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Deterioration of water quality of Anchar Lake as indicatedby analysis of various water quality parameters

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ABSTRACT

Various physico-chemical parameters of water body were assessed over a period of one year from March 2016 to February 2017 on monthly basis at different sampling sitesinAnchar Lake. Thephysico-chemical parameters assessed at three selected sites were Air temperature, Water temperature, Turbidity index, Dissolved oxygen, Total alkalinity, Electrical conductivity, pH ,Depth,Transparency,Total hardness, Chloride, Nitrate Nitrogen, Total Phosphorus, TDS,. The data collected from water analysis indicates eutrophication in lakeis related to heavy nutrient loading from human inhabitation around lake, runoff from nearby settlementsespecially from SKIMS (Sheri Kashmir Institute of Medical Sciences) and agricultural fields. It is evident from the analysis that organic matterhas drastically increased due to dumping of carcasses in lake which hasresulted in deterioration of water quality. It is a grave concern to take some necessary steps to conserve the Lake in near future from furtherdeterioration.

Key words: Physico-chemical parameters, Carcasses, Eutrophication, deterioration, Anchar Lake.

I INTRODUCTION

Water is the most fundamental and one of the primary necessitiesfor survival and no one can imagine to live life without this natural source (Khanna *et al*., 2007). The most irresistible character of water is its huge quantity present on the land of earth. Besides, 80% of population of valley is dependent on these water bodies.The lake is connected with Khusalsar Lake from southern end which in turn is connected with the famous Dal Lake through small inflow channel, NallaAmir Khan. River sindh enters the Lakeon its northern side, Lake is also fed by a number of springs present in the basin itself and along its periphery. At the south east of this water basin is situated one of the famous hospitalSKIMS (Sheri Kashmir Institute of Medical Science), discharging its toxicwastes into Lake and this Lake also receives the agriculture runoff and domestic sewage from the surrounding agricultural field and residential areas without any filtration plant and that enhance the nutrient levels of the Lake (Singh, R. K. and Singh, K. N.,

2007).As a result of heavy anthropogenic pressure, due to negligence on behalf of local people of Anchar village and government authoritieswho can never come forward for the betterment of the Lake and play a positiverole(Sharma *et al.*,2012).So that, the quality of the Lake is deteriorated day by day due to the various factors which can give the birth tothreat not only to the biodiversity of Lake but also to the people which are directly or indirectly depend on the source ofLake (Jeelani and Kaur,2012) and (Bhat *etal.*,2013),the aquatic life is also badlyaffected. This encourages us to study the physico-chemical propertiesof this water body for a period of one year at different locations.

II STUDY AREA

Observations were carried out on monthly basis to check the level of contamination in Anchar Lake, which is popular among the records of Kashmir civilization due to its vast agricultural out comes as well as huge fresh water resources, usable for the survival of life. It is situated 12 km to the North West of Srinagar city in Kashmir valley at an altitude of 1584m a.s.l within the geographical coordinates of 34°20´ - 34°26´ North latitude and 74°.82´- 74°.85´ East longitude. Towards the north east of the lake is situated the complex of Sheri-Kashmir institute of Medical sciences(SKIMS) draining much of its effluents into the lake. Three study sites were selectedin the lake that represents different environmental features.

III MATERIAL AND METHODS

During the present study all physico-chemical parameters were analyzedin according to the procedures given in APHA (1998), Golterman and Clymo(1969),Mackereth(1978)andTrivedy, R.K. and Goel, P.K. (1986). Sampling was done during the day time at three sampling sites,Water samples for physical chemical Characteristics were collected on monthly basis.Temperature and Transparency were measured in the field, Dissolved oxygen were fixed on the spot in accordance with Winklers method, PH of the water was determined by an electronic method using a laboratory pH meter, Conductivity was measured by a digital conductivity meter and TDS was measured by digital TDS meter. Water samples for various physico- chemical parameters was stored and carried to laboratory in polyethylene bottlesof 1 L capacity from pre-selected sites with the help of Ruttner type water sampler (Ruttner, 1968), Turbidity , Total alkalinity, Chloride, total hardness, Nitrate Nitrogen and total Phosphorus were determined separately. The average (mean) for each parameter per month was computed, considering the values from three stations viz., Jinab Sahib, Central site and Sangam outlet to evaluate the parameters of ecological concern.

Morphometric features of the Anchar Lake

Location

Latitude: - *34°20´ - 34°26´N*

Longitude: - *74°.82´- 74°.85´E*

Lake type: - *Freshwater*

Floating Gardens: - *1.7km²*

Surface area: - *5.8 km^2*

Land: - *0.51km²*

Marsh: - *1.08km²*

Length: - *3.6 km*

Width: - *1.6 km*

Maximum depth: - *1.8 m*

Minimum depth: - *0.8 m*

IV RESULTS AND DISCUSSION

Air and water temperature ranged from 2.3°C to 29.5°C and 5.7°C to 19.5°C respectively. The maximum water temperature was recorded in June-August and minimum was observed in December-January, while as for air temperature the maximum was recorded in June and minimum in January. The monthly variation was noticed during the present investigation in both air and water temperature, which is in accordance with Zuber*et al*. (2010) and Parray*et al.* (2010).More fluctuations were observed in water temperature than air temperature due to the shallowness of Lake. As a result, the volume of the water comes in the air contact which means relationship exists between atmospheric temperature and water temperature.

The turbidity index values ranged from 2.9 to 5.8 mg $_L^{-1}$ in all the study sites throughout the whole study period. The present study revealed low Secchi values. The low values have been attributed to different factors, viz. plankton population Zutshi DP and Vass KK. 1970, the set of materials in calm weather, suspension of phytoplankton in water Khan MA, Zutshi DP (1980). The flow of sewage and increased quantity of dissolved organic matter is also the factor for low Secchi values Wanganeo A (1980).In analyzing the monthly reports of the Lake, it has been disclosed that during the rainy season the water will show more turbidity limits as compared with the dry seasonal time.

Dissolved oxygen is an essential parameter in analyzing water quality values and also helps to carry out the speed of metabolic processes of various organisms. In the present study, the dissolved oxygen concentration in all the study sites varied from 3.5 to 6.5 mg $_L^{-1}$ throughout the study period. Low value of DO is an indication of a tendency towards an anoxic condition. The low dissolved oxygen is mainly due to effluents released from SKIMS, adding large quantity of organic wastes which consume the dissolved oxygen. The values further deplete during summer

because of high temperature, the oxygen holding capacity of water decreases. In winter season dissolved oxygen level was found to be low just because of various biological activities (Vass *et al.*, 1977) and (Qadri*et al.*, 1981).

Total alkalinity in all the study sites during the study period ranged from 100 to 399 mg_L^{-1}. This was due to extreme photosynthetic activity removing free as well as bound carbon dioxide from bicarbonates. As a result calcium carbonate got precipitated and pH value increased. As per the classification of Moyle(1945).

The present estimation of electric conductivity varied from 200 to 475 μScm-1. The highest value was recorded in April-June whereas the lowest value was recorded in December- January which can be related to the abundance of nutrients released during the decomposition of organic matter ofmacrophytes and animals at rising temperature. Increased electrical conductivity is regarded as pollution indicator in shallow lakes.

The pH of water ranged from 7.2 to 8.3. The Ph values of water indicates water to be on alkaline side in the Anchar Lake. The alkaline nature of water is attributed due to the increased organic compound degradation and coincides with the period of higher photosynthetic activity by macrophytic infestation of several regions of the lake.Variations of pH over a high range are often observed in the lakes due to several factors such as production of salicylic acid by the hydrolysis of silicates in the rock beds of the catchment areas.(Sankar*et al*., 2010).

During the study period of various sites the depth of water fluctuates due to the change occurred in various climatic factors from time to time ranged from 0.08 to 1.8 meters. Shallowness of the Lake is attributed to the process of continuous silting.

During the present study transparency ranged from 0.15 to 0.53 meters. It is a function of the quantum of suspended and dissolved solids and subsequently reflects the portability of the fresh water. Greater the transparency deeper penetration of light and hence the higher rate of photosynthesis. Most workers have found transparency to be higher in winter and low in the summer. A similar trend was observed during the present study. This condition has been attributed to different factors by different limnologists like settling of materials in calm weather (Spurr, 1975), suspension of phytoplankton in the water (Zutshi*et al*., 1980)and glacial slit (Zutshi and Khan, 1978). The transparency was low at all sites of Anchar, which may be due to increased suspended matter, silt load and humus brought in from the catchment area as well as due to rich macro- vegetation, which determines the nature of eutrophic Lake OECD (1982).

The values of total hardness ranged from 150 to 450 mg $_L^{-1}$. Hardness is the concentration of multivalent metallic cations in solution and, due to carbonates and bicarbonates of calcium and magnesium salts from detergents and

soap. The degree of hardness fluctuated irregularly from month to month at different Sites. Similar observations were noticed by Trisal (1977) and Pandith (1993).

The chloride contents of the water samples in all the study sites throughout the study period varied from 12.3 to 2.5mg $_L^{-1}$. The present study found a chloride concentration increases from January to March. The high chloride content may be attributed to the presence of large amounts of organic matter of both allochthonous and autochthonous origin (Pandit, 1999). Zuber*et al*. (2010)recorded an increase in chloride values due to heavy inputs of domestic sewage along with surface runoff into the domain of the river from the catchment area.

From the time of study period Nitrate Nitrogen ranged from 119.1 to 148.6μg_L^{-1}. In the present study period an increase in the concentration of Nitrate Nitrogen was observed, that can be related to oxidation of Ammonical Nitrogen to Nitrate J.H. Quastle, P.G. (1951) andD. Q. Toetz (1981).

In the present study total phosphorus ranged from 140 to 473μg_L^{-1} in all the study sites. In the vertical column, values were generally increasing from the surface to bottom, Wanganeo (1980). This may be due to both allochthonous and autochthonous inputs, when the metabolic activity in the water starts to gear up.

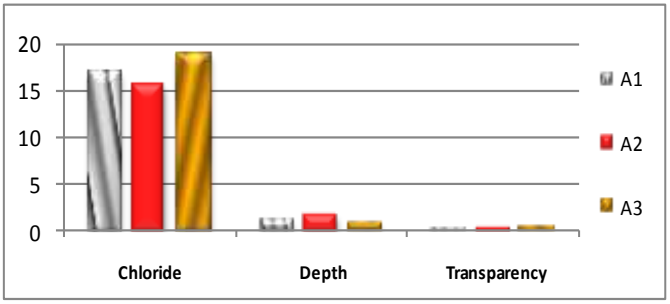
The huge quantity of salts is dissolved in natural waters and during the present study total dissolved solids ranged from 120 to 397μg_L^{-1}. These are mainly carbonates (CO_3), bicarbonates (HCO_3^-), sulfates (SO4 $_2^-$), phosphates (PO_4^{3-}), chlorides (Cl^-), and nitrates (NO_3^-) of Calcium, Magnesium, Sodium, Potassium, Iron, and Manganese. APHA, AWWA and WEF, 21st Edition, 2005. So to be comprehensive, Anchar Lake has over the period of time turned out to be a sink for the faecal matter, detergents, soaps, sewage, suspended particles. Emanating frompeople living in its catchment area which not only has deteriorated the water quality but has also rendered it unfit for drinking purposes.

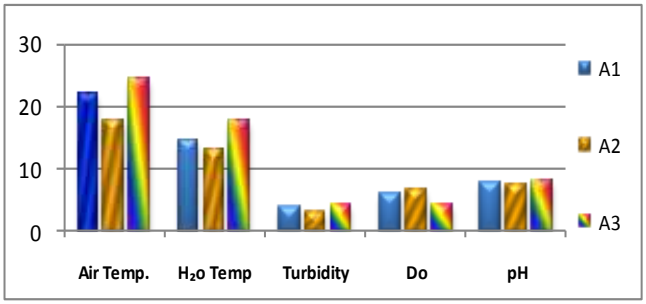
Table 1:-The monthly analysis ofrange of mean variation and Standard Deviation of physico-chemical parameters of three different sites at Anchar Lake during Mar2016 to Feb 2017.

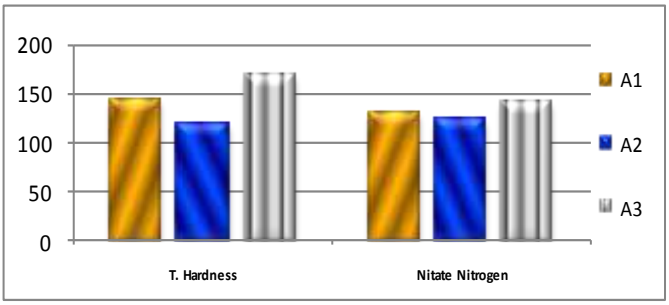
S.No.	Parameters	Units	Range of Variation	
			Min	*Max*
1.	**Air temperature**	**^oC**	2.3	29.5
2.	**Water Temperature**	**^oC**	5.7	19.5
3.	**Turbidity**	**mg^{L-1}**	2.9	5.8
4.	**Dissolved O_2**	**mg^{L-1}**	3.5	6.5
5.	**Total Alkalinity**	**mg^{L-1}**	100	399
6.	**E. Conductivity**	**(µS/cm)**	200	475

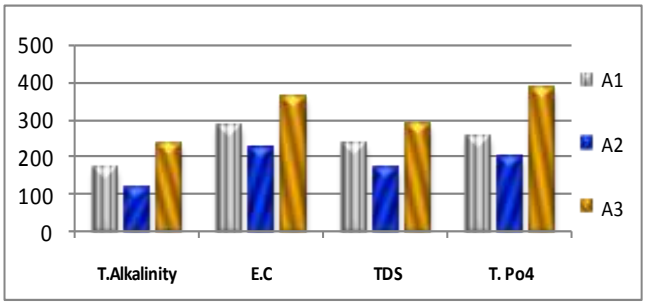
7.	**pH**	**-**	7.2	8.3
8.	**Depth**	**M**	0.8	1.8
9.	**Transparency**	**M**	0.15	0.53
10.	**Total Hardness**	**mg^{L-1}**	109	182
11.	**Chloride**	**mg^{L-1}**	2.5	12.3
12.	**Nitrate Nitrogen**	**(μg^{L-1})**	119.1	148.6
13.	**Total Phosphorous**	**(μg^{L-1})**	140	473
14.	**TDS**	**(μg^{L-1})**	120	397

Fig: - 2 ***to 5*** Monthly fluctuations in the physico-chemical parameters of three different sites at Anchar Lake during Mar 2016 to Feb 2017.









V CONCLUSIONS

In this study higher values of physico-chemical parameters obtained indicates the eutrophic status of the lake .Thevarious water quality parameters of the surface water of Jinab Sahib, Central Site and Sangam outlet of AncharLake were evaluated. Above results bring light to the fact the Anchar Lake an important ecosystem for both flora and funna is under constantly increasing anthropogenic pressure resulting in encroachment, water pollution,

weed infestation, siltation and it is present trend of excessive anthropogenic pressure and resultant degradation of Lake is not addressed in time, Lake may deteriorate beyond retrieved and must face an ecological disaster.

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