

# Study on the Impact of Excess Use of Fertilizers, Nutrients Accumulating in the Sewage Water Leading to the Contamination and Eutrophication in Mansagar Lake (Jalmahal), Jaipur

Dr. Chetna Pradhan Jain

Assistant Professor, Environmental Science) S. S Jain Subodh PG College, Jaipur, Rajasthan, India  
env. chetna[at]gmail.com

**Abstract:** Water the Elixir of Life and a precious Natural Resource found in various places depending on the Climatic and Geographic Conditions. Various activities like Domestic, Industrial with more and more Urbanized tasks leading to the pollution and deteriorating water quality. Inundation of Sewage water with various nutrients load increase the plant growth in the water body leading to the process of Eutrophication and altered Physico Chemical Parameters. Jalmahal Lake (ManSagar) surrounded by hills and specially in Rainy season surface weathering of mountains, rocks make water quality contaminated. Various Physico Chemical Parameters like pH, EC, TDS, Color or Hue, Odour, Nitrates, Hardness, D. O, and Heavy Metals like Mercury, Cadmium, Chromium, Iron, Zinc lead to Chronic Poisoning in Aquatic Life and its Environment. Algal Blooms are the main reason behind the Eutrophication of Water Bodies. Analysis of Water Quality and regular monitoring of Effluent Water Discharge should be done seasonally every year.

**Keywords:** Jal Mahal, Elixir of Life, Physico Chemical Parameters, Eutrophication, Heavy Metal

## 1. Introduction

Lake Ecosystem is very vast and its each zone is rich assemblage of Aquatic Life with varying species of Fauna and Flora. JalMahal water body is a renowned Wetland site and a monument of UNESCO Heritage. Lakes are the site of studying rich Ecosystem Dynamics, but ongoing waste accumulation from various source contaminating the Water Quality. Beside this it is also a great Wetland Ecosystem as many special as well as rare Migratory Bird Species came

here every year specially during the time of winter season and a beautiful site for the Bird Watchers. As we know that Wetlands are the site of varied and rich species of Flora and Fauna which are Ecologically important for the Ecosystem point of view. Lake sites are the places where we can find Chemical, Physical and Biological interactions in the form of Ecosystem Dynamics. Lakes consists of different zones mainly Four Types viz. Littoral, Limnetic, Profundal and Benthic.

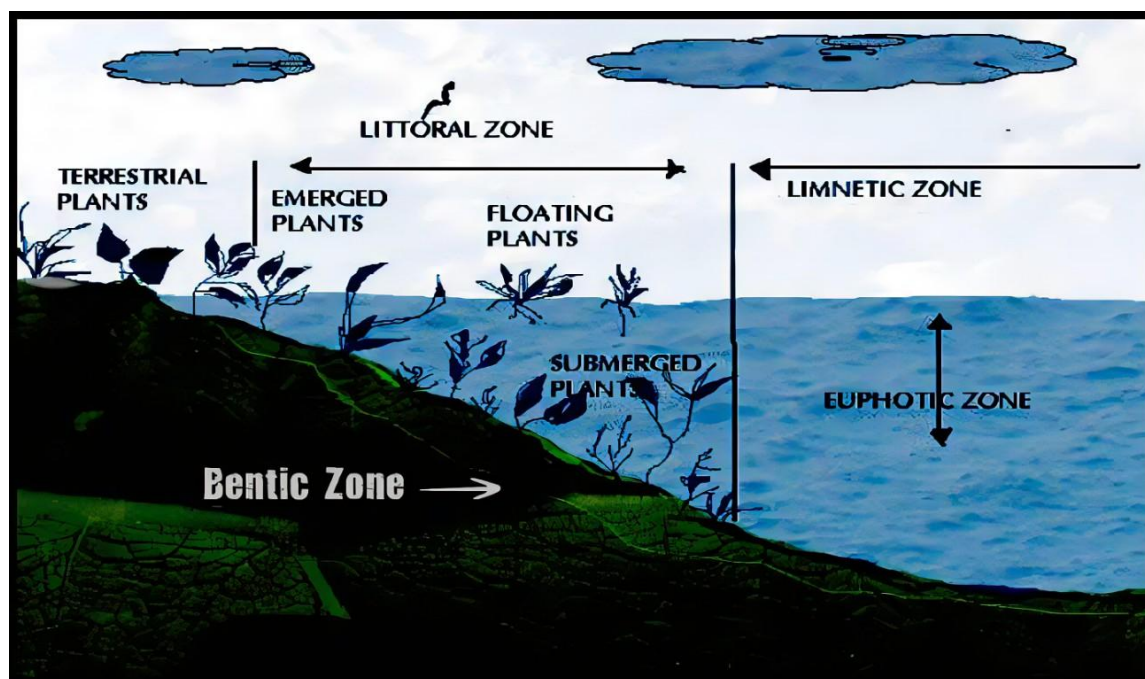


Figure 1: Showing different zones inside the Lake

Volume 11 Issue 1, January 2022

[www.ijsr.net](http://www.ijsr.net)

Licensed Under Creative Commons Attribution CC BY

The mechanisms of origin are numerous and are reviewed by (Chapman 1996), who differentiated lakes into 11 major types and subdivided into 76 sub types.

It is very essential to test the water for the analysis of its various PhysicoChemical Parameters. Delay in observation and Testing the Quality leads to the process like Eutrophication of the Water Body which results in increased BOD and decreased DO and Light inside the Water Body.

JalMahal, from years before is a migratory site for the Avian Fauna specially the Flamingoes and Siberian Cranes with many other type special species. Waste water flows in

untreated and somewhat partially treated forms with the help of Sewage Treatment Plants, but mostly in untreated manner, specially Sewage from outlets known as the Nallah's viz. one from the city side i.e. Brahmपुरi Nallah and the other one is NagatalaiNala. Sewage Water is the rich source of varied nutrients which lead to increase the organic overflow inside the Water Body, the main culprit for the Eutrophication and resultantly increased in the number of small and big Phytoplanktonic Species including Algal Blooms floating on the surface of the water results in depletion of Dissolved Oxygen and Sunlight inside the water Body.



Figure 2: Heritage View of the JalMahal Water Body



Figure 3: Migratory Bird Habitat

**Study Conducted on the Water Body:**

Water Samples were taken and tested for the various PhysicoChemical Parameters like pH, EC, TDS, Dissolved Oxygen, Temperature, Biochemical Oxygen Demand, Total Hardness including Calcium and Magnesium, Sodium,

Potassium, Nitrate, Ammonia, Phosphorus, Chloride concentration etc. during the Pre and Post Monsoon Season.

Temperature, impacts the conditions inside the Water Body where living organisms survive. It impacts on the oxygen content of the water, increase in the temperature decreases

the oxygen content. Causes of temperature change include, weather, removal of shading stream bank vegetation, impoundments, discharge of cooling water, urban stormwater and groundwater inflows to the stream (Spellman and Drinan 2012).

pH, nature of the water is determined by it. With increase in the pH value, corrosive nature of the water increases. Photosynthetic activity decreases with more and more assimilation of the carbon di oxide and bi carbonates. Their equilibrium imbalances.

EC (Electrical Conductivity), shows correlations with various Physico Chemical parameters. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials that do not ionize (dissolve into ionic components) when washed into the water (Gupta and Paul 2010). Study suggests that, a failing Sewage System would raise the Conductivity because of the Chloride, Phosphate and Nitrate. An oil spill would lower the conductivity.

Biochemical Oxygen Demand, is the measure of Dissolved oxygen consumed by the microorganisms in the water body during the oxidation of reduced substances. The discharge of wastes with high levels of BOD can cause water quality problems such as severe dissolved oxygen depletion and fish kills in the receiving water bodies (Penn et al.2003).

Sulphate, existence of Industrial waste and presence of shale in rich organic compounds are one of the main source of Sulphur in the water bodies. Atmospheric sulphur di oxide formed by the combustion of fossil fuels and emitted by the metallurgical roasting processes may also contribute to the sulphate compounds of water. Sulphur trioxide (SO<sub>3</sub>) produced by the photolytic oxidation of sulphur dioxide comes with water vapour to form sulphuric acid which is precipitated as acid rain or snow. Sulphur-bearing mineral are common in most sedimentary rocks. In the weathering process, gypsum (calcium sulphate) is dissolved and sulphide minerals are partly oxidized, giving rise to a soluble form of sulphate that is carried away by water. In humid region, sulphate is readily leached from the zone of weathering by infiltrating waters and surface run off but in semiarid and arid regions the soluble salts may accumulate within a few tens of feet of land surface (APHA 2005).

Calcium, in the form of Ca<sup>2+</sup> ion, is one of the major inorganic cations or positive ions in saltwater or freshwater. The concentration of calcium ions (Ca<sup>2+</sup>) in freshwater is found in a range of 0 to 100 mg/L and usually has the highest concentration of any freshwater cation (Abboud 2014).

Magnesium, Important contributors to the hardness of a water, magnesium salts break down when heated, forming scale in boilers. Chemical softening, reverse osmosis, or ion exchange reduces magnesium and associated hardness to acceptable levels. Magnesium is an essential element in chlorophyll and in red blood cells. Some salts of magnesium are toxic by ingestion or inhalation. Concentrations greater than 125 mg/L also can have a cathartic and diuretic effect (APHA 2005).

Sodium and Potassium, It is measured with the help of flame photometer. The instrument is standardized with the known concentration of sodium ion (1 to 100 mg/l) and concentration of potassium ion (1 to 5 mg/l). Potassium is an essential element in both plant and human nutrition. The ratio of sodium to total cations is important in agriculture and human pathology. Soil permeability can be harmed by a high sodium ratio. Persons afflicted with certain diseases require water with low sodium concentration. Potassium is an essential element in both plant and human nutrition and occurs in groundwater as a result of mineral dissolution (APHA 2005).

Phosphorus, despite being an essential element for plant growth, is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen and the death of certain fish, invertebrates and other aquatic animals. Sources of phosphorus accumulation includes, soil and rocks, wastewater treatment plant, runoff from various sources etc. In nature it usually exists as phosphate molecule (PO<sub>4</sub>). In aquatic ecosystem it occurs as organic and inorganic phosphate. Both organic and inorganic phosphorus can either be dissolved in the water or suspended attached to particles in the water column (Spellman 2014).

TDS (Total Dissolved Solids), The TDS concentration in a body of water is affected by various factors (APHA 2005). Fertilizers from field and runoff from wastewater treatment plants may contribute higher levels of nitrate or phosphate ions. If TDS levels are high, especially due to dissolved salts, many forms of aquatic life are affected. TDS values in lakes and streams are typically found to be in the range of 50 to 250 mg/L. In areas of especially hard water or high salinity, TDS values may be as high as 500 mg/L. In domestic wastewater, solids are about 50 percent organic, which in turn contaminates the ground and fresh water. These solids are generally from plants, dead animal matter and synthetic organic compounds.

Nitrate (NO<sub>3</sub>-): High concentration of nitrate in water, infants, less than six month old, are suffering from "methaemoglobinaemia" or "BLU BABY" disease. It is affecting plant nutrient and moderately toxic. Repeated heavy doses of nitrates on ingestion may also cause carcinogenic disease. Nitrate value varied from 40 to 360 mg/L & maximum permissible limit is 50 mg/L (ICMR).

Impact of Waste Water on the Planktonic Growth of Lake: Presence of Planktonic organisms in the lake or any other water body describes the amount and richness of or we can say the presence of organic matter composition in the aquatic environment. Phytoplankton composition is a tropic indication of the water mass. In addition, phytoplankton species are used as an indicator for determining the nutrient level which is the basis for preparing and monitoring the strategies of the lake management in the lakes. In Jalmahal due to the accumulation of Sewage Water which is untreated or in partial treated manner is responsible because of its nutrient richness for increased population of algal blooms,

particularly the species of Cyanobacteria. The cyanobacteria are of particular interest to limnologists and lake users because members of this group are those that often form nuisance blooms and their dominance in lakes may indicate poor water conditions. Some species of cyanobacteria are known to produce toxins (Fakioglu 2013).

## 2. Material and Methodology

Water Sample were collected during Pre Monsoon and Post Monsoon period during the year 2021, and studied in the laboratory for analyzing various Physico Chemical Parameters, like pH, EC, TDS, Temperature, DO, BOD, Total Hardness including (Calcium and Magnesium), Chloride (Salinity), Acidity, Alkalinity, Fluoride, Nitrate.

## 3. Result and Discussion

S. No.	Parameter	Pre Monsoon	Post Monsoon
1.	pH	7.75±0.11	8.26±0.032
2.	E. C. (µmho/cm)	1.98±0.041	1.80±0.020
3.	T. D. S.	1612.33±0.577	1715.67±0.577
4.	D. O.	4.02±0.057	3.26±0.057
5.	B. O. D.	239.33±1.154	199.33±1.154
6.	Total Hardness (mg/l)	710±1.732	722.66±1.527
7.	Calcium Hardness	406.33±0.577	428.66±0.577
8.	Magnesium Hardness	310±1.00	299±1.00
9.	Chloride (Salinity)	360.1±0.10	399.38±0.545
10.	Alkalinity	398.33±1.527	584.33±1.527
11.	Acidity	125.33±1.527	116.66±1.154
12.	Fluoride (ppm)	0.233±0.020	0.36±0.015
13.	Nitrate (ppm)	2.26±0.115	2.21±0.10

Table showing the concentration of various Physico Chemical Parameters: (Mean±Standard Deviation)

The above analysis shows varied range of Parameters. Fluctuations in all the parameters had been observed. pH is 7.75 in pre monsoon and terminates to 8.26 during post monsoon time. Electrical conductivity retards slightly from 1.98 to 1.80 µmho/cm. The water content shows increase in the Total Dissolved Solid concentration from 1612.33 to 1715.67mg/l, because as surrounded by the hilly areas from all the sides the particulate material specially in the form of soil and rock granules got dissolved in the water body during rainy season. The concentration of the Dissolved oxygen reduces due to increased uptake by algal blooms and different types of planktonic species. It reduces to 3.26 from 4.02 mg/l, as a result the BOD ie. Biochemical Oxygen Demand increases from 239.33 to 199.33mg/l. Due to deposition of the Calcium and Magnesium particles especially by rock salt deposition from surrounding hilly areas in the rainy season Total Hardness increases. It tends to 722.66 mg/l. Alkalinity increases inside the water body from 398.33 to 584.33 mg/l. Due to the accumulation of more and more rain water during monsoon, the concentration of alkalinity increases due to the dissolution factor. Therefore, the acidity reduces to 116.66 from 125.33mg/l in post and pre monsoon season respectively. Fluoride concentration is 0.23 ppm during pre monsoon time and 0.36 ppm during post monsoon time. Nitrate is also observed in the Water Samples, although it not beyond the permissible limits, but its presence is an strong indicator for

characteristic phenomenon of the Eutrophication process inside the Water Body. It is 2.26 and 2.21ppm during pre and post monsoon time respectively.

## 4. Conclusion and Recommendations

Ongoing rapid Urbanization and Industrialization have direct and indirect impact on our precious natural resources. Water is one the important natural resources, which is crucially important for our survival. Present study focuses on the impact of various contaminants on the water body and its various Physico Chemical Parameters. Effluents from point and non point sources carrying various type of contaminated material enters inside the water body specially non treated and partially treated sewage water, which results in the phenomenon like as Eutrophication. All this have vast impact on the survival of Floral and Faunal Species. Jalmahal, popularly known as Mansagar Lake is one of the best Natural Tourist Spot of Jaipur City. It is a renowned Wetland Site famous for its Migratory Bird Status. Our main motive is to protect it, secure it with clean and treated water accumulation inside it. Many fish species survive there spectacularly, and also are one of the main sufferers inside it. The status of DO and BOD is of great concern. For this the condition of prolific algal blooms have to be controlled and monitored regularly. For Lake Management and Restoration, various techniques and tendencies should be approached, like as Pollution Control through Diversion and Control of Waste Water, Bioremediation and Catchment Area Treatment specifically taking concern of the Wetland area surrounding it. Formation of Settling Tank, Physical and Biological Analysis of water samples, Afforestation surrounding the Lake area, Nesting Island and Checkdam Construction. These are the ways and action required for maintaining one of the Precious Natural Resource and Sustainable Ecosystem.

## References

- [1] APHA (American Public Health Association) (2005) Standards methods for the examination of water and wastewater, 21<sup>st</sup> edn. American Public Health Association Washington DC.
- [2] Bhatia Rachna; Jain Disha (2016) Water Quality Assessment of Lake Water; A Review, Springer International Publishing. DOI 10.1007/s40899-015-0014-7.
- [3] Abboud (2014) Describe and statistical evaluation of hydrochemical data of Karst phenomena in Jordan: Al-Dhafer Cave Karst
- [4] Spring. IOSR J Appl Geol Geophys (IOSR-JAGG) 2 (3): 23–42 (e-ISSN: 2321–0990, p-ISSN: 2321–0982)
- [5] Chapman (1996) Water quality assessments—a guide to use of biota, sediments and water in environmental monitoring, 2nd edn, ISBN 0 419 21590 5 (HB) 0 419 21600 6 (PB)
- [6] Fakioglu O (2013) Phytoplankton biomass impact on the lake water quality. doi: 10.5772/55361
- [7] Gupta, Paul M (2010) The seasonal variation in ionic composition of pond water of Lumding, Assam, India. doi: 10.12944/CWE.8.1.12
- [8] Penn, Pauer, Mihelcic (2003) Environmental and ecological chemistry vol 2

- [9] Spellman FR, Drinan JE (2012) The drinking water handbook, 2<sup>nd</sup> edn, ISBN: 978-1-4398-6690-0
- [10] Spellman (2014) Handbook of water and wastewater treatment plant operations, 3rd edn. Taylor and Francis group, ISBN: 978-1-4665-5385-5