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Identification of Water Quality of Four Lakes in the Medchal District, Telangana State

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Abstract: ***Water-quality characteristics were determined for four lakes (Dundigal, Mallampet Nizampet and Bowrampet) in the Quthbullapur Mandau of Mitchel District, Telanagana State to evaluate changes in lake water quality that may occur in summer and after initial rains. Samplings were collected from each lake in May 2017 and July 2017. The measured water quality parameters included pH, color, turbidity, alkalinity, hardness, suspended solids, Dissolved oxygen, COD, BOD ,Chloride content TDS, Total load of bacteria. From this values it is observe that the lake water is not potable, but can be used for general purpose as well as recreational purpose. Higher values were recorded after initial rains due to natural and anthropogenic sources such as run- off containing salts, land fill leachates, septic tank effluents and animal feeds is higher in first flush. It is also observed that the water turbidity, nitrate and phosphorous levels are more in all lakes. It is due to the increase of nutrient level and the water hycanith presence in the lakes. Therefore it is necessary to reduce the nutrient loads by treating the waste water prior to the discharge into the lakes and removing the water hycanith from the lakes to clarify the water.***
Keywords: lake water; water quality; physico-chemical analysis; seasonal vaiation

I. INTRODUCTION

Lakes are either formed by variety of geomorphic processes (tectonic, volcanic, glacial, fluvial, Aeolian and coastal) or man-made efforts (excavation of earth or obstruction of flow). World's lakes contain about four times freshwater than rivers thereby showing their importance as a potential water resource. India is endowed with large number of shallow natural lakes, most of which are in Himalayan belt. In recent times, large reservoirs are constructed on practically all the rivers. With fast growing industrialization and urbanization, the demand of fresh water has increased tremendously in recent years ultimately putting huge pressure on water resources. The problems of siltation, tourism, discharge of domestic and industrial sewage, dumping of solid waste, encroachment are becoming the common serious problems of rivers, lakes, wetlands etc

Hyderabad Metropolitan Development Authority (HMDA) developed from the 400 years old Bhagyanagar city, geographically situated land locked arid zone and no perennial river but a seasonal River Musi flowing through it. For longer periods, it is the capital city of so many rulers and in long run expanded to the 8,005 sq km in Telangana State, India. To cater to the domestic and irrigation needs of people the local leaders/ rulers dug so many lakes and shallow dug wells distributing the entire area. By preserving the rain water in tanks leads increased harvesting fruits, attains a special stature to the city. Later increased population, city culture demands industrial growth spoils the catchment of all the Lakes in the city. It results in environmental degradation sequentially in time. These problems include faecal contamination and water supply, eutrophication, acid rain, toxic chemicals and ecosystem dysfunction, among others.

Medchal district has cascade of lakes (Fig.1). Due to the expansion of the Hyderabad city and rapid urbansiation of the Hyderabad surrounding areas the water quality of lakes are destroying. Therefore in the present project four lakes are selected in such a way that sundial lake in growing village, mallam pet lake near to city, nizampet lake in city, and bowrampet lake village. This lake supports local inhabitants present in its catchment area; hence, anthropogenic activities like surface runoff, domestic sewage, construction activities, and agricultural activities have significantly changed the water quality of the lakes.

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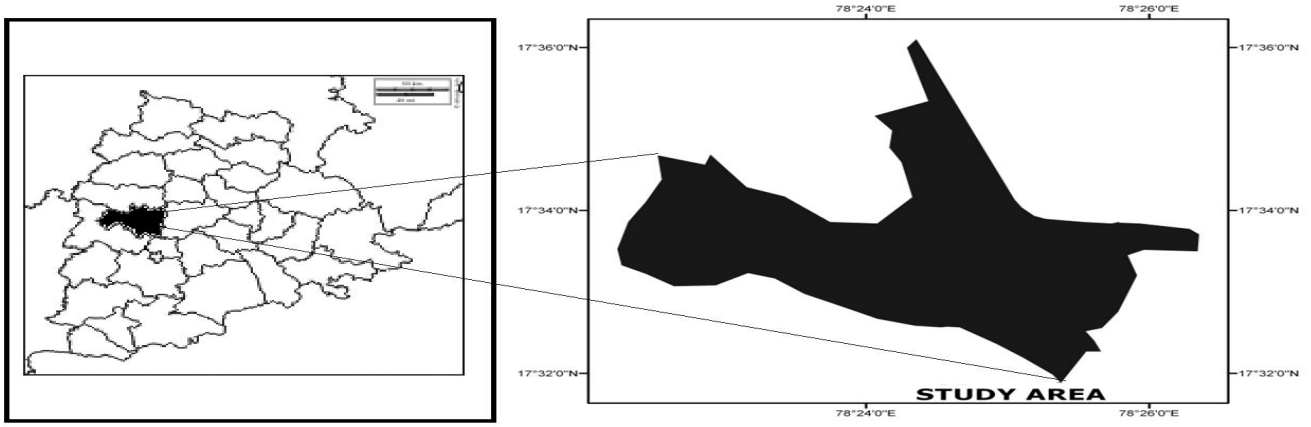

Fig.1 Study Area Map

II. METHODOLOGY

Surface water samples were collected from the four lakes (Figure 1) during the month of may representing summer and June after the initial rains (i.e., first flush) 2017.grab samples of water were collected in polyethylene bottles (1000ml) were filled with lake water. The sampling, preservation, transportation, and analysis of water samples were carried out according to the methods described in APHA-AWWA-WEF (1998). A total of 18 physicochemical parameters were analysed in laboratory using standard protocol APHA-AWWA-WEF (1998) including total dissolved solids (TDS), total suspended solid (TSS), turbidity, phosphate, total hardness, pH, alkalinity, temperature, BOD, DO, Cl, etc.

III.RESULTS AND DISCUSSION

It is 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. Water does contain different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, pH, turbidity, TDS, etc., while chemical tests should be perform for its BOD, COD, dissolved oxygen, alkalinity, and other characters.

A. Physical Parameters

Table:1 Physical Parameters Of Four Lakes

Lake name	Sample	Colour	Odour	Temperature	P^H	Turbidity	T D S	TSS
Dundigal	Before rain	Greenish	objectionable	28	6.45	17.2	668	188.01
	After 1st rain	Greenish	objectionable	27.2	8.53	18.8	667	228.99
Mallampet	Before rain	Greenish	objectionable	27.8	6.54	23.6	2250	131.11
	After 1st rain	Greenish	objectionable	28.1	6.94	17.9	1997	139.95
Nizampet	Before rain	Greenish	objectionable	28.4	5.88	29.3	1854	180.94
	After 1st rain	Greenish	objectionable	28.0	7.98	16.2	1427	193.41
Bowrampet	Before rain	Greenish	objectionable	28.6	5.71	22.8	349	187.08
	After 1st rain	Greenish	objectionable	28.3	7.80	47.5	338	164.40

1) *Temperature:* Temperature can exert great control over aquatic communities. If the overall water body temperature of a system is altered, an aquatic community shift can be expected. In water above 30^0 C, a suppression of all benthic organisms can be expected (Spellman and Drinan 2012). Also, different plankton groups will flourish under different temperatures. For example, diatoms dominate at 20 - 25 ^{0} C, green algae dominate at 30 – 35 ^{0} C, and cyano-bacteria dominate above 35 ^{0} C. the temperatures of the lake changes from 27.2 to 28.6 ^{0}C.
2) *pH:* Hydrogen ion concentration plays an important role in the biological processes of almost all aquatic organisms. For the existence of aquatic life the pH Range should be lie between 6.5 to 8.5 and for irrigation it should be 6.0 to 8.5. In the present investigation the Dundigal, Nizampet and Bowrampet lake shows below 6.5 pH in summer. This is ascribed due to increased photo synthetic assimilation of dissolved inorganic carbon by planktons. A similar effect could also be produced by water evaporation through the loss of half bound CO2 and precipitation of mono-carbonate. After the initial rains the pH value is increased and varies from 6.94 to 8.53.
3) *Turbidity: Turbidity* is a measurement of the cloudiness of water. Cloudiness is caused by material suspended in water. Clay, silt, organic matter, plankton and other microscopic organisms cause turbidity in natural water. This has been recognized as a valuable limiting factor in the biological productivity of the water bodies. In the present study the turbidity found in the range between 16.2 to 47.5 NTU. It indicates the slightly pollution of the lakes
4) *Total Dissolved Solids:* Total dissolved solids (TDS) - It is an important parameter in drinking water quality standard. It develops a particular taste to the water and at higher concentration reduces its potability Water and may cause gastro intestinal irritation with more than 500mg/l. High TDS levels generally indicate hard water, which can cause scale build up in pipes, valves and filters. In the present study the value of TDS found in the range 349 to 2250mg/l in summer and 338 to 1997 mg/l after the initial rains. All the lakes show decreased in TDS after the initial rains. Mallampet and Nizampet lakes shows the high TDS i.e., 2250mg/l and 1854 mg/l in summer and 1997 mg/l and 1427mg.l after the initial rains. It represents that the lakes are is polluted due to the urbanization of the surrounding areas. Bowrampet and Dundigal lakes shows the low TDS Value i.e., 349 mg/land 668 mg/l in summer and 338mg/l and 667mg/l after initial rains which shows the suitable for drinking and aquatic life.
5) *Total suspended solids:* Total Suspended solids are an indication of the amount of erosion that took place nearby or upstream. This parameter would be the most significant measurement as it would depict the effective and compliance of control measures e.g. riparian reserve along the waterways. The suspended material in water supports increased numbers of photosynthetic organisms, such as rooted algae. In the present study the total suspended solids varied from 131 to 228 mg/l .

B. Chemical and Biological Parameters

Tbale:2 Chemical And Biological Parameters Of Lake Water

Lake name	Sample	Alkalinity	Chloride	DO	BOD	COD	Nitrate	Phosphate	Coliform
Dundigal	Before rain	258.51	284	11.3	4.3	50	5.2	2.13	383
	After 1st rain	179.35	449	8.4	0.6	45	9.2	3.38	218
Mallampet	Before rain	160	184	8.2	1.3	45	8.3	1.8	107
	After 1st rain	208	504	6.2	1.1	47	10.1	3.6	137
Nizampet	Before rain	368	124	7.7	1.1	30	8.6	1.6	107
	After 1st rain	489	524	8.4	1.5	38	9.3	3.1	454
Bowrampet	Before rain	153	139	8.8	2.3	53	9.4	2.1	96
	After 1st rain	157	619	8.9	2.9	39	8.7	3.4	113

1) *Alkalinity:* Alkalinity is a measure of the buffering capacity of water, or the capacity of bases to neutralize acids. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. Alkalinity does not refer to pH, but instead refers to the ability of water to resist change in pH. The presence of buffering materials help neutralize acids as they are added to the water. These buffering materials are primarily the bases bicarbonate (HCO_3^-), and carbonate (CO_3^{2-}), and occasionally hydroxide (OH^-), borates, silicates, phosphates, ammonium, sulfides, and organic ligands. Waters with low alkalinity are very susceptible to changes in pH. Waters with high alkalinity are able to resist major shifts in pH. As increasing amounts of acid are added to a water body, the pH of the water decreases, and the buffering capacity of the water is consumed. If natural buffering materials are present, pH will drop slowly to around 6; then a rapid pH drop occurs as the bicarbonate buffering capacity (CO_3^{2-} and HCO_3^-) is used up. At pH 5.5, only very weak buffering ability remains, and the pH drops further with additional acid. A solution having a pH below 4.5 contains no alkalinity, because there are no CO_3^{2-} or HCO_3^- ions left.
2) *Chlorides:* The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects. In natural fresh water, however its concentration remains quite low and is generally less than that of sulphate and bicarbonates. The chlorides present in the lakes is varied from 124.96 mg/l to 284.91mg/l during summer and 449.86mg/l to 619.81mg/l after initial rains. Higher value of chloride content was recorded after first may be due to natural and anthropogenic sources such as run- off containing salts, land fill leachates, septic tank effluents and animal feeds is higher in first flush. Higher value of chloride content affects on health of man.
3) *Dissolved oxygen(DO):* The decomposition of organic matter might be an important factor in consumption of DO, as more vigoroso deposition could be likely during warm weather, which also witnessed increased inflow of tourists in the region.The re-oxygenation of water during monsoon might be occurring due to circulation and mixing by inflow after monsoon rains. A good water quality should have solubility of oxygen 7.6 mg/l and 7.0 mg/l at 30^0C and 35^0C respectively. The oxygen saturated water has pleasant taste. From the table(2) it is observed that Dundigal and Mallampet lakes showed higher values of dissolved oxygen in summer compared to after first rains. This may be due to several factors, the rise in temperature, increased biological activity, respiration of organisms and increased rate of decomposition of organic matter after starting the rains. The studied sites at nizampet and Bowrampet Lakes shows low DO values in summer as expected from the converse relationship of water temperature versus DO content. All the samples show more than 4mg/l of DO Content. It represents that the lake water is safe for existence of aquatic life.
4) *Bio chemical oxygen demand (BOD)::* BOD is a value of presence of organic materials in water which can support increasing of microbe organisms. Surface water (river, lake) containing BOD values 6 mg/l are consider to be slightly and more than 12 mg/l as to be highly polluted water (Penn et al. 2003). The greater the decomposable matter present, greater the oxygen demands and greater the BOD values. The regional distribution of BOD in all samples varies between 1.1 mg/l to 4.3 mg/l in summer and 0.6 mg/l to 2.9 mg/l after the initial rains. BOD variations depend on variable of dissolved oxygen and oxidisable organic matter.
5) *Chemical oxygen demand (COD):* The maximum permissible value of COD is 10 mg/l for drinking water. Chemical oxygen demand of all the water samples collected exceeds the limit. Chemical oxygen demand level varied from 30 mg/l to 53 mg/l. COD values fluctuated between 30 mg/l to 53 mg/l in summer season and 39 mg/l to 45 mg/l in rainy season. These higher values indicated that Sundial, Malapert, Nizampet and Bowrampet lakes rich either with respect to some dissolved organic compounds or oxidisable inorganic substances. The highest COD is carried to these lakes possible cause of this could be illegal discharge of slaughter house waste, dumping of garbage, (poor) sewage.
6) *Nitrate and Phosphate:* Both Nitrate (NO_3-N) and Phosphate concentrations are highly variable during lake seasonal cycles. For deep stratified lakes, nitrate is higher during mixing events and usually decreases in late summer and fall. For the trophogenic zone of shallow lakes, both concentrations would be lower during periods of water column stability and they will increase during vertical mixing events. Nitrate and phosphate level indicates that Lakes is moderately productive. The present study indicates all 4 Lake would be expected to support higher algal production with increased nutrient enrichment (Wetzel 2001, Spellman 2014,). Total nitrate in present study found to vary from 5 mg/l to 10 mg/l and phosphate 2mg/l to 4 mg/l. this high rate of nitrates and phosphates are present may be due to large amounts of drainage water discharged into Lakes.
7) *Total coliform::* The purpose of the total coliform counts in water bodies was to estimate the number of coliforms in water samples as an index of magnitude of biological contamination. Total coliform counts in water bodies are an important parameter for checking possible sewage contamination. The maximum permissible value of total coliforms is 50 mg/l for drinking water, but all lakes exceed the limit. After the initial rains higher values of total colonies were observed at three lakes namely malapert, nizampet and bowrampet. The increased pathogens in first flush are due to surface runoff generated from the rains. Elevated

flows in lakes most likely agitate bed sediment, which causes enhancement of pathogen levels of the water column (Jamieson et al. [2005a]; Jamieson et al. [2005b]; Pandas and Soupy [2013]; Bai and Lung [2005]).

IV. CONCLUSIONS

From this values it is observe that the lake water is not potable without treatment due to the low DO and high Nitrates and Phosphates concentrations, but can be used for general purpose as well as recreational purpose. Higher values were recorded after initial rains due to natural and anthropogenic sources such as run- off containing salts, land fill leachates, septic tank effluents and animal feeds is higher in first flush. It is also observed that the water turbidity, nitrate and phosphorous levels are more in all lakes. It is due to the increase of nutrient level and the water hyacinth presence in the lakes. Therefore it is necessary to reduce the nutrient loads by treating the waste water prior to the discharge into the lakes and removing the water hyacinth from the lakes to clarify the water.

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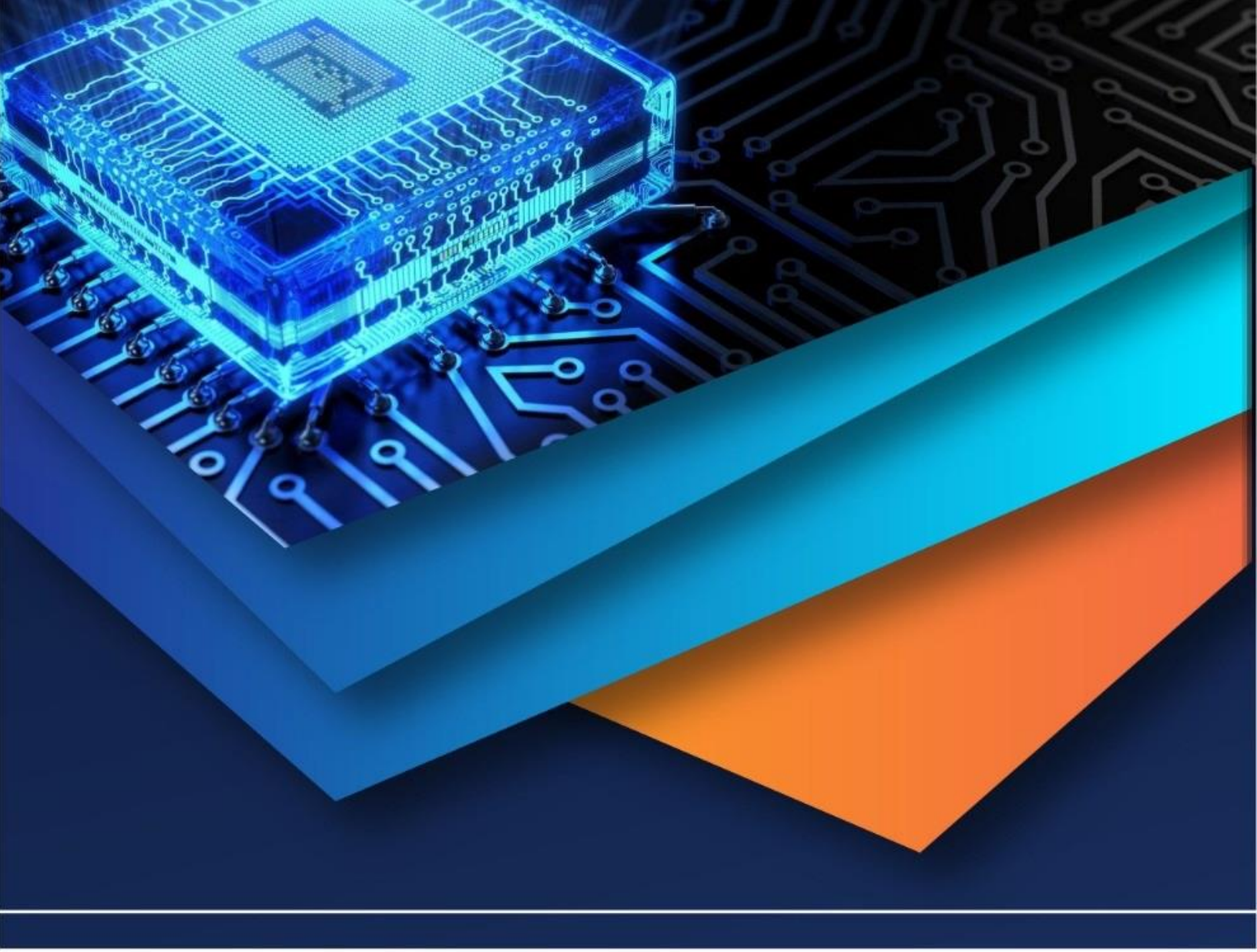

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