

## Physio chemical parameters and study of zooplankton in fresh water ecosystem: A review

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### Abstract

Water is the most imperative compound that enormously influences life. Quality of water is habitually described as per its physicochemical and biological characteristics. The aquatic biota is depleted and the water quality is deteriorate due to rapid industrialization and recurrent consumption of fertilizers and pesticide in agriculture leads to pollution of aquatic environment. This contaminated water affects the surrounding of lakes which are unique assets and are very important ecosystems in the nature and society. The water quality of Anasagar Lake is fluctuated due to its water quality. The lake is suffering from so many environmental problems. The catchment area of Lake constitutes of 30% of the city's population. Water is a surprisingly unique substance due to its thermal property i.e. with low freezing point, high boiling point, high specific heat and conductivity, makes it an essence of life. Water is the only chemical compound which occurs in all the three states solid, liquid and vapour. The rainfall in the Rajasthan is normally 549.1mm by the year. However between the 2005-14 period the minimum in 2009. The rainfall of the year 2014 is about twenty percent lower as compared to the rainfall of 2013. Out of the country Rajasthan receives much lower rain fall also maximum in evaporated due to excessive heat and arid conditions here.so the stored fresh water is main source of drinking and domestic purposes like in pond lakes tanks.

**Keywords:** anasagar lake, environmental problems, rainfall

### 1. Introduction

The Anasagar is one of the lake suffers with eutrophication. The water quality of Anasagar Lake is fluctuated due to its water quality. The lake is suffering from so many environmental problems. The catchment area of Lake constitutes of 30% of the city's population. The water of lake is being contaminated by municipal waste, agricultural run-off which is continuously washed inside the lake. Heavy rain in the lake area has upgraded the water quality of lake in last two to three years. But the water quality is still unfit for general domestic uses. The values of Total hardness, total dissolved solids, alkalinity, pH, total suspended solids, fluoride, chloride, BOD, total coliform organism's makes the water unfit for drinking and other household uses.

Study area for research work is ANASAGAR LAKE and BARALI LAKE. ANASAGAR LAKE is situated in mid of Ajmer while BARALI LAKE is situated in village HURDA District Bhilwara. Both lakes serve people for different purposes like drinking, bathing, washing clothes and animals all the year so they play best role for research.

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Central Ground Water Board has set up a network of 1,111 stations called the NHS the national hydrograph station helps to monitor the ground water behavior. Monitoring of water temperature, water quality, water level and other parameters done by NHS during 2014-15. These 1111 stations are composed of 377 piezometers and 734 dug wells.

State of Rajasthan comprises of area 3,42,238 sq km. its density. The rainfall in the Rajasthan is normally 549.1mm

by the year. However, between the 2005-14 period the minimum in 2009. The rainfall of the year 2014 is about twenty percent lower as compared to the rainfall of 2013. Out of the country Rajasthan receives much lower rain fall also maximum in evaporated due to excessive heat and arid conditions here.so the stored fresh water is main source of drinking and domestic purposes like in pond lakes tanks.

### 1.2 Limnology

Limnology a science to study the fresh water ecology with multifold dimensions has emerged with time. It is the functional and structural study of lentic fresh water ecosystems along with their problems and environmental conditions. Lake is the water body comprises of either salty or fresh water of significant size having land surrounded it. In Indian subcontinent there are two types of lakes are found manmade and natural. When any water body that is fed by three four rivers, is inland, deeper than a pond, and larger than pond also should not be the part of ocean is known as Lake.

### 1.3 Water

Water is considered as base of life, for all the living organisms the water is basic and unavoidable requirement. Due to more and more economic development in last few centuries the population grows as well and requirement of fresh water also goes high. Due to excessive pulling out of fresh water the quality as well as quantity of fresh water get worse.

Water is a naturally offered resource and is the foundation of growth and development of human population. The consumption of water needs proper planning and management for valuable use. The trophic status of any water bodies either fresh or marine is decided by the

topography and local living population. Water is having the unique features out of all the renewable natural resources of Earth. It is dynamic for preparation of food, Economic Enlargement, also for sustaining all forms of life.

There has a remarkable population proliferation during the last century without a conforming expansion of civic facilities which has resulted in alteration of wetlands into contaminated basins, principally in urban areas. The main causes for the weakened conditions of the lakes can be shortened as follows:

**a. Pollutants from stable point sources**

- a. Nutrients from unwanted water from municipal and domestic discharges.
- b. Organic, inorganic and toxic pollution from industrial run-offs.
- c. Rainstorm water run-off.

**b. Pollutants from non-point sources**

- a. Nutrients from side to side fertilizers, poisonous pesticides and other chemicals, largely commencing agriculture run-off.
- b. Biotic level of pollution from human disbursements in the catchment zone of lakes and reservoirs.

**c. Other lake basin-related causes of diminishing**

- a. Silting of lakes caused by increased destruction of soil resulting from expansion of metropolitan and cultivated areas, forest degradation, road manufacture and other disturbances related to land in the drainage area.
- b. Alteration of rivers nourishing the lakes, thereby tumbling lake size
- c. Challenging water uses including urban use, irrigation, drinking and hydropower uses.
- d. Unprocessed or ineffectively treated house hold and industrial effluents from point sources located throughout the basin.

**1.4 Present status of Lake Anasagar**

Anasagar lake Ajmer is situated in the center of the city at the dimentions of 26.27 degree north to 74.37 degree east. It was manufactured by Anaji chauhan. Due to pollution this water body reduced to 25.38 degree north to 73.52 degrees east. After some time the Mughal emperor made some more buildings to raise the beauty of Anasagar like Baradari and Daulat Bagh are the places made by Jahangir. The area covering the catchment of lake is 70.55 square km, and it's over all periphery is 12.88 km. Lake was prepared to fight against the uncertainty of rainfall and unpredictable climate. This was monsoon fed, shallow and perennial fresh water Lake.

**1.5 Multiple factors corrupting the Anasagar Lake**

The Anasagar is corrupted by so many element today. For the long-term solutions for sustainability the strength and quantum are needed to understand. It is valuable to mention that the ecological health of many lakes in India are not satisfying regarding the ecological heath before conversing about the Anasagar.

India is land for high range of water gathering organizations situated in diversity of climate, widening from mountains located near the Himalayas to tropical south.

**1.5.1 Disposal of raw sewage and municipal wastewater**

In the beginning source of water supply in Ajmer was Anasagar started from 1884 the Lake acts as an reservoir for the people of 50,000 population. Although today the

catchment area of Anasagar is made up of 35% of population. The sewage and domestic waste is discharged directly without being treated inside the lake because of the absence of sewer lines by open drain.

It was found during sudden inspection that the sewage, household waste, from lake surrounding named Christianganj Nallah-1, Christianganj Nallah-2, Antend Nallah (next to mittal hospital old), the Kazi ka Nallah, Chaurasiawas Nallah(next to new mittal hospital), Shantipura Nallah, nallah of mahaveer colony, nallah of ramnagar, nallah of Bandi river, Maheshwari public school side nallah Nagfani jain temple nallah are the major polluting areas for the lake. Some of the buildings constructed or under constructed can be seen in the lake area.

**1.5.2 Ejection of detergents**

Dumping of detergents are all because of cloth washing, disposal of municipal wastewater, bathing into the lake. Washing of clothes and bathing at the banks of the lake deliver contribution of Phosphorus in the lake water. Phosphorus is major cause of eutrophication. It is deposited in the sediments of the lake and can be free or remobilized by different methods. It causes the lake to be in eutrophic conditions for longer period of time. The phosphoras can be recycled in the water and the sediments when the iron concentration is lower. In dangerous cases, interior recycling can add over 90 percentage of phosphorus available to planktons by the year.

**1.5.3 Input of remaining pesticides and fertilizers**

Disposal of chemical fertilizers and pesticides are mainly due to unmaintainable agriculture, fish culture and gardening in the lake's catchment area. Cultivated undertakings in the lake's catchment are heavily reliant on the use of different chemical fertilizers. During monsoon rains the left-over quantity of these chemicals is drained inside the lake. In acount, farmers also exercise the farming of fodder crops and *Trapa bispinosa* with the use of organic and inorganic fertilizers. The pestiside naming organochlorine is used to increase the production of crop Trapa which eventually added in the food chain of aquatic living organisms.

**1.6 Zooplankton**

Zooplanktons (Zoon, animal wandering) are the animals which are found with the inadequate power of locomotion and these animals are floating and drifting in the water body with water current. These animals in the majority are microscopic in nature size from few microns to mm and more also uni or some are multicellular forms of animals. Morphologically and taxonomically these animals are different. They are very good water quality indicators.

Zooplankton word denotes that these are dependent on others for feeding, so are predators, grazers or suspension feeders in the community. Faunal biodiversity of aquatic ecosystem is help to studied by the zooplanktons. All the texons of this animal kingdom found in pelagic environment include the representative of zooplanktons. The eggs or adults or larvae are found known as eggs, Holo planktons, Mero planktons respectively. The zooplanktons are consumed to assess energy transmission at secondary trophic level depends on abundance of both their presence and their types at varying depths.

Present study has done on the four major groups of zooplanktons and Protozoan which are indicators of water quality along with the physio chemical properties of water bodies. Protozoans are found in water body in both the states the trophic state and in cyst state. The amount of food available and number of predators determines the presence and abundance of protozoan species. Some of the protozoans directly or indirectly depend on dead or decaying substances for feeding. Maximum number of protozoans will be found in the area of high productivity. In shallow low deep-water body where light penetrates deep inside the leaves on borders of water body, other plant debris collects are the highest source of protozoa.

The present investigation has been carried out taking into consideration of the various findings of earlier work done by researchers working in the field. The present study is carried by the motivation of earlier study findings on limnology or fresh water ecology. This kind of motivations is discussed in review of literature under following paragraphs. The study of waters like reservoirs, rivers, wetlands, groundwater, lakes fresh water and marine, streams etc as environmental systems inter relating to the surroundings and their drainage sinks is referred to ecology of fresh water or limnological studies. It is generally called as sub division of environmental science or ecological science.

It includes the physical, chemical, geological and biological and other parameters of all types of waters either flowing and stable waters, fresh and saline, man-made or natural). The study of limnology or fresh water ecology indicates the efficient relationships of nutrient cycles, biological activities, growth, biological productivity adaptations with species composition. This study helps to describe and evaluate how these environments like chemical physical and biological regulates these relationships.

Limnology is in general a new science as the people were only aware of inland water system, on which people dependent for transport, food, source of worship, joy and recreation. Due to human curiosity and fascination the integrated science gave birth to different disciplines such as biology, geology, mathematics, chemistry, physics etc. the limnology consists of the study of interior water but regularly it includes the study of fresh water of lakes and ponds.

Most of the conceptual background all over the place which the limnological science was built was correlated to lakes and mostly the initial limnologists were known as lake scientists. Fresh water ecology plays an important role to solve the problems of pollution control and practices like aquaculture. The water's role in nature is different and important not only from the human being's but also from the countless organism's point of view that include to make an aquatic environment.

Thus the aquatic life needs a deep knowledge of the organisms distributed inside but also the external factors that influences the medium. The fresh water bodies which are standing always have more studies interest as compared to other kind of fresh water systems. The fresh water studies are carried out in different water bodies like lakes, ponds, rivers, streams etc by different researchers.

In fact, water is considered as an essence of life as it dominates the chemical composition of all organisms and no organism can live without water. To prevent and control water pollution, the management of water resources and water quality management are highly essential. The

multiplicity of natural regulatory mechanisms controls the nature and distribution of aquatic system biota and physio chemical parameters which are directly influenced by and related to each other.

Because of urbanization and human interference, the water resources are continuously exploited and results in disturbance of natural dynamic balance. Thus as a result the physio chemical factors changes, the flora and fauna of water body depleted, fishes are killed and the ecosystem is continuously disturbed. The role and influence of physicochemical characters on the fresh water life has been carried out by many investigators.

### 1.7 Physiochemical parameters

**Temperature:** Temperature was taken at the time of water sample collection with the help of thermometer and seasonal change in temperature was observed. According to study the maximum and minimum temperature in both the lakes observed were recorded 24<sup>o</sup> C and 36<sup>o</sup> C respectively.

**pH:** amount of hydrogen ions present in water are measured represented by pH. it results in determination of water quality as it is Alkaline, Acidic or Neutral in nature. The word pH denotes potential of hydrogen.

Calculation of pH was done with electrometric method for this

1. The Suitable amount of water sample was taken in beaker.
2. The distilled water was used to wash the electrodes.
3. Then the electrodes were cleaned with soft tissue paper.
4. The instrument than Calibrated with pH 4.0 to 7.0
5. Reading was noted down.
6. The electrodes were washed with distilled water and dried with tissue papers.
7. Again the pH value was noted down in the same sample.

### Transparency/ Turbidity

Transparency is the feature where light get allowed to penetrate into water body. The depth is calculated for the sunlight penetration. The phyto organisms only able to grow in this area. It is affected by turbidity which is the measure of water clearly. It can be measured by Secchi disk or turbidity meter. It is inversely related to transparency. The Secchi disk is lowered into the water until it is seen. The depth is measured. This is used to calculate the transparency of water body. This shows the length of eutrophic zone.

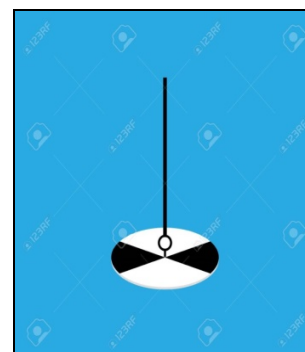


Fig 1

### Secchi disk

Nephelometer calibration: Standard turbidity solution of

required range was run and adjusted to calibrate the instrument and the Transparency was measured. Sample was gently agitated and left until air bubble disappears and then it was poured into cell and reading of Transparency was noted down.

### Total Hardness

Total hardness of water is the amount of magnesium and calcium which is dissolved in the water sample. High amount of minerals dissolved in the water makes it hard water. Due to the presence of divalent metallic cations the water total hardness is measured. The divalent metallic cations like, iron, and manganese ions in form of bicarbonates, calcium, Sulphates, magnesium and Chlorides render the water hard, both temporarily and permanently. Total Hardness is based on classification in terms of softness and hardness. The water sample containing total hardness under 60 mg per liter it is considered as soft water, total hardness in the sample having in between 60 and 120mg per liter the water is called as moderately soft and if the total hardness will between 121 and 180mg per liter the water will be moderately hard and more than that it will be considered as very hard water. It is of two types temporary hardness due to calcium and magnesium other is permanent hardness due to sulphate, chlorides and nitrates.

Measurement by volumetric method EDTA

### Alkalinity

Basically, an acid neutralizing capacity of water is called alkalinity. The ions present in water neutralize the hydrogen ions this over all capacity is referred as alkalinity.

All the bases present in water which are titratable, their sum in average is alkalinity in the sample. So, alkalinity helps to neutralize the weak acids of natural water.

Steps

1. 50 ml of sample was pipette out into a 250 ml Erlenmeyer flask
2. Add two to three drops of indicator that is phenolphthaline.
3. If pink color is appeared than titrated Against Sulphuric acid till colorless.
4. Note the reading as A (difference in both initial and final reading).
5. Now add methyl orange indicator.
6. Titrate again against sulphuric acid
7. Light orange color appears.
8. Note the reading as B

$$\text{Phenolphthalein Alkalinity as mg/l as CaCO}_3 = \frac{(A - C) \times N \times 50 \times 1000}{S}$$

$$\text{Total Alkalinity mg/l as CaCO}_3 = \frac{(B - C) \times N \times 50 \times 1000}{S}$$

### Chloride

Chloride is main anion found in all the water bodies in nature. In aqueous medium these ions acts as conservatives. Their movement is not degraded by reactions of water with rocks, sediments or soil.

Steps

1. Water sample of 50 ml is taken in the conical flask.
2. The sample pH should be in between 7 to 10
3. Indicator potassium chromate is added.
4. Burette is filled with Standard silver nitrate.

5. The water sample is then titrated against the Standard Silver nitrate.
6. Color changes to brick red.
7. Reading is noted B (Final reading)

### Total Dissolved Solids

A total dissolved solid is an indicator of water quality. It is a measurement of Inorganic salts present in water and also small amount of Organic matter that is present in water. Mainly hydrogencarbonate, sulphate, nitrate, calcium, sodium, chloride, potassium, carbonate and magnesium anions are the part of total dissolved solids. These mineral joins the water body by the means of both naturally or by anthropogenic activities.

Steps

1. The sample is stirred.
2. Filtered through whatman filter paper no. 42.
3. A beaker is dried an weighted earlier W1.
4. 100 ml of filtrate is pipette in dried beaker.
5. The solution dried till dryness in oven on 180° C for one hour.
6. It is than cooled in desiccators.
7. The beaker is again weighted and dried in hot air W2.
8. Repeat the process for accuracy.

$$\text{Total Dissolved Solids (mg/l)} = \frac{(W2 - W1) \times 6 \times 10}{S}$$

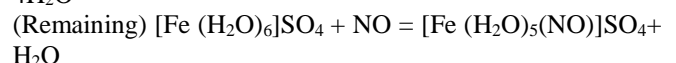
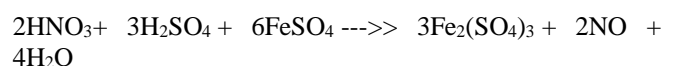
### Nitrate

In water Body nitrate is included by the chemical fertilizers runoff and they inserted to the ecosystem cycle by first trophic level to another. The presence of nitrate in the water makes water nutrient rich and thus condition moves on to eutrophication of the water body. To find out the presence of nitrates in the water sample we have to take sample in laboratory

The test of nitrate is called nitrate test. Nitrates are soluble in water so easy to do the test in laboratory as compared to other ions which are highly insoluble. The test of nitrate ion is based on its property of oxidizer.

Brown Ring test

1. Take 50 ml of water sample in flask (Nitrate solution)
2. Add iron sulphate in the solution.
3. Slowly add concentrated sulphuric acid in it.
4. The aquas solution has formed a layer of sulphuric acid over it.
5. At the junction of two layers the brown layer is formed
6. It indicates the presence of nitrate in the sample.



This test is sensitive up to 2.5 micrograms and a concentration of 1 in 25,000 parts.

### Phosphate

Phosphates affects the water quality by increasing the growth of algae in excess introduced by the chemical having element phosphorus. By many ways the phosphorus enters in environment like waste water, farm waste and factory waste. In water the phosphates helps algae to feed and grow but due to excess of phosphates the algae grow out of control and results in water ecosystem imbalance.

Other life forms and aquatic animals are greatly affected by the toxins released by them. Its excess also creates cloudy water by algal bloom and decreases in dissolved oxygen quantity, also reduce in penetration of sunlight for the other aquatic fauna even kill them. These algae when dies the bacteria decomposes them by using dissolved oxygen and reduces the water oxygen quantity results in suffocation for other aquatic organisms.

### Dissolved Oxygen (DO)

Dissolved oxygen is an important physio chemical quality of water which have great values for organisms living in the environment there. It varies according to change in season temperature etc. For different sites the variation in Dissolved oxygen is comparable to that of Temperature and pH. The surface of water body has high water temperature with respect to high amount of dissolved oxygen. Because of the reason that the surface water has more Air contacts and Diffusion aerators are found naturally.

### Chemical Oxygen Demand (COD)

Chemical oxygen demand is described as "in specific conditions the amount oxygen consumed to oxidize the organic and inorganic oxidisable compounds."

This is done through organic substances in water they will oxidise them into biodegradable and non-biodegradable compounds with the help of strong oxidant(chemical). The COD values can be achieved accurately and are of great importance. Disadvantage of testing COD by the test is during the test oxygen is also consumed to oxidise the inorganic matter like nitrites, sulphides, thiosulphate, reduced metal ions, etc.

### Biochemical Oxygen Demand (BOD)

On certain physiochemical status of water body like temperature, specific time the amount of oxygen needed to breakdown the organic material present in taken water sample by the aerobic biological living organisms is called Biological oxygen demand. BOD is used to represent the level of pollution of water.

It is expressed in Miligrams of oxygen per liter of water sample taken for incubation period of 5 days and 20 ° of temperature. The reduction of biological oxygen demand is a base of waste water treatment plants efficiency. Sort term effect on the oxygen levels of receiving water can be point out by the waste water effluents BOD.

Analysis of BOD is similar to that of COD analysis. Both measures water organic compounds. The BOD is more specific in nature as it measures all of the organic matter oxidized biologically at all levels rather than COD which measures everything that is only the chemically oxidised

### Summary and Conclusion

First of the study area of present investigation is the Anasagar Lake lacated in the mid of city ajmer constructed by Anaji Chauhan during 1153-1150AD.its dimentions are 26°27' to 26°29' north and 74°36' to 74°37' East. It is the biggest lake of ajmer and now very much polluted by the urbanization and development of the city. Its periphery is about 12.88km. and catchent area is about 70.55km<sup>2</sup>. The water quality of Anasagar Lake is fluctuated due to its water quality. The lake is suffering from so many environmental problems. The catchment area of Lake constitutes of 30% of the city's population. Water is a surprisingly unique

substance due to its thermal property i.e. with low freezing point, high boiling point, high specific heat and conductivity, makes it an essence of life. Water is the only chemical compound which occurs in all the three states solid, liquid and vapour. The rainfall in the Rajasthan is normally 549.1mm by the year. However between the 2005-14 period the minimum in 2009. The rainfall of the year 2014 is about twenty percent lower as compared to the rainfall of 2013. Out of the country Rajasthan receives much lower rain fall also maximum in evaporated due to excessive heat and arid conditions here.so the stored fresh water is main source of drinking and domestic purposes like in pond lakes tanks. We studied all the physicochemical parameters.

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