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Assessment of Physio-Chemical Parameters of Goverdhan Sagar Lake (GSL)

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Abstract: ***The study was carried out to assess the Current physico-chemical and biological status of lake Goverdhan Sagar of Udaipur. The physico-chemical and biological parameters of the lake have been studied at three different locations for a period of four months from Jan'2022 to April'2022. Physico-chemical parameters of lake were found to be moderate throughout the study period as per drinking water standards. As per tests performed following water quality parameters were found, the average Temperature of water was found to be 28.31℃, Colour and Odour disagreeable, and pH of lake was found with mean value of 9.1. Area of Study the mean value of BOD 4.02 ppm and COD 45.88 ppm was observed. The mean value of dissolved Oxygen (DO) 5.4 was found and satisfactory for the survival and growth of aquatic organisms. In present study the mean value of nitrogen was found as 7.23 ppm, which is under permissible limit. The hardness is mainly due to calcium and magnesium ions. During the study, mean value of total hardness, Calcium hardness and Magnesium hardness was observed as 31.50 ppm, 7.60 ppm and 23.91 ppm respectively, which are under permissible limits. finding of lake water which recorded mean value of total alkalinity 253.25 ppm. During the study mean value of chloride content observed as 165.48 ppm which is below the permissible limit. Fluoride 0.58 ppm was found as a mean value.***

The High value of pH, EC and TDS characteristics of Lake Goverdhan Sagar shows its nutrient rich and alkaline nature. The water quality indicated that the water of lake is suitable for the fishery purpose. However, water of the lake was not found suitable for potable and domestic uses as the high value of bacterial load, bio-chemical oxygen demand and Chemical oxygen demand showed its high pollution status.

Keywords: Physico-chemical Parameters, biological parameters, Water Quality, Assessment, BOD, COD, TDS

I. INTRODUCTION

As water is the prime element for survival of life on planet Earth and it cannot be replaced. It is used for basic needs, irrigation needs and also for industrial development. If the water is polluted or has too much salt in it, it will not be suitable for drinking, Crops and plants irrigated with saline water will not be healthy and food production will decline. A lake is a large body of water surrounded by land, inhabited by various aquatic life forms, for all practical purpose, pure water is considered to that which has low dissolved or suspended solids and obnoxious gases as well low in biological life. Such high quality of water may be required only for drinking purposes while for other uses like agriculture and industry, the quality of water can be quite flexible and water polluted up to certain extent in general sense can be regarded as pure. The health of lakes and their biological diversity are directly related to health of almost every component of the ecosystem. Each lake has its own characteristics, such as drainage, inflow and outflow, size, nutrient content, dissolved oxygen content, temperature, pH and productivity.

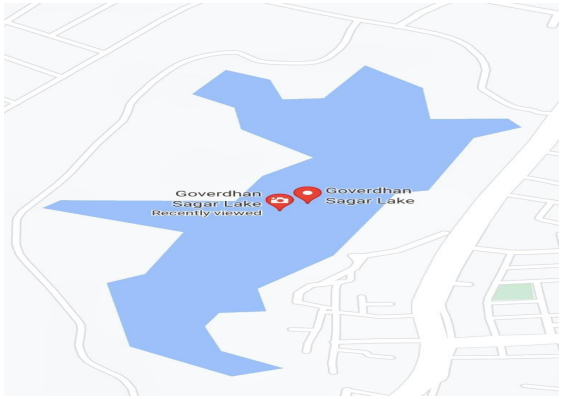

Fig No 1.1: Google map image of Goverdhan Sagar Lake (GSL)

II. LITERATURE REVIEW

Hardik Vashishtha, Himanshu kumar Sadhya (2020) have studied Physico-chemical parameters of lake were found to be moderate throughout the study period as per drinking water standards. The average water quality parameters of the lake during the study period were found to be, Temperature as 28.6 0C, Colour and Odour disagreeable, pH as 9.0, EC as 735 ppm, BOD as 3.8 ppm, COD as 42.3 ppm, DO as 5.3 ppm, Nitrogen Content as 7.1 ppm, Alkalinity as 245.9 ppm, Total Hardness as 30.9 ppm, Calcium Hardness as 7.9 ppm, Magnesium Hardness as 23.0 ppm, Chloride Content as 161.7 ppm, Fluoride Content as 0.5 ppm, MPN coliform as 350 MPN/100 ml. High value of pH, EC and TDS characteristics of GSL shows its nutrient rich and alkaline nature.

Rawal et al., (2014) studied the water quality of Pichhola Lake in Udaipur between 2011 and 2013. In this study, three sampling sites selected for collection of lake water sample and different water quality parameters were measured in the laboratory. During the study, the average water quality parameters of the lake were recorded as the average temperature varied between 20.1 ºC to 34.2 ºC, the value of pH indicate that the lake water is alkaline and pH value ranges from 7.70-8.67, Total alkalinity varies from 169-196 mg/l, the average value of total hardness is ranges between 171- 200mg/l, the value of dissolved oxygen varies between 6.4-10 mg/l, Bio-chemical oxygen demand ranges from 2.5-4.9 mg/l, Chemical oxygen demand ranges from 20.8-31.5 mg/l. In this study, the water quality of Pichhola lake was found to be ascertain for drinking water supply and lake water is polluted, as many of these parameters were recorded above permissible limit.

Choubisa and Dubey (2017) Conducted study on Kishore Sagar Lake, Kota in April 2017 in order to analyze the Phytoplanktonic diversity and Physico-chemical characteristic of lake. In this study, three sampling sites selected for collection of lake water sample and had measured different water quality variables. From the study, the average water quality parameters of the lake: water temperature 28.3°C, Turbidity 10.91 NTU, pH value 8.67 units, EC 444.33 µS/cm, mean value of total alkalinity 126.67 mg/L, total hardness of 173.33 mg/L, Chloride 60 mg/L and fluoride 0.67 mg/L, Nitrate – Nitrogen 4.33 mg/L, sulphate 18 mg/L, TDS 311 ppm, mean value of dissolved oxygen 6.93 mg/L, BOD 4.13 mg/L, COD 130 mg/L.

K.C.Khare et.al he was done water quality assessment of Katraj lake, pune. He was done water analysis for the parameters like pH, DO, BOD, COD, TDS, Calcium, Magnesium and Hardness for lake water. The analysis of Water quality indicates the temperature in the range of 240 C.The pH was 7.3 to 8.45.It shows slightly alkaline water. The DO varied from 4.8 to 5.7 mg/l.The total hardness ranged from 160 to 298 mg/l which is higher than permissible limit. The turbidity of water was 28 to 42 NTU which is higher as per the APHA limit.

Dangi and Sharma (2017) conducted study on Pichhola Lake which is located in Udaipur city between February'10 and May'10 in order to analyze Water quality status of Lake Pichhola, Udaipur, Rajasthan. In this study two sampling sites selected for collection of lake water sample and had measured different water quality variables. dissolved oxygen were determined in the field itself, while the measurement of electrical conductivity (EC)/Total dissolved solid (TDS), orthophosphate, free carbon dioxide, total hardness, carbonate alkalinity, bicarbonate alkalinity and total alkalinity were analyzed in the laboratory. It was observed on the basis of physicochemical characteristics, Lake Pichhola is nutrient rich, alkaline and hard water body. The water quality indicated the suitability of Lake Pichhola for fishery purpose.

III.METHODOLOGY AND WATER QUALITY PARAMETERS

The details like location and study area, selection of sampling station, sampling method and Parameters to be tested. The detailed methodology has been described under the following sections:

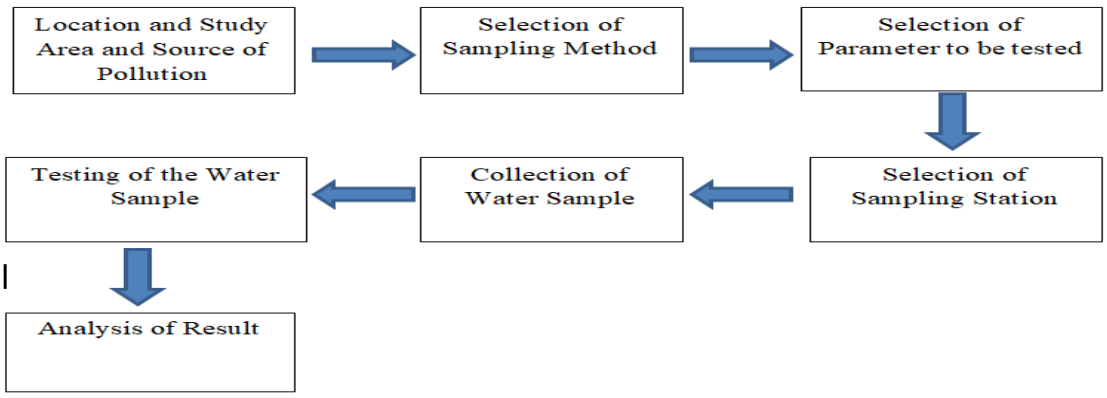

Fig No 3.0:- Flow diagram of Methodology

A. Parameters to be Analysed

Water Quality parameters like Temperature of water, pH will determine on field itself and for the analysis of the Alkalinity, Nitrogen content, Hardness, Dissolved oxygen (DO), Chemical oxygen demand (COD), Bio-chemical oxygen demand (BOD) sample were brought to the laboratory in polyethylene bottle of two litter capacity and analysed as soon as possible.

The water quality of Goverdhan Sagar Lake was analysed using standard methods as mentioned in the Manual on Water and Wastewater analysis.

IV. RESULT AND DISCUSSION

A. Test Result of Temperature

Temperature plays an important in influencing the characteristics of water. When temperature gets high it reduces the solubility characteristic of water which in turn affects the quality of water and shows the level of contamination/pollution.

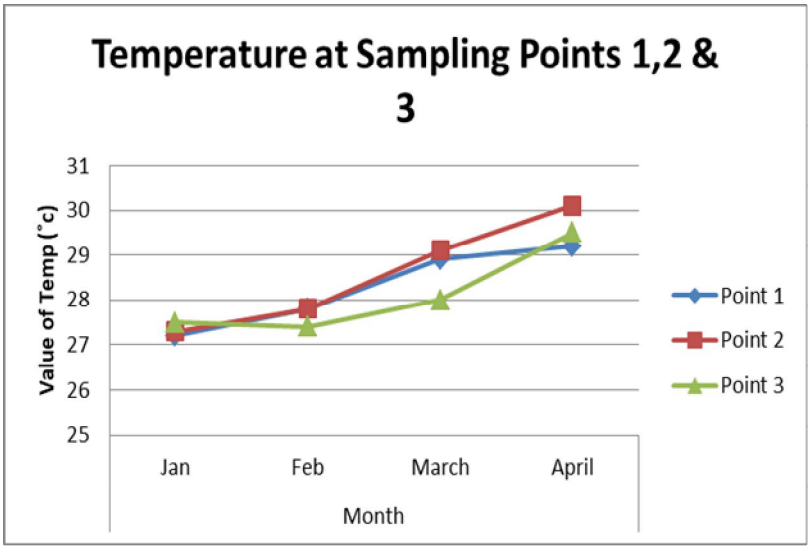

Figure No 4.1:-Monthly variation of Temperature at Sampling Points 1, 2 & 3

B. Test Result of pH

The water of lake Goverdhan sagar remained alkaline throughout the study period. Variation in pH is between 9.1- 9.4, 8.9- 9.3, 8.9-9.3 at collection point 1, Collection Point 2 and Collection Point 3 respectively.

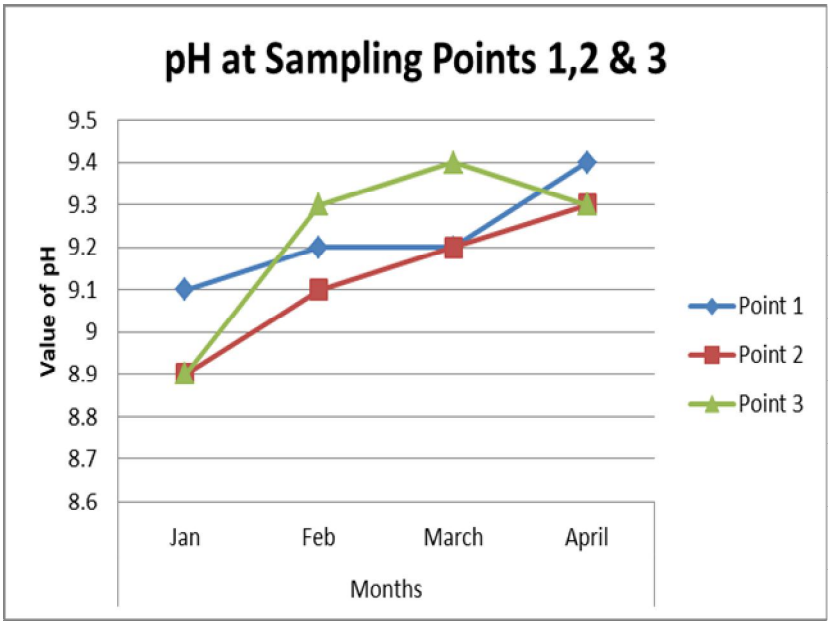

Figure No 4.2:- Monthly variation of pH value at sampling points 1, 2 & 3

C. Test Result of Electrical conductivity (EC)

The electrical conductivity represent total ionic load in water due to dissolved substance. In present study the EC of water was recorded between 789 – 810 mS/cm at all three sampling points.

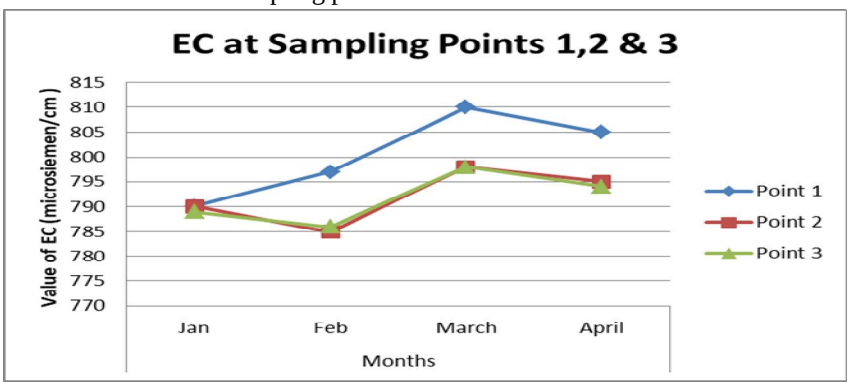

Figure No 4.3:- Monthly variation of EC value at Sampling Points 1, 2 & 3

D. Test Result of Total Dissolved Solids (TDS)

The total dissolved solids (TDS) at sampling point 1 varied between 512ppm – 525 ppm, at sampling point 2 it varied between 511ppm- 520 ppm, at sampling point 3 it varied between 512ppm – 519 ppm. The highest mean value of TDS 525 ppm was observed in the month of march at point 1 and the lowest mean value of TDS 511 ppm was recorded in the month of January at point 2. Overall mean value of TDS was recorded as 515.25 ppm.

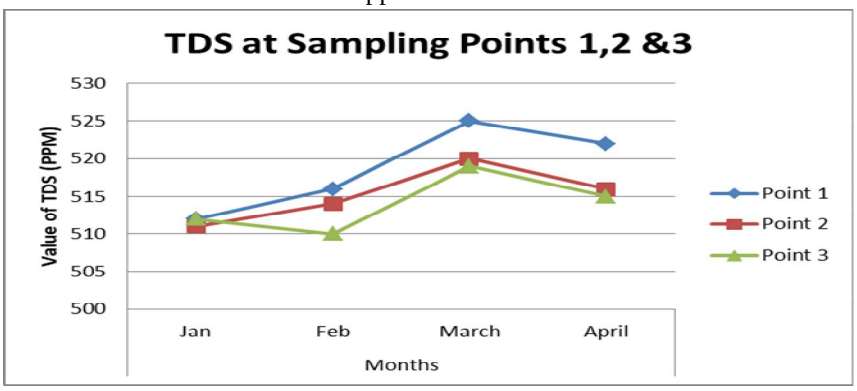

Figure No 4.4:- Monthly variation of TDS value at Sampling points 1, 2 & 3

E. Test Result of Bio-chemical oxygen demand (BOD)

BOD is a measure of quantity of oxygen required by bacteria and other microorganisms under aerobic condition in order to biochemically degrade and transform organic matter present in the water body. High BOD is considered as a limiting factor for the living organisms, it is an indirect indicator of organic pollution of water body. In present study the values of BOD were recorded with care as per the sampling procedure and it was found between 3.89 - 4.12 mg/l at all three sampling points.

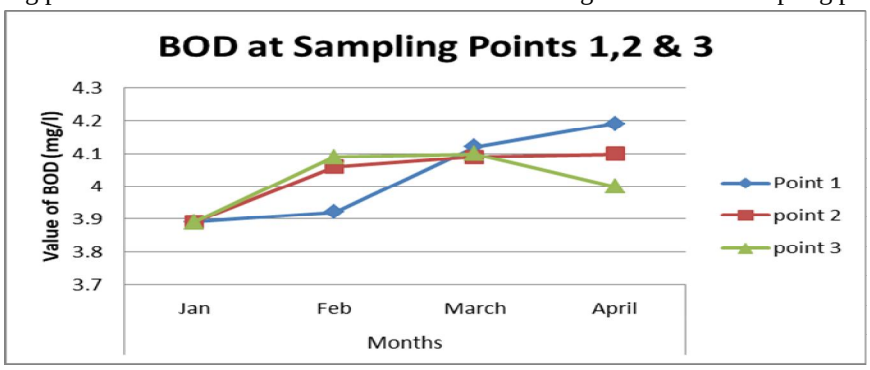

Figure No 4.5:- Monthly variation of BOD value at sampling Point 1, 2 & 3

F. Test Result of Chemical Oxygen Demand (COD)

COD gives a measure of organic strength of domestic and industrial wastes. The higher value of COD indicates the presence of undesirable organic matter, demanding investigation of the cause before the water is pronounced potable. In present study the values of COD were recorded with care as per the sampling procedure and it was found between 42.84 - 48.21 ppm at all three sampling points. COD has indicating the pollution level due to oxidisable organic matter present in water.

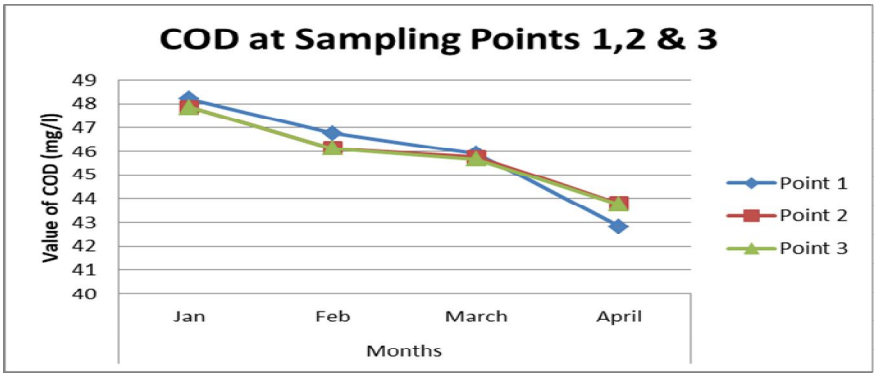

Figure No 4.6:- Monthly variation of COD value at sampling point 1, 2 & 3

G. Test Result of Dissolved Oxygen (DO)

Dissolved oxygen is the most critical water quality variable in aquatic ecosystem. It is of primary importance both as regulator of metabolism of plant and animal communities and as an indicator of water condition. In present study the values of DO were recorded with care as per the sampling procedure and it was found between 4.2 – 5.7 mg/l at all three sampling points.

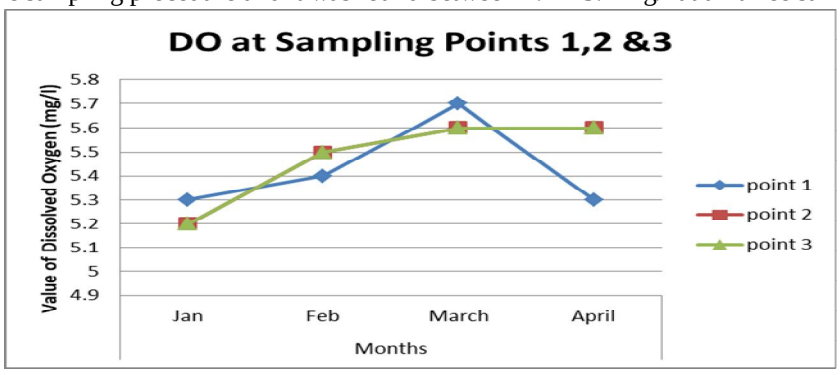

Figure No 4.7:- Monthly variation of DO value at sampling points 1, 2 & 3

H. Alkalinity

Natural water bodies show a wide range of fluctuation in total alkalinity values depending upon the location, season, plankton population and nature of bottom deposits. It is a measure of buffering capacity of the water and is important for aquatic life in a fresh water system because it acting as a stabilizer for pH. In present study the Alkalinity of water was found between 242 - 272 ppm at all three sampling points.

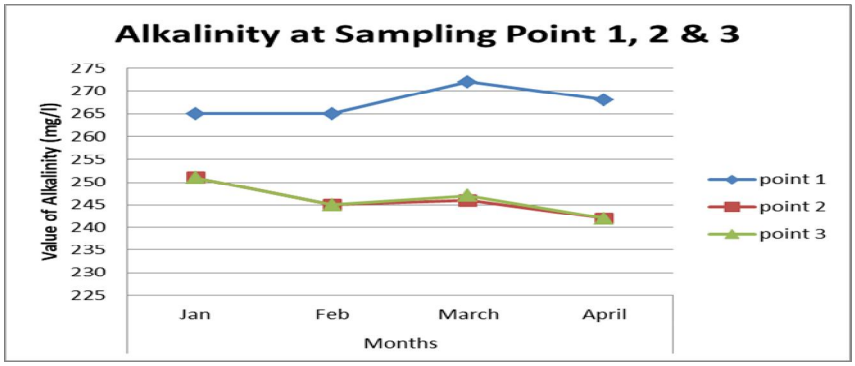

Figure No 4.8:- Monthly observation of Alkalinity value at sampling points 1, 2 & 3

I. Test Result of Total Hardness

The value of total hardness lies between 30.1 mg/l -32.0 mg/l, 31.4 mg/l - 32.3 mg/l, and 31.2-32.3 mg/l for sampling point 1, sampling point 2 and sampling point 3 respectively (Figure 4.9). The highest mean value of total hardness 32.3 mg/l were observed in the month of Jan and the lowest mean value of total hardness 30.10 mg/l were recorded in the month of April. Overall mean value of total hardness was recorded as 31. 5mg/l.

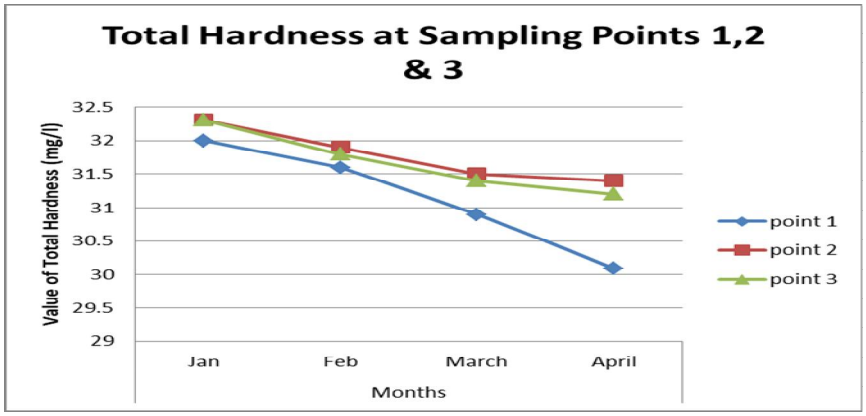

Figure No 4.9:- Monthly variation of Total Hardness value at sampling points 1, 2 & 3

J. Test Result of Total Nitrogen content

The value of Total nitrogen content oscillates between 7.4 mg/l – 7.1 mg/l, 7.4 mg/l – 7.1mg/l, and 7.3 mg/l – 7.0 mg/l for sampling point 1, sampling point 2 and sampling point 3 respectively. The highest mean value of Total nitrogen content 7.4 mg/l were observed in the month of April and the lowest mean value of Total nitrogen content 7.0 mg/l were recorded in the month of March. Overall mean value of Total nitrogen content was recorded as 7.2 mg/l.

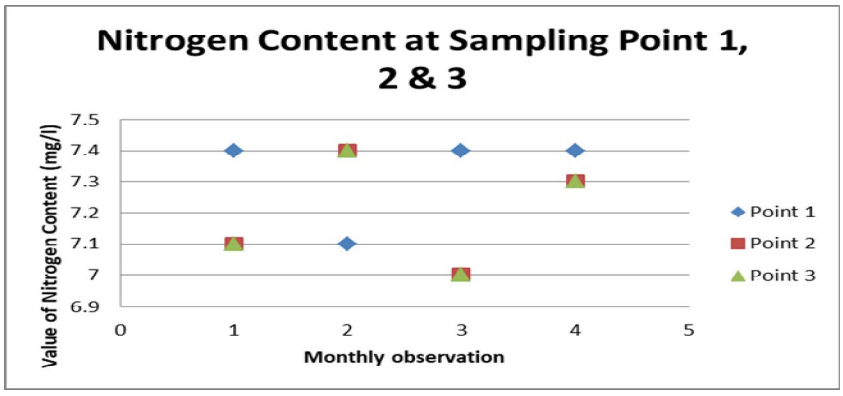

Fig No 4.10:- Monthly variation of Nitrogen Content value at sampling points 1, 2 & 3

V. CONCLUSION

The present work was conducted to find out the physico-chemical parameters and biological parameter of Goverdhan Sagar Lake Udaipur in southern Rajasthan. From this study, following conclusions have been made.

1) The present study reveals that the water temperature was determined as mean value of 28.31℃.

2) For Goverdhan Sagar Lake pH was determined with mean value of 9.1, which is moderately alkaline; high electrical conductivity and total dissolved solids supports fairly good aquatic productivity indicates initial eutrophication.

3) As far as organic loading in study area the mean value of BOD 4.02 ppm and COD 45.88 ppm was observed during the study period which is somewhere between reasonable and tolerable category of water.

4) Study also reveals that mean value of dissolved Oxygen (DO) 5.4 is satisfactory for the survival and growth of aquatic organisms.

5) Higher value of nitrogen tends to increase net productivity of aquatic ecosystem. Presence of Nitrogen in water indicates presence of organic matter and also indicates polluted status of lake. In present study the mean value of nitrogen was observed as 7.23 ppm, which is under permissible limit.

6) Property of hardness of water is due to a complex mixture of ions. The hardness is mainly due to calcium and magnesium ions. During this study, mean value of total hardness, Calcium hardness and Magnesium hardness was observed as 31.50 ppm, 7.60 ppm and 23.91 ppm respectively, which are under permissible limits.

7) This study supports the finding of lake water which recorded mean value of total alkalinity 253.25 ppm, hence fall under moderate to high productive water body.

8) High chlorine concentration is pollution indicator. During the study mean value of chloride content observed as 165.48 ppm which is below the permissible limit.

9) Fluoride 0.58 ppm was found as a mean value which is under the permissible limit.

10) The human interferences in the catchment area and in the nearby vicinity of lake shore were also evident from the bacterial load. The present study reveals that the lake has attained very high bacterial load faecal coliform 350.3 MPN/100 ml as such the water is unacceptable for human consumption without proper treatment.

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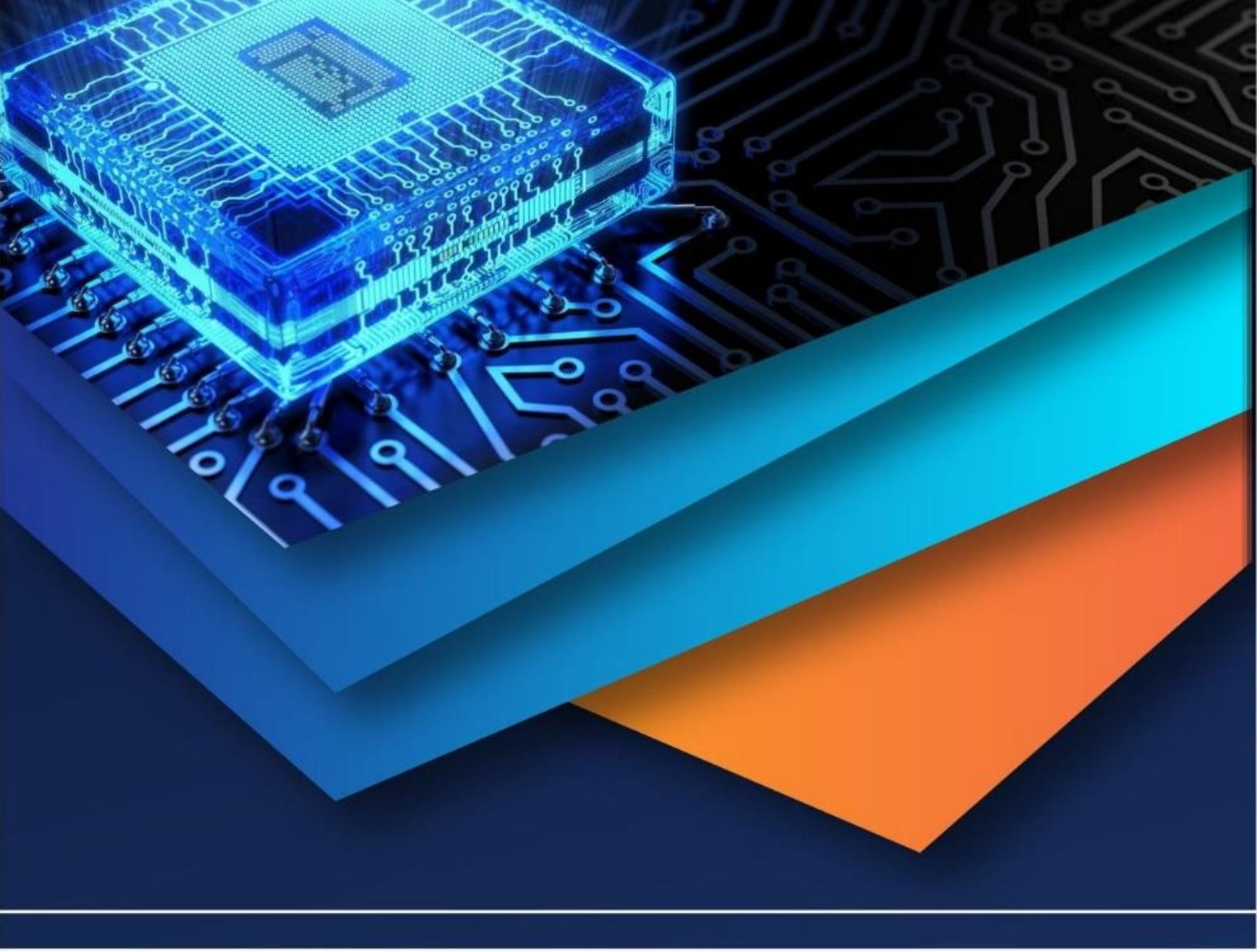

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