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Analysis of Surface Water Quality of Lake Ana Sagar

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ABSTRACT
Thereare three lakes in Ajmer Ana Sagar Lake, Foy Sagar Lake and Pushkar Lake. In which Ana Sagar Lake is biggest and covers the large catchment area. The catchment area of Ana Sagar Lake is 70.55 sq. Km. The quality of water is usually described according to the physical, chemical and biological parameters of the water. Due to increase in population the pollution level is also increase day by day. The lake water is polluted due to direct discharge of sewage disposal, domestic waste, detergents, agriculture runoff, use of chemical fertilizers and pesticides etc. By all these pollutants the aquatic environment and human population will suffered. That is why it is necessary to check the water quality of the lake water at regular basis of interval. Following parameter will be tested and those are as follows: pH, Temperature, Dissolved Oxygen, Total Dissolved Solids, BOD and Total hardness. The water quality of the Ana Sagar Lake was monitored by collecting the water sample from different location. Collected five surface water sample from different location during period of March 2021 at morning time. The sampling site are selected where the pollution load is high. Sampling points are Behind NCC (Clothes washing), Mid of lake, Baradari, Ghat, Near Nallah Vaishali Nagar. By result we concluded that the lake water is organic, by domestic and agriculture activities effect the quality of water. High amount of pollution was increased the BOD. Due to high pH value the lake water is Alkaline and by high amount of Alkalinity, the lake water is hard. Some parameters are very high in concentration and some are within the permissible limits.

Key Words: *Lake, Catchment area, Water quality, Physico–Chemical parameters.*

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I. Introduction

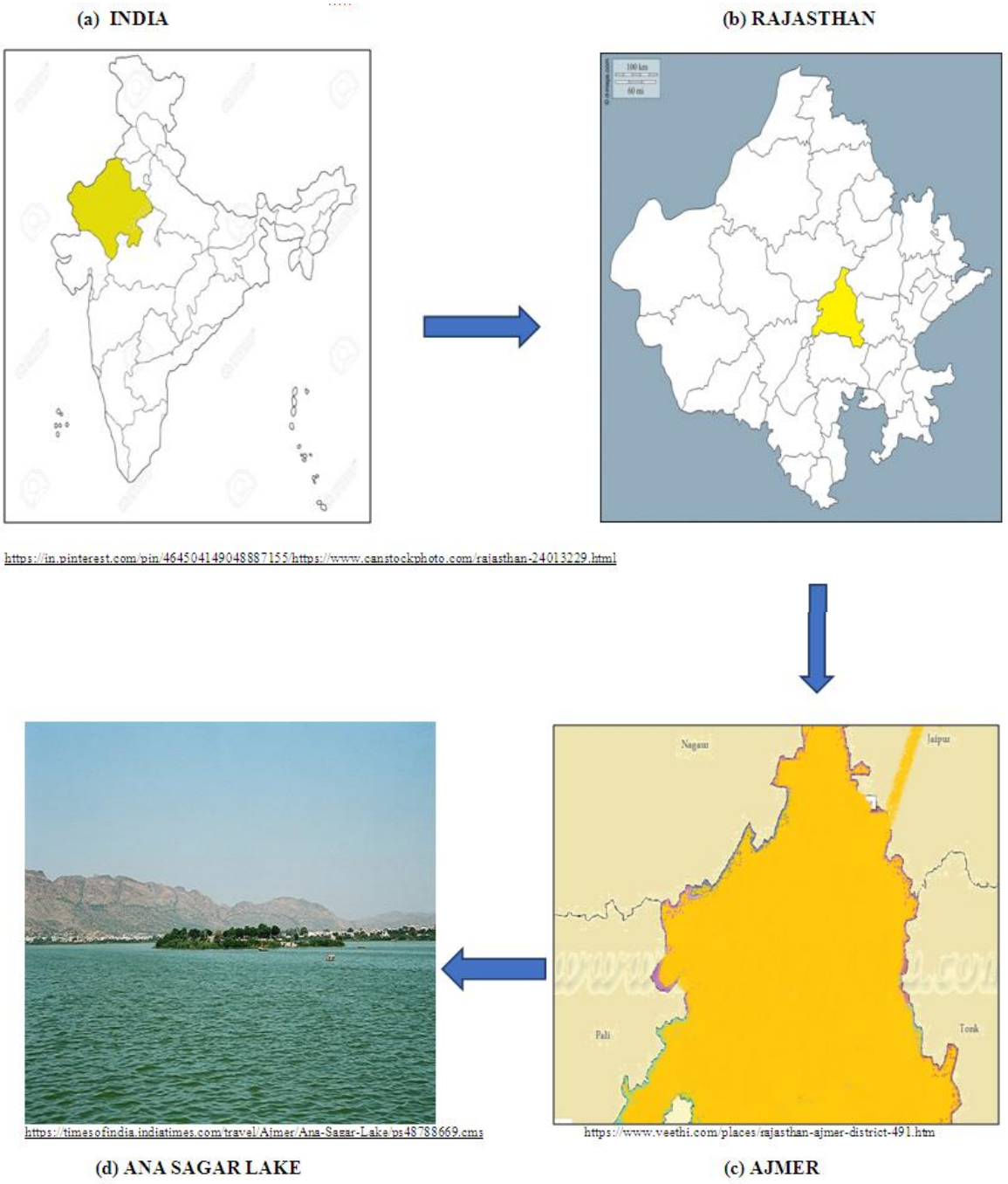
Water is the most valuable thing; we can't image our life without water almost every sector require water. Whether it is industries, factories or any other field. As water is depleting day by day due to rapid increase in population and pollution. Lake water is mainly polluted by sewage disposal domestic waste, detergents, agriculture runoff, use of chemical fertilizers and pesticides and many others.

The beauty of Ajmer lies in that it has one of the most gratifying lakes, The Ana Sagar Lake. Shown in figure 01. It is a fresh water lake worked by directing the water of the catchment water bodies, build in the 1135-1150 AD. Seated right in the core of the Ajmer city, Ana Sagar Lake is one of the most seasoned and the most authentic lake in this locale. Ana Sagar Lake is a perennial shallow fresh water body situated in the heart of Ajmer city (25˚38' and 26˚58' North latitude and 73˚52' and 75˚22' East latitude). The maximum length of Ana S agar Lake is 13 Km, Maximum depth 4.4 m (14 ft.) and water volume is 47,50,000 m^3. The average rainfall in Ajmer is 40-50 cm in the rainy season. In the last 2-4 year due to heavy downpours the quality of water has improved but because of continuous direct disposal of sewage, domestic waste, detergents, agriculture runoff, use of chemical fertilizers and pesticides and other pollutants will polluted the quality of the lake water (Vijay et. al. 2011, Abhas et. al. 2013, Jakir Hussain et. al., Subroto Dutta et. al. 2009, Akhilesh et. al. 2020, Prabhu et. al. 2008). By all these heavy pollutants the water is not safe for any purpose. The high concentration of physico-chemical parameters like total dissolved solids, chloride, fluoride, biological oxygen demand, etc.(Vijay et. al. 2011, Abhas et. al. 2013, Jakir Hussain et. al., Subroto Dutta et. al. 2009, Akhilesh et. al. 2020, Prabhu et. al. 2008).

Table 1 – Geographical features of Ana Sagar Lake

S.no.	Characteristics	Description
1.	Geographical Location	74˚38'- 74˚42' and 26˚25'- 26˚29'
2.	Location in Ajmer	North west in Ajmer
3.	Catchment Area	56 sq. km (gross)
4.	Nature of Catchment Area	Steep to gentle slope with low vegetal cover
5.	Storage Capacity	4.75 million cubic meters (for maximum depth of 4.4m)
6.	Circumference	4.81 km
7.	Depth	Maximum 4.4 m
8.	Over flow arrangement	Four overflow gates of size 4'x6'

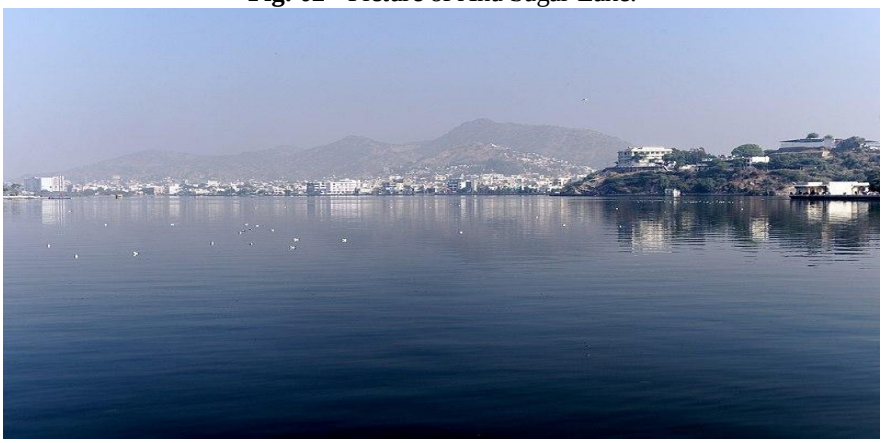
Fig. 01- (a) Map of India with location of Rajasthan, (b) Map of Rajasthan with location of Ajmer, (c) Map of Ajmer
(d) View of study area (Ana Sagar Lake).



Study Area

The study was conducted on Ana Sagar Lake. Ana Sagar Lake is situated at the center of Ajmer city. Large part of the Ana Sagar Lake catchment area is surrounded by agricultural activities. Due to agriculture activities agrochemical particularly, pesticides put into the lake. (Prabhu et. al. 2008). Around the Ana Sagar Lake various sources responsible for polluting the lake water are agricultural activities, construction of housing colonies, restaurants on a major part of its margin, sewage disposal, washing clothes. (Prabhu et. al. 2008)The climate of the region is semi-arid with strongrainfall. The highest temperature in summer season (April to June) while in peak winters (December to January). (P. Mathur et. al. 2010).

Fig. 02 - Picture of Ana Sagar Lake.



Source - https://www.google.com/amp/s/pickyourtrail.com/blog/ajmer-ana-sagar-lake/

II. Methodology

The water sampling was analyzed for various parameters in the laboratory. Various physical and chemical parameters like temperature, pH, dissolved oxygen, BOD, total hardness, total dissolved solids have been monitored for the water sample collected by Ana Sagar Lake.

Plastic bottle of 1-liter capacity with stopper were used for collecting water samples. Each bottle was added with 1-2 drop of Nitric acid and washed then rinsed three times with distilled water. (Subroto et. al. 2009). The bottles were kept in a clean place. The bottle was filled leaving no air space and then the bottle was sealed to prevent any leakage. Each container was marked with the name and date of sampling.

The water quality of the Ana Sagar Lake was monitored by collecting the water sample from different location. We collected five surface water sample from different location during period of March 2021 at morning time. The sampling site are selected where the pollution load is high. The list of sampling points is shown table 02.

Table02: List of surface water sampling sites in Ana Sagar Lake.

Sampling Points	Location
01	Behind NCC (Cloth washing)
02	Mid of Lake
03	Baradari
04	Ghat
05	Near Nallah Vaishali Nagar

Fig. 03–Location of Sampling Sites.

Source- https://www.semanticscholar.org/paper/Potential-of-floating-photovoltaic-system-for-and-Mittal-Saxena/376808a66884478ccaa210f140c9fb423316ffc8

III. Result and Discussion

The observed physicochemical parameters of surface water samples of Ana Sagar Lake (Ajmer) are illustrated in Table 03. All the observed values are also compared with the standard values as recommended by the World Health Organization (WHO, 2017) and Bureau of Indian Standards (BIS, 2012).

Surface water quality parameters of Ana Sagar Lake (Ajmer)

Temperature

The temperature of Ana Sagar Lake water was found in the range of 27˚C to 29˚C during water sampling in March 2021. The seasonal changes in water temperature greatly affect the quality of water, aquatic life and solubility of solid constituents in water.

pH

The pH of water samples of Ana Sagar Lake was found in the range of pH 9 to 9.44 during water sampling in March 2021. pH value of all the sites is alkaline due to carbonate and bicarbonate. The maximum pH was recorded from source 05 (Near nallah VaishaliNagar) whereas minimum was recorded from source 04 (Ghat).

Dissolved Oxygen

Dissolved Oxygen is a basic requirement for a healthy aquatic ecosystem. Most fish and aquatic insect need dissolved oxygen to survive. In present study value of dissolved oxygen is 0.10 to 4.60 mg/l. This is probably due to high rate of decomposition of autochthonous and allochthonous organic matter in water which consumed oxygen in the process. (Vijay et. al. 2011) Secondly at higher temperature the solubility of oxygen in water reduces and surplus oxygen is lost to atmosphere.

BOD (Biological Oxygen Demand)

BOD is an indicator of the potential for a water body to become depleted in oxygen and possibly become anaerobic due to biodegradation. During present study BOD range from 5.9 to 48.3 mg/l. The highest BOD value was at station 02 (mid of lake) and the lowest was at station 03 (Baradari). The high BOD in the lake due to high decomposition activity of microorganism acted on dead aquatic plants, sewage and organic fertilizer. (Vijay et. al. 2011)

Total Hardness

The hardness of water depends on the presence of dissolved calcium and magnesium salts. (Vijay el. at. 2011) The total hardness of the study area was observed in the range of 222 to 375 mg/l in source 01 (washing cloth) and 04 (ghat) respectively. Hard water is not fit for its domestic use. It may scale in the pipes and obstruct lather with soap during washing.

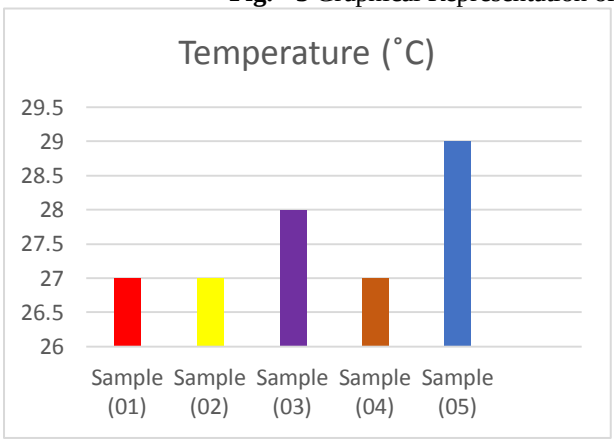
Total Dissolved Solids

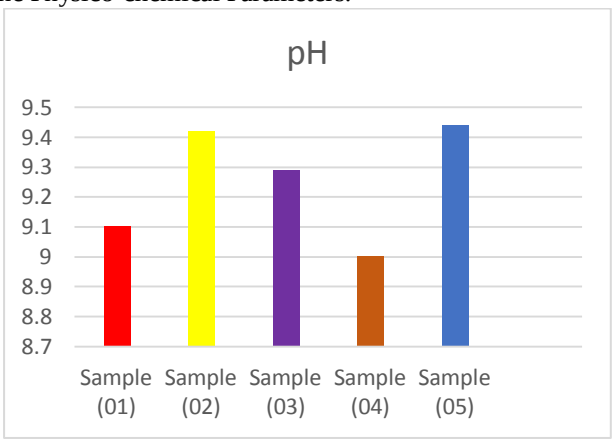
The Total Dissolved Solids of water are the amounts of Dissolved inorganic constituents of water. The permissible limit of Total Dissolved Solids in drinking water is 500 mg/l and 600 mg/l as prescribed by WHO and BIS respectively. The Total Dissolved Solids of surface water of Ana Sagar Lake was found in the range of 1061 to 1110 mg/l during water samples exceeds the permissible limit of Total Dissolved Solids.

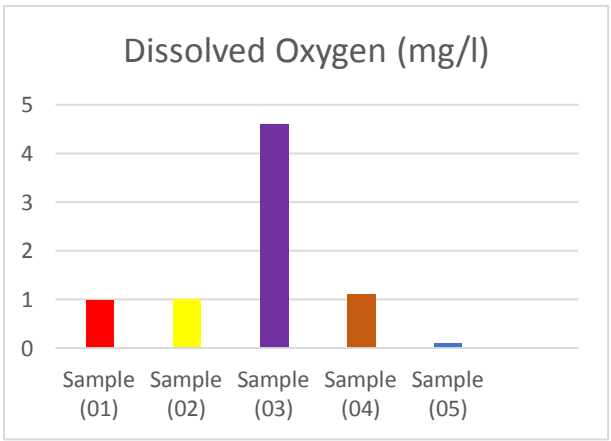
Table 03 - Physio-chemical parameter in Ana Sagar Lake of selected sampling points.

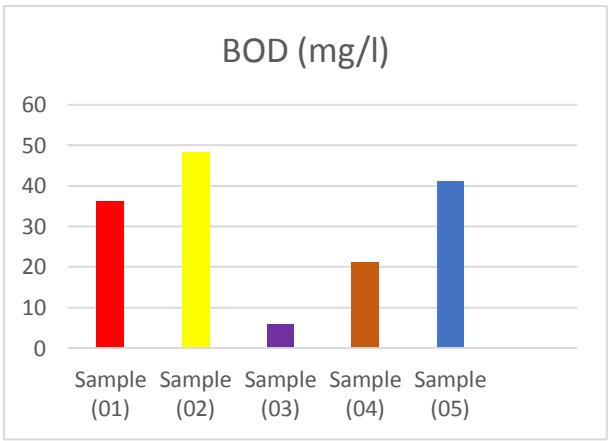
S.no	Parameters	Units	Sample (01)	Sample (02)	Sample (03)	Sample (04)	Sample (05)
1.	Temperature	˚C	27	27	28	27	29
2.	pH		9.1	9.42	9.29	9	9.44
3.	Dissolved Oxygen	mg/l	0.98	0.99	4.60	1.10	0.10
4.	BOD		36.3	48.3	5.9	21.1	41.2
5.	Total Hardness		222	306	240	375	289
6.	Total Dissolved Solids		1061	1089	1089	1106	1110

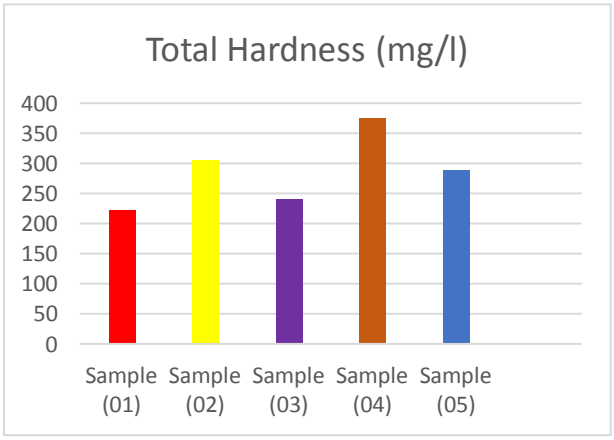
Fig. - 3 Graphical Representation of the Physico-chemical Parameters.

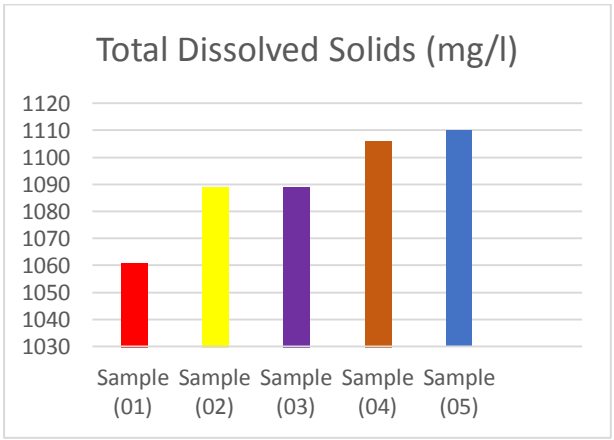












IV. Conclusion

Following conclusions can be drawn from the study:

1. All the results we concluded are that the Ana Sagar Lake water is not safe for domestic purpose. The unnatural color and unpleasant odor of surface water suggest that the surface water of Ana Sagar Lake is highly polluted due to municipal sewage of Ajmer city.

2. The pH value of lake water is crossing the maximum desirables limit. In few areas like Behind NCC, Baradari and Near Nallah Vaishali Nagar total hardness found within maximum desirable limit (300 mg/l). Total hardness is high in water due to addition of calciumand magnesium salts from detergents, which were used for bathing and washing by the local people. Hard water is not fit for its domestic use. It may scale in the pipes and obstruct lather with soap during washing.

3. Dissolved Oxygen level is low because of high rate of decomposition organic matter in water which consumed oxygen in the process. Due to high temperature Dissolved Oxygen level is also decreased.

4. The high value of BOD in the lake due to high decomposition activity of microorganisms acted on dead aquatic plants, sewage and organic fertilizer.

5. Total Dissolved Solids is received in the lake water by the agricultural runoff and residential runoff and by the discharge from industrial and sewage treatment plants.

Remedial Measures

In the light of conclusions drawn from this study, following suggestions are made for futureresearch work in this area:

1. The study shows that Ana Sagar Lake is severely eutrophied. Hence a continuous monitoring and analysis of lake eutrophication can be carried out using Remote Sensing and Geographical Information Systems as eutrophication and increase in productivity are associated with change in optical properties of the water mass. (Abhas et. al. 2013, Vijay et. al. 2011). It would enable to capture and update all water quality parameters and plan, compare, visualize and evaluate the outcome resulting from simulating various management scenarios.
2. Sewage treatment plant (STP) to treat waste water may start functioning in near future, allowing the treated effluent to enter the Ana Sagar Lake. Hence, analysis of lake pollution can be revised later on and identification of lake use can be ascertained on the basis of treatment cost/ benefit ratio and other aspects considering various lake uses. (Vijay et. al. 2011).

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