Practically without exception, they are held sacred or at the very least, have fascinating legends lapping their crystal clear waters. Others lakes are far more recent and are made reservoirs. Many are sources of the rivers that start as tiny streams and grow to become the giants that feed the fertile valleys of the state and the gangetic plains of worth India. Several are home to a variety of resident and migratory birds, and a host of aquatic life. These water bodies have also opened a tremendous range of activity and adventure that includes boating, swimming, canoeing, and water-skating, kayaking, sailing, surfing and fishing. Rewalsar Lake is situated in Mandi district of Himachal Pradesh, about 24 kms from Mandi Town. It is located 1360 mtrs above sea level. Its shape is quite like a square and with a shoreline of 735 mtrs; this dark jewel rests on a mountains spur and is protected by a variety of dense vegetation. The spot is held sacred by Hindus, Sikhs and Buddhists alike.

2. Sampling Station

Sampling station will be selected on the basis of the identified pollution problems to assess the overall status of the lake. The thought will given before the selection of sampling points after having the activity survey that all sorts of problems should be represented through the sample analysis to access the limnological status of the lake. Sampling stations are representing the lake as the deeper water zone and sewage inflow points. The representative samples of the particular zone will be checked with the analysis to reflect the status of the spot. On the basis of above criteria following three sampling points will be selected. The location and description of the sampling points of Rewalsar lake are as follows:-

Sampling Station **S1** inflow point – Near Bus Stand.Sampling Station **S2** inflow point – Zoo area.Sampling Station **S3** inflow point – Bathing Ghat.

MATERIAL AND METHODS

The Physico chemical parameters of water will be analyzed by standard method devised by American Public Health Association 24th edition 2023 & others [22].

The water samples were collected during the month of November and December 2013.The samples for analysis were collected in satirized bottles. Almost care was taken, so that no bubbling should observe during sampling, which avoids influence of the dissolved oxygen. The temperature was recorded at the sample site. The chemicals used were of A. R. grade and was used without further purification. The solutions were prepared in distilled water. The pH of water sample was measured with the help of pH meter (Elico LI-120) with a glass electrode. The pH meter was calibrated using buffer of pH 4.0 and 7.0. The conductance of water samples was measured using conductometer (Elico CM 180). For COD determination aliquot of sample water was taken in a round bottom flask which was acidified by concentrated H2SO4 and solid HgSO4 (0.4 gm) was added. A Standard K2Cr2O7 solution was added to

the resultant mixture and refluxed for two hours and unreacted K2Cr2O7 was determined by titrating against known concentration of FAS. The chloride ions present in the sample was determined by Mohr's method. A known volume of sample was taken into conical flask. A 2% potassium chromate was used as indicator and resultant solution was titrated against standard silver nitrate solution. For determination of hardness, EDTA solution of its disodium salt was prepared in distilled water, it was standardize by using Zinc ion solution at pH 10 and using solochrome black T indicator. A definite amount of sample water was taken in conical flask. It was buffered to pH 10. Few drops of indicator solochrome Black T was added and titrated against standard EDTA Solution. Similar procedure as total hardness was used for the determination of calcium hardness the only difference is that instead of solochrome Black T another indicator murexide was used. Dissolved oxygen and BOD determined by Wrinkle's method. Viscosity and surface tension is determined with the help of Ostwald's viscometer and stalgmometer. Heavy metals determined by Atomic absorption spectrophotometer.

RESULT AND DISCUSSION

The man made activities, anthropogenic stress have a considerable effect on the physico– chemical characteristics of water and of the lakes and affected the status of the water quality of the study sites. Social development and human activities greatly accelerate eutrophication. The main cause of eutrophication of reservoir is the discharge of nutrients through sewage.

Some of the parameters are above the permissible limits which have made its water unsuitable for human consumption. However the water seems to be suitable for agriculture and other domestic needs during all seasons. The results reveal that the lake water is polluted and the cumulative efforts to protect water bodies by bringing the National Lake Conservation Plan into action and creating awareness about its effect on health and environment.

Table: Variation in physico-chemical analysis of lake water.

S.NO.	PARAMETER	Sampling station- 1(NBS)	Sampling station-2(zoo area)	Sampling station-3(Bathing Ghat)
1	Temp.	12	12	
2	Color	Green	Green	Green
3	P^H	2.93	5.92	7.01
4	Conductivity	43.1	231.1	39.0
5	DO	2.2	2.0	2.2
6	BOD	0.570	0.8	0.820
7	COD	0.064	0.081	0.083
8	Dissolved CO_2	4.4	8.23	8.20
9	Total Hardness	44.5	44	45
10	Chloride	29.31	57.52	29.12
11	TDS	171	181	145
12	Alkalinity	ND	9.9	9.9
13	Viscosity	0.1189	0.1175	0.1125
14	Surface tension	73.49	73.59	73.15
15	Odor	Odorless	Odorless	Odorless
16	Pb	1.53	0.01	0.01
17	Cd	ND	ND	ND

All the values are in mg/lit except pH, TDS (ppm), surface tension(dyne/cm), viscosity(poise),Conductivity (µmho/cm) and temperature (0C).

The results obtained were analyzed, compared with the WHO standards and discussed in brief, which had played a conclusive role in deciding the status of water quality of lakes under study.

1. **Water temperature:** The air and water temperatures have a direct effect on free CO2, Acidity, Ph, Nitrate and other parameters; show a slight variation during the seasonal changes. The water temperatures are within optimum range of aquatic life supporting system in the water bodies and always higher than that of the air temperature due to its natural slow cooling phenomenon and intermolecular interaction occurring due to the wind action.
2. **Color:** The color of Rewalsar lake water at sampling stations 1,2 and 3 is green.

3. pH: pH of Rewalsar lake varies from 2.93 to 7.01 maximum at station 3 and minimum at station 1 in. It is found a slight acidic as well as basicity of water it may be due to addition of chemical pollutants from agriculture waste.

4. Conductivity: Conductivity is due the dissolved cations and anions in the water samples. The conductivity of Rewalsar lake varies from39.0 to 231.1, minimum is at station 3 and maximum at station 2. At this station addition of chemical pollutants of urban, weed infestation may take place.

5. Chloride: Chloride of Rewalsar lake is varies from 29.12 to 57.52, minimum at station 3 and maximum at station 2.

6. Total Hardness: Hardness of water is due to salts of Ca and Mg. Total hardness of Rewalsar lake varies from 44 to 45 minimum is at station 2 and maximum is at station 3.

7. COD: The chemical oxygen demand Rewalsar lake varies from 0.064 to 0.083, minimum is at station 1 and maximum is at station 3.

8. Dissolve Oxygen: Dissolved oxygen reflects the status, physical and biological process in water, shows the metabolic balance and D.O. level acts as an indicator of water body. DO of Rewalsar lake is varies from 2.0 to 2.2, minimum is at station 2 and maximum is at station 1and 3.

9. **BOD:** BOD of Rewalsar lake varies from 0.570 to 0.820, minimum is at station 1 and maximum is at station 3.

10.DISSOLVED CO2: The free CO2 concentration change may be due to the micro bacterial activities, increase in & biochemical reactions. CO2 of Rewalsar lake varies from 4.4 to 8.23, minimum is at station 1 and maximum is at station 2.

11. **Surface tension**: Surface tension of Rewalsar lake varies from 73.15 to 73.59 , minimum is at station 3 and maximum is at station 2.

12. **Viscosity:** Viscosity of Rewalsar lake varies from 0.1125 to 0.1189, minimum is at station 3 and maximum is at station 1.

13. **Alkalinity:** Alkalinity of Rewalsar lake varies from 0 to 9.9, minimum is at station 1 and maximum is at station 2.

15. TDS: The high TDS may adversely affect water quality by increasing the density of water, changing the osmoregulation and thus reduce the solubility of the gas and utility of water for drinking, irrigation, industries and other domestic purpose. TDS of Rewalsar Lake varies from 145 to 181, minimum is at station 3 and maximum is at station 2.

16.Odour: It is to be observed that the water of Rewalsar lake at station 1,2 and 3 is odourless.

17.Pb: Pb in Rewalsar lake varies from0.01 to 1.53, minimum is at station 2 and 3 and maximum at station 1.

18. Cd: Cd in Rewalsar lake is not identified.

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