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DETERMINATION OF CHLOROPHYLL-A IN OSMANSAGAR LAKE, HYDERABAD, ANDHRA PRADESH, INDIA

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ABSTRACT:
Chlorophyll-a an indicator of algal biomass has always been affecting the lakes and reservoirs. It may be dependent on the different water quality patterns in lakes. The present study was undertaken during January 2012 to December 2014 in order to investigate the seasonal diversity of Chlorophyll- a in Osmansagar lake by analyzing various abiotic characteristics.
A Glass fiber filter assembly method with the help of Spectrophotometry was followed to determine chlorophyll-a in the Osmansagar lake. In Osmansagar, the observed chlorophyll-a was in the range of 7 to 18 µg/l throughout the year. Vertical distribution of chlorophyll-a during a season showed a uniform pattern. These finding helped to understand the ecosystem of the lake.

Keywords: - Chlorophyll- a.Osmansagar. Glass fiber filter. Spectrophotometry. Ecosystem.

INTRODUCTION :

Chlorophyll is the green molecule in plant cells that carries out the bulk of energy fixation in the process of photosynthesis. Chlorophyll itself is actually not a single molecule but a family of related molecules, designated as chlorophyll a, b, c, and d. Since chlorophyll-a molecule is found in all plant cells and it indicates the state of fertilization of a water body, the measurement of chlorophyll-a is important. Chlorophyll-d is found only in marine red algae, while chlorophylls-b and c are common in fresh waters. The molecular structure of chlorophylls-*a* and b consists of a ring-like structure called a porphyrin and a long organic phytol "tail." In the center of the porphyrin ring is a magnesium molecule. The relative concentrations within the cell of these chlorophylls vary with the species of algae. These are the carotenes and the xanthophylls.

By measuring the concentration of chlorophyll- a in water, it can be used to characterize the biomass of phytoplankton, that preliminarily determine the eutrophication degree of water, and reflect the water quality of lakes (Bi, J. Spatial 2020 & Kim, H.G. *et al* 2021). In addition to environmental factors, natural properties of lakes, physicochemical properties of water, and human activities have direct or indirect effects on chlorophyll- *a* concentration (Zhang, Z.Y. *et al* 2018 & Deng *et al* 2019).

MATERIALS AND METHODS :

Hyderabad, the capital of Andhra Pradesh, is situated 20 km from the Osmansagar reservoir, and the reservoir is one of the sources for supplying water for use to the city. The main sources of surface water are Osmansagar, Himayatsagar, Manjira Barrage, Singur Dam and Nagarjunasagardam (Fig.1). Osmansagar was constructed across Musiriver during the period 1912-1920 in Gandipet village,

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Rajendranagarmandal in Ranga Reddy district. The reservoir is located at latitude 17^{0}22'30" and longitude 80^{0}04'00".The catchment area is 285 sq. miles. From the Osmansagar and Himayatsagar reservoirs, there has been a decline in water supply over the years due to reduced inflows. It is reported that there has been a progressive decline in the per cent of rainfall converted into inflows into these two reservoirs even though the rainfall pattern has not changed much. Despite copious rains in Hyderabad and its surroundings, the inflows have been very less into these reservoirs. Barring 2010-14, it is reported that these two lakes were not at full level in earlier 7-8 years. The entire city lies in the Musi river sub-basin, which is a part of the Krishna river basin and is drained mainly into Musi river system. Esi is the main tributary to the river Musi.

The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWS&SB) is a statutory authority providing and maintaining water supply and sewerage facilities in Hyderabad and surrounding municipalities. The Board is responsible for supply of potable water including planning, design, construction, implementation, maintenance, operation and management of water supply and sewerage system. The main surface sources of water for the city of Hyderabad is from five impoundments, viz., Osmansagar on River Musi, Himayatsagar on Esi River, Manjiraphase I and II on Manjira Barrage, Manjira phase III & IV on Singur Dam, Krishna water supply phase I & II on Akkampally reservoir. In view of uncontrolled anthropogenic activities, the water characteristics of Osmansagar and Himayatsagar reservoirs, particularly the former one, have been deteriorated substantially. Since this water is being used as a source of drinking water, the water treatment plant efficiency has been reduced substantially in recent times. As a result, HMWS&SB often stops taking Osmansagar reservoir water as a source of drinking water. Hence there is a need to undertake monitoring and suggest remedial measures for restoration of these freshwater reservoirs in the interest of mankind, looking into the shrinkage of drinking water sources. Considering severity and consequences of the situation the present study was undertaken. The objective of the study was to assess the comprehensive seasonal assessment of Chlorophyll- –a during winter, summer and monsoon seasons from 2012 to 2014.In all, 12 water samples covering all the seasons from the reservoir were collected using a Niskin (depth) sampler with the help of a mechanized boat.

In determining the chlorophyll-a, sample was concentrated by centrifuging or by filtration through a membrane or glass fiber filter under mild pressure. A small quantity of magnesium carbonate was added to prevent acidification, which, otherwise would have led to the formation of phaeophytin, the main chlorophyll degradation product. The chlorophyll was extracted in acetone. Acetone extraction was achieved by storage for 24 hrs. in a refrigerator in darkness. The filtered or centrifuged supernatant was then used for spectrophotometric determination to obtain the optical density. For freshwater algae 1 or 4 cm cuvettes were used. Readings of optical densities were taken at 750, 664, 647 and 630 nm. The OD reading at 750 nm is correction for turbidity (APHA 2005).

Formula

$$\frac{\text{Ca X extract Volume}}{\text{Volume of Sample}} = \text{Amount of pigment}$$

OBSERVATION & RESULT :

Chlorophyll-*a* count recorded at different sampling locations are presented in Table 1 & Fig.1.In 2012 minimum recorded chlorophyll-*a* was 8 µg/L at sampling station 9 in summer while maximum level of 18 µg/L was recorded at sampling station 1 in winter.

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In 2013, it varied between 7 and 18 µg/L. Minimum value was at sampling station 9 in summer while maximum amount was at sampling station 4 in winter. Similarly in 2014, it was between 9 and 17 µg/L, minimum being at sampling station 9 in winter and maximum at sampling station 6 in winter. Chlorophyll –*a* was high in Osmansagar reservoir due to shallow water and high photosynthetic activity. Throughout the seasons, Chlorophyll-*a* concentration varied between 7 and 18 µg/L.

A similar kind of result was observed by Ajayan and Parameswara (2014) in Lentic Water Bodies of Bhadravathi Taluka, Shimoga District, Karnataka. Rajashekar and Vijaykumar (2008) also studied Chlorophyll in Trophic Index State of Sharanabasaweshwara Lake, Gulbarga District, Karnataka, which supports the present study. Devi et al. (2013) studied Phytoplankton community of Lake Baskandianua, Cachar District, Assam, North East India. Karthick et *al.* (2016) recorded Chlorophyll -*a* in Kadamba tank of Thoothukudi district in Tamil Nadu supports our findings.

Considering present ecological status of the lake and problems faced during previous years, comprehensive studies were initiated. Chlorophyll-*a* values for surface samples indicated medium water quality, although there is evidence of comparatively better quality in former than the later. The values during winter, summer and monsoon seasons also indicated medium surface water quality of the lake. In 2014, water quality of lake was improved gradually from medium to good qualities.

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Table 1: Chlorophyll-*a* Contents in Osmansagar

Sr. No.	Year	Season	Chlorophyll – *a* [µg/L]
1	2012	W	18
		S	12
		M	10
	2013	W	15
		S	13
		M	12
	2014	W	13
		S	15
		M	10
2	2012	W	13
		S	15
		M	16
	2013	W	18
		S	15
		M	13
	2014	W	10
		S	10
		M	13
3	2012	W	13
		S	9
		M	10
	2013	W	16
		S	15
		M	13
	2014	W	15
		S	14
		M	13
4	2012	W	13
		S	12
		M	15
	2013	W	18
		S	16
		M	12
	2014	W	13
		S	14
		M	13
5	2012	W	15
		S	13
		M	14
	2013	W	15
		S	13
		M	10
	2014	W	15
		S	10
		M	13
6	2012	W	15
		S	16
		M	13
	2013	W	15
		S	14
		M	16
	2014	W	17
		S	13
		M	15
7	2012	W	10
		S	15
		M	18
	2013	W	13
		S	15
		M	16
	2014	W	14
		S	12
		M	10
8	2012	W	16
		S	13
		M	15
	2013	W	18
		S	12
		M	10
	2014	W	15
		S	15
		M	10
9	2012	W	12
		S	8
		M	10
	2013	W	9
		S	7
		M	10
	2014	W	9
		S	10
		M	10
10	2012	W	16
		S	15
		M	12
	2013	W	17
		S	15
		M	13
	2014	W	15
		S	12
		M	13
11	2012	W	16
		S	12
		M	10
	2013	W	13
		S	15
		M	14
	2014	W	15
		S	15
		M	12
12	2012	W	15
		S	16
		M	13
	2013	W	15
		S	10
		M	14
	2014	W	12
		S	16
		M	12

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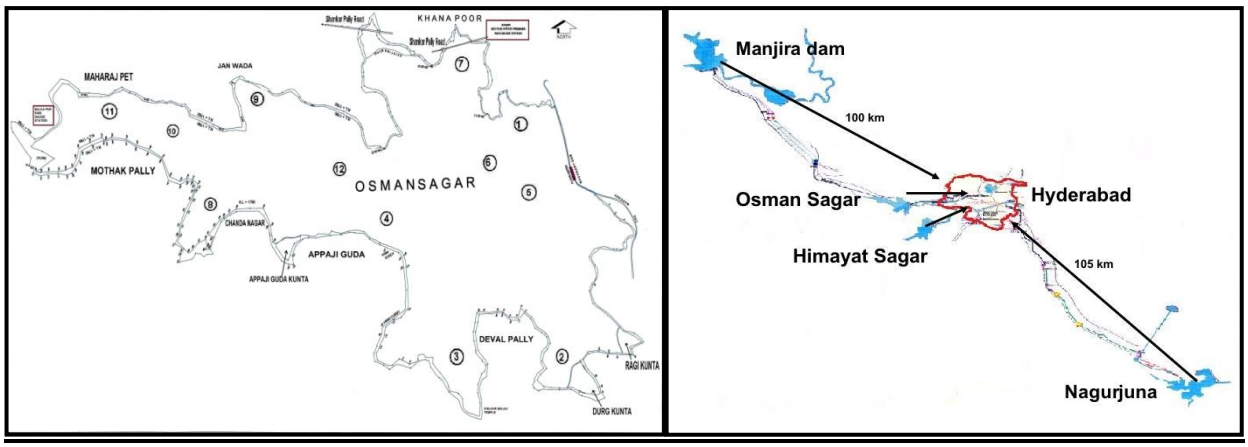

Fig. 1: Schematic Map of Osmansagar Lake– Location of Sampling Stations

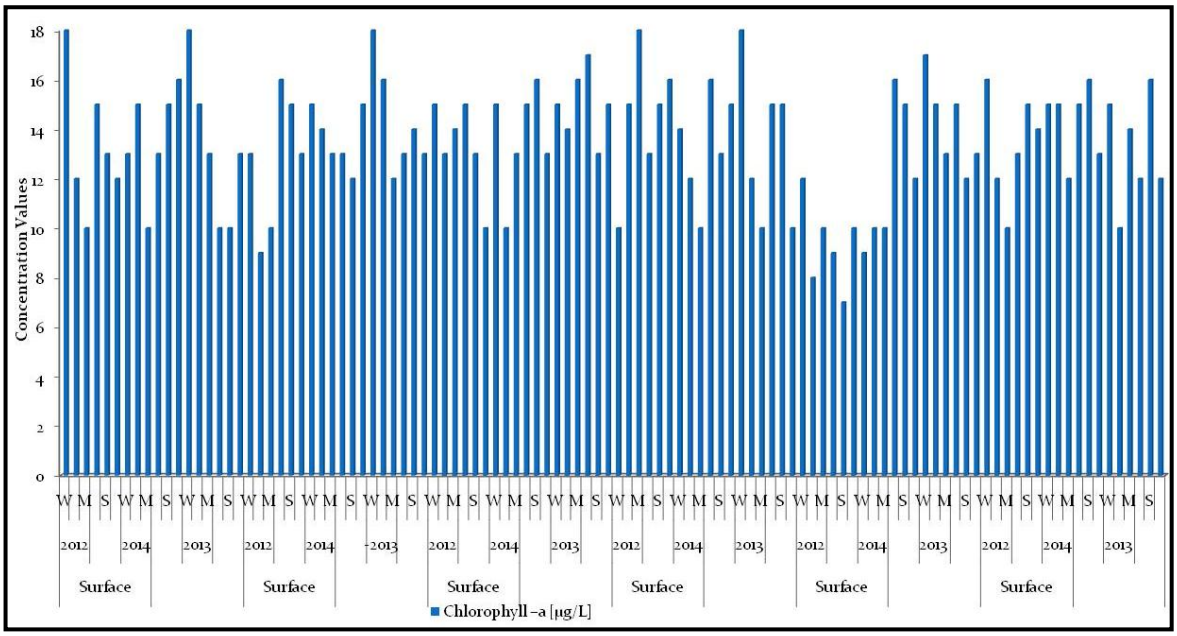

Figure 1: Chlorophyll-α concentrations in Osmansagar Lake (2012-2014)

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