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Physico-Chemical and Biological Status of Hussain Sagar Lake in Hyderabad City, Telangana State, India

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Abstract.
The present study was carried out with the aim to assess of water quality using Physico-chemical parameters of Hussain Sagar Lake, located at Hyderabad of Telangana State India. Seasonal changes in water quality parameters (Physico-Chemical and Biological) of a rain fed Hussain Sagar Lake, were investigated to assess the suitability of this lake as a source of drinking water and fish culture. Several parameters such as rainfall, temperature, pH, DO, Total Alkalinity, Sulphate, and Phosphate have been studied for a period of one year i.e. from Sept. 2018 to August 2019. Various Physico-Chemical and Biological parameters determined, revealed that the fluctuation in water temperature, pH, DO and Sulphate but they were within the desirable limits. On the other hand, Total Alkalinity and phosphate were beyond the permissible limits in the lake water used for fish culture. Increase in the level of these factors was owing to the discharge of sewage into the lake. This research paper throws a light on control of these high level parameters in the lake in order to confirm to the level suited for the fresh water fish culture.

Key Words: *- Hussain sagar Lake, Physico-Chemical parameters, Biological status and Fish culture.*

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I. Introduction:

Water, like air is indispensable and one of the most precious of natural resources on this planet, and is obviously, absolutely essential to life, not only human life but also life forms. Indeed it is a part of life forms indeed it is a part of life itself, since the "protoplasm of most living cells contains about 80% of water and any substantial reduction in this percentage is disastrous. Most of the biochemical reactions that occur in the metabolism and growth of living cells involve water, and all the biochemical reactions take place in water, which has often been referred to as the universal solvent. Yet man's assessment of the value of water is very low until the finds himself without it. Most of the surface of the earth is covered with water that is 79% of water. Most of this is salt water to be sure, though most of the habitable landmasses have adequate fresh water resources.

Water is a chemical compound and may occur in three forms like liquid, solid and gaseous forms. It is transformed into different forms and is circulated mainly by solar and planetary forces.

The oceans with a mean depth of 3.8 kms and covering 71% of the earth's surface hold about 97% of all the earth's water and about 2% is frozen in ice caps and 0.3% is in storage as deep ground water. The remainder which is in the order of 4.4×10^6 km represents the fresh water resources with which man must deal.

Man uses water not only for drinking and culinary purposes but also for bathing, washing, laundering, agriculture, stock raising, gardens, for industrial processes, cooling, for water power and steam power, for fire protection, for disposal of wastes, for fishing, for wild life propagation, for navigation, swimming. Boating and other recreational purposes. That is why we find that human settlements have established themselves and flourished where large size sources of water are available.

India has vast and varied inland water resources, which are considered to be one of the richest in the world Natural lakes. However, they are largely confined to the Himalayan region while the rest of the subcontinent is dominated by river systems and man-made impoundment.

The lakes are formed as a result of earth movements, retreat of glaciers, weathering, denudation, volcanic eruptions, floods and other natural causes besides the various types of anthropogenic activities and they are mainly used for hydroelectric power, drinking water supply, navigation and residential purposes, irrigation, food and fodder resources, fish culture, tourist and recreational spots.

The first account of the algal ecology of a fresh water body from India was written by Prasad (1916). It was followed by a series of publications on the ecology of lentic environment. They are Pruthi (1933), Iyenger (1933, 1938, 1940), Ganapathi (1940-1955), Philipose (1960), Mookerjee (1945), Gonzalves and Joshi (1946),

Gupta (1948), Singh (1960), Chacko and Krishna murthy (1954), Alikunhi *et al.,* (1955), Das and Srivastava (1956), Pankajam (1956), Doudoroff and Warren (1957) and Swami (1959).

Lakes have been home and have afforded livelihood to millions of people over the centuries. But with increasing populations and economic development, of late there have been ominously increasing demands on lakes and their water sheds, due to which they have degraded or are on the way to degradation. Lakes could be generally classified on the basis of their nutrient levels as oligotrophic, eutrophic and or senescent.

Water is an essential component for survival of life on earth, which contains minerals, important for humans as well as for world and aquatic life. Lakes and surface water reservoirs are the planet's most important freshwater resources and provide in numerable benefits. They are used for domestic and irrigation purposes and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein and for significant elements of the world's biological diversity. They have important social and economic benefits as a result of tourism and recreation, are culturally and aesthetically important for people throughout the world (Arain *et al.,* 2008).

The Physico-chemical parameters are very essential and important to test the water, before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different Physico-chemical parameters. Selection of the tested parameters is only depended on the purpose of using that water and what extent we need its quality and purity. The Physico-chemical parameter is very important to get exact idea about the quality of water and then we compare the obtained results with standard values. Water quality analysis is important to protect the natural ecosystem (Patil *et al.,* 2012). Few literatures exist on the Physico-chemical parameters of Çamlıgöze Dam Lake. Dirican *et al.* (2009) investigated some Physico-chemical characteristic (water temperature, electrical conductivity, pH, dissolved oxygen) and rotifers of only the surface water in Çamlıgöze Dam Lake. The present study was carried out with the aim to assess of water quality using physico-chemical parameters of Hussain Sagar Lake.

II. Material and Methods:

Hussain Sagar Lake is located in the centre portion of Hyderabad, the capital city of Telangana (between latitude (17.4239° N, 78.4738° E). It is bordered by parks and natural spaces, but it is most known for its huge Buddha statue, which is located in the lake's southern end. Hussain Sagar Lake covers an area of 5.7 kilometres and is located on a branch of the Musi River. Hyderabad and Secunderabad are separated by the lake. In the centre of the lake is a massive statue of Lord Buddha. This beautifully carved monolithic monument was constructed on Gibraltar Rock in 1992. This man-made lake has a maximum depth of 32 feet. Physicochemical and biological characters of water.

Water samples were collected in the morning between 9-10 am. In the polythene bottles. Temperature and pH were recorded at the time of sample collection using portable kit. For determination of Dissolved Oxygen, water was fixed in the field and brought to the laboratory in an ice-box for further processing. Total alkalinity, sulphate and phosphate were determined in the laboratory, employing methods described by APHA (1989).

III. RESULTS AND DISCUSSION:

Hussain Sagar natural lake is a rain-fed body of water with a roughly oval form. When the lake is full, the depth in the Centre is around 36 feet. The water level rises during the monsoon due to rainfall and falls during the summer due to evaporation and consumption. The lake's bottom is made of dirt. The lake's bottom is murky and covered in algae and other aquatic plants.' Lake water is widely utilized for washing clothing, livestock, and other household needs. The statistics on the physicochemical properties of Hussain Sagar Lake are provided in (Table-1 and Fig –I and II).

Table 1:- Reveals seasonal variations in some Physico-chemical parameters of Hussain Sagar Lake during Sept. 2018 to Aug 2019

Sl.No	Parameters	Post –Monsoon (PM)	Winter (W)	Summer (S)	Monsoon (M)
1	Rainfall (mm)	28.0	16.0	10.0	68.0
2	Temp Water OC	27.6	20.2	29.0	24.0
3	Temp Air OC	23.4	16.50	30.30	24.30
4	pH	7.50	6.80	6.31	6.50
5	DO oxygen (ml/l)	7.5	8.5	6.7	6.2
6	Alkalinity (Mg/l)	450.00	480.20	530.23	350.32
7	Sulphate (Mg/l)	42.30	2.85	45.80	38.37
8	Phosphate (Mg/l)	3.12	1.20	3.25	3.60

During the period of this investigation while analyzing the water samples of lake, the sulphate content showed its range between 2.85mg/L in winter and 36.37 mg/L in monsoon. Similar observations were made by Aher *et. al* (2007). Phosphate concentration ranged between 3.12 to 3.60 mg/L, being higher in monsoon low in

winter season. The higher phosphate concentration in monsoon might be owing to influx through rain water as has already been reported by Munawar, (1970) and Aher *et. al* (2007).

An evaluation of Hussain Sagar water and its appropriateness for public household use and pisiculture was deemed necessary in the current attempt. The majority of the physicochemical parameters of Hussain Sagar Lake listed above display certain fundamental features that support a successful use of the water for washing clothes, bathing, and fish farming activity. Hussain Sagar Lake's productive and useful character is shown by its favorable temperature range, alkaline pH, and high DO levels. The comparison of water quality of Hussain Sagar Lake with limits laid down by fresh water quality criteria for public use i e. fisheries practices, bathing, washing cloths and animals etc. by Subbamma and Ramasarma (1992) and Chandra Prakash (2001), suggest that the water parameters of the lake are within the permissible limits. However, very high level of phosphate and alkalinity was recorded which needs to be managed to reach permissible limits.

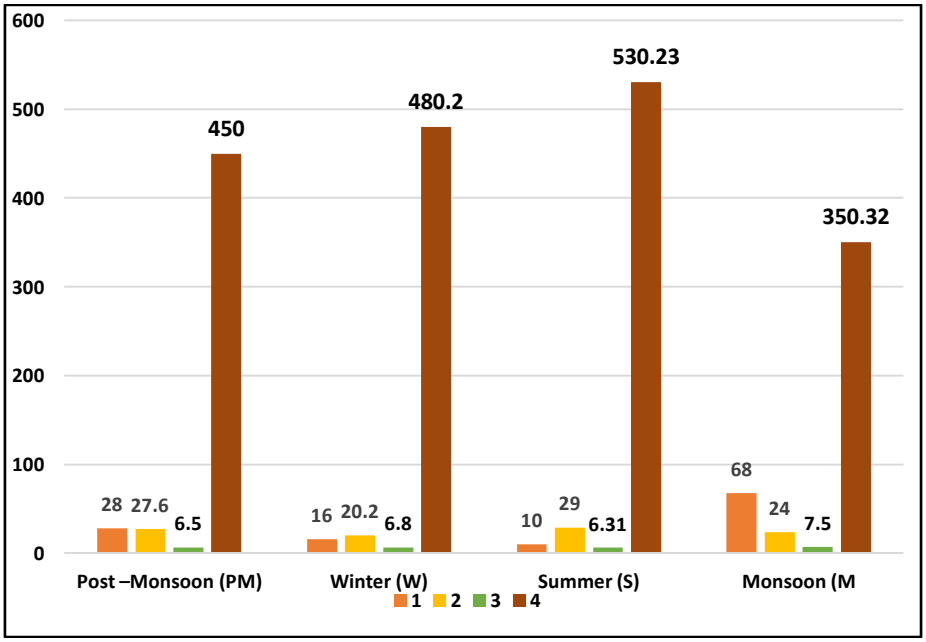

Fig-I Seasonal variations in the Physico-Chemical parameters of Hussain Sagar Lake during Sept. 2018 to Aug2019.

During this research, it was discovered that the lake got the most rainfall (65.33 mm) during the monsoon season and the least (26 mm) during the post-monsoon season, with no precipitation recorded during the winter and summer seasons. According to the temperature record given in (Fig-1), the air temperature was greater in the summer and lower in the winter. During monsoon, post-monsoon, and winter, the surface water temperature was greater than the ambient temperature. Furthermore, while they are highly impacted and modified by climate and vegetation (Hutchineson 1975 and Aher2007), Physico-chemical characteristics of water are essential indicators of an aquatic environment.

The pH varied from 6.50 to 7.50, with both the lower range in the monsoon and the highest in the winter. The monsoon's low pH value was affected by a large inflow of fresh water into the water body. The higher pH in the winter might be attributed to increased photosynthetic activity. Roy (1955), Tiwari and Chauhan (2006), and Aher *et. al.* (2006) all made similar observations.

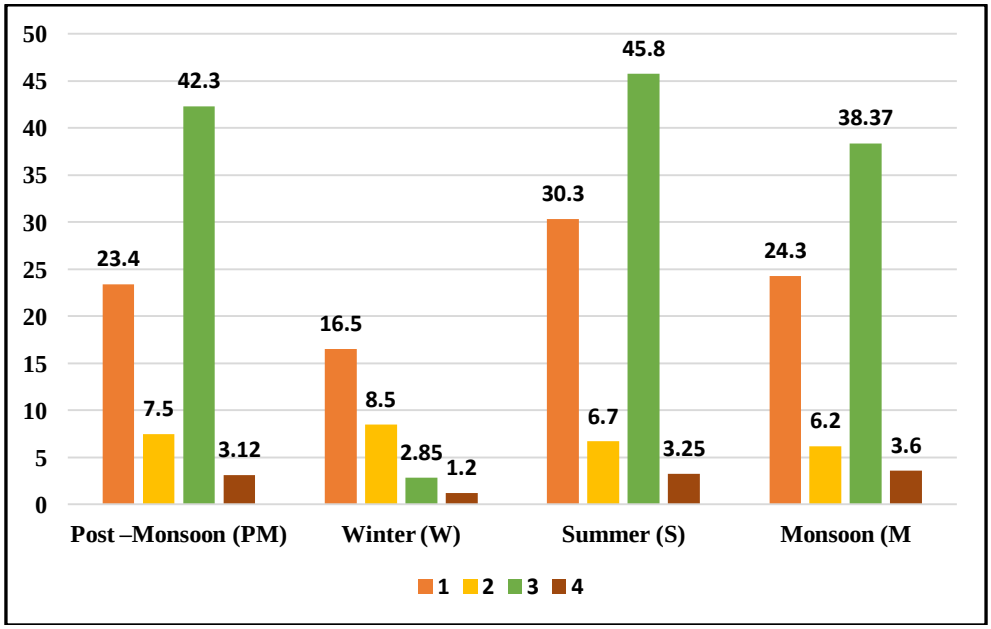

Fig-II: Seasonal variations in the Physico-Chemical parameters of Hussain Sagar Lake during Sept. 2018 to August2019

The amount of dissolved oxygen (DO) in Hussain Sagar Lake's water body ranged from 8.5 to 6.2 ml/ L throughout the year, with minimal levels in the summer and highest levels in the winter, as well as being far over the minimum level required for pisiculture. Low dissolved oxygen levels have been related to the ability of flowing water to purify itself, the photosynthetic efficiency of aquatic plants, and airflow, among other things (Singh and Trivedi 1979).

In the current research, total alkalinity varied from 350.32 to 530.23 mg/l, with monsoon being the lowest and summer being the highest. The accumulation of a high amount of bicarbonate might be caused by organic decomposition and a reduction in water level. Dilution was clearly responsible for the decrease in alkalinity throughout the monitoring month (Mishra *et. al.,* 1989). Jhingram (1982) indicated that a high productive water body has alkalinity more than 100 mg/l.

Total sulphate levels ranged from 2.85 to 45.80 mg/l, with winter having the lowest levels and summer having the highest. The buildup of a large number of sulphates as a result of organic decomposition and a decrease in water level. Total phosphorus levels varied from 1.20 to 3.60 mg/l, with the lowest values occurring during the winter and the greatest occurring during the monsoon.

IV. Conclusion:

1) The water in Hussain Sagar Lake was not determined to be contaminated, according to the findings of this investigation.
2) When compared to ISI, all measured parameter results are within allowable levels.
3) The water surrounding Hussain Sagar Lake has indeed been proven to be applicable to public use, i.e. for drinking following standard processing.
4) While Hussain Sagar is an ancient lake, it is oligotrophic in nature.
5) Excessive water exportation for irrigation, bathing, washing of clothes, and animals might putting the Hussain Sagar Lake's water in risk.
6) The Hussain Sagar Lake appears to be the future resource, which is under rigorous management and bioremediation operations, considering the demand and volume of water supply for the ever-growing human population and also taking into account the freshwater budget. As a result, remedial actions such as preventing sewage from entering the marsh or treating it properly before discharge are required to ameliorate the situation and allow the lake's full potential to be realized.

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