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Assessment of Hussainsagar Lake Water Quality and Treatment Process of Triveni Groups in Hyderabad, Telegana, India

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Abstract

Fresh water lakes are vital resources for any country because they regulate the urban climate and also have a prominent effect on ground water quality and ground water table .Water bodies like lakes, ponds, rivers and streams are polluted to a lesser extent by natural sources but are highly polluted by anthropogenic sources such as urbanization, industrialization, various human developmental activities and improper management of water resources. This has led to severe water quality impairment. Hussainsagar Lake (HSL) connects the twin cities of Hyderabad and Secunderabad and it was originally used as a source of drinking and irrigation water during 1894–1930.The present investigation was undertaken to study the treatment efficiency of 30mld wastewater treatment plant of Triveni group. The Physico-chemical characteristics such as Temperature, pH, EC, TSS,TDS, BOD, COD, , TN and TP of HSL water before and after treatment where analysed, it was observed that all the parameter where exceeded the permissible limit. But after treatment the water quality is found to be within the desirable limit and the same is discharged into the HSL in order to reduce the pollution level.

Keywords: Physico-chemical, Treatment units, urbanization, Industrialization, Hussainsagar lake

INTRODUCTION

Enormous consumption of world's water reserves is the result of huge increase in population. Population growth, urban run offs, sewage discharge and improper agricultural practices can disturb or disrupt aquatic ecosystems leading to eutrophication of inland water bodies causing the deterioration of water quality, which in turn interferes with most of its beneficial uses(Priya,2015). 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 8500 sq km in Telangana southern Indian State. There are 400 small and big lakes comes under Hyderabad Urban Development Administration (HUDA) area, 169 lakes notified by HUDA for protection and conservation of water spread area.

OBJECTIVE OF THE STUDY

The main objective of the study is to assess the present the state of groundwater pollution due to urbanization. To present the water quality after various treatment process from 30mld treatment plant of Triveni groups.

MATERIALS AND METHODS

Methodology adopted for the study are shown in the following Fig.1.

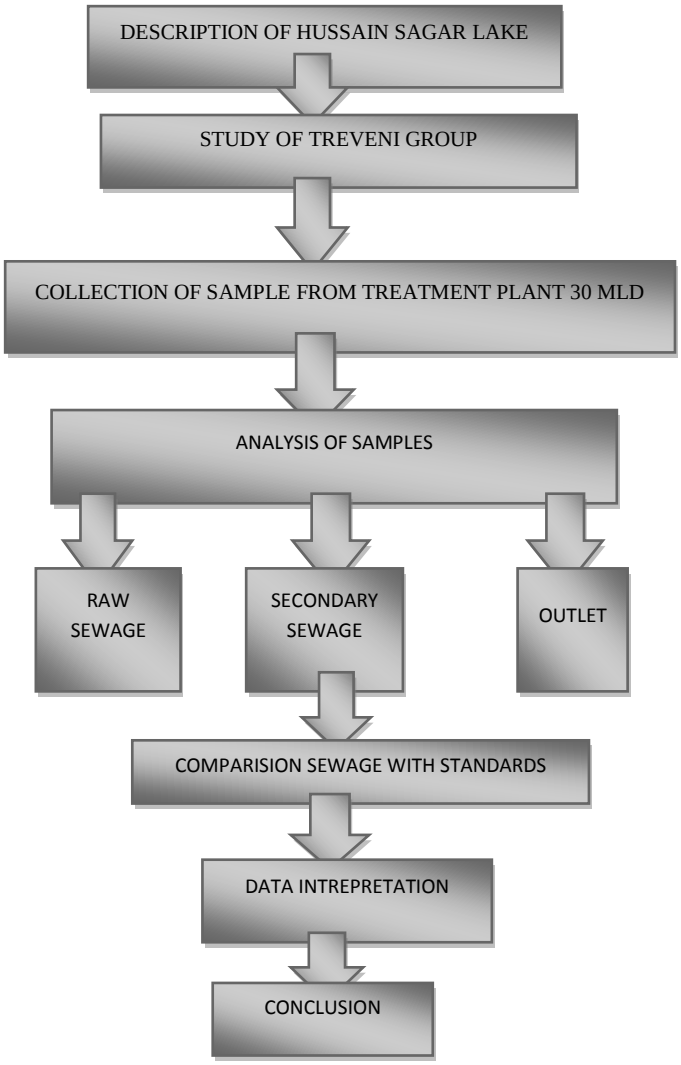

Figure 1. Flow chart of Methodology

Description of Hussainsagar lake

Hussain Sagar lake largest man-made lake in Asia is located in Hyderabad in India and is situated at 17° 22' of northern Latitude and 78° 29' of the eastern longitude, is built on a tributary of the Musi river by Hussain Shah Wahi, under ruling of Ibrahim Quli Qutub Shah in the year 1562. The storage volume at spill level is 28.6×10^6 m^3, average depth at full capacity is 5.2 m and the road bund level is 5.18 m (Kora, 2017). In addition to storm water, due to rapid residential and industrial growth in its catchment area, the lake is fed by four major drains nalas**,** which act as feeding channels. A million litres per day (MLD) of domestic sewage and solid waste is discharged into the lake through (13.3MLD) Balkapur, (6MLD) Banjara, (70MLD) Kukatpally and (5.7MLD) Picket nalas (Sridhar, 2015). HSL view and 4 nalas are shown in the following Fig 2 & 3.

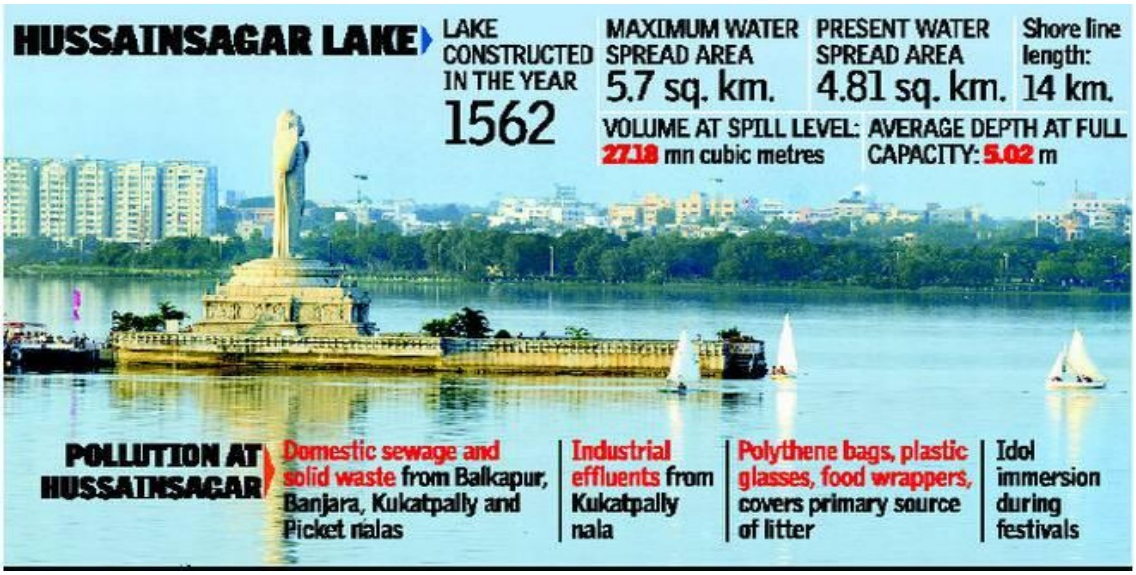

Figure 2. Hussainsagar Lake

Figure 3. Nalas around Hussainsagar lake

Environmental Pollution of Hussiansagar Lake

The primary source of litter includes polythene bags, plastic cups, food wrappers and covers. It is originally designed for drinking water purpose that receives domestic sewage and industrial effluents through drainage canals due to rapid residential and industrial growth. Also, every year twenty to thirty thousand idols made up of plaster of paris along with flowers and leaves are immersed in HSL during the festival held in september, which led to increase the chemical and organic content of the water.

Description of Triveni Treatment Plant

Triveni Engineering & Industries Limited Started in 1984, the leading water treatment company in India contributes to a clean environment by offering state-of-the-art products and technologies for turnkey solutions for the treatment of water and wastewater.

It involves in providing solutions for water, wastewater treatment and recycling systems using various physico - chemical for settling, clarification, filtration, disinfection, membranes and ion exchange technologies. It also have the best biological processes for removal of biodegradable organics from the effluent including nutrient and also offer Membrane bio reactor (MBR) and Moving bed bio reactor (MBBR) systems. It uses the latest technology and software for design, engineering and project management. Their strong design and engineering capabilities include process, electrical and mechanical providing optimum designing at the minimum operating cost.

Their major jobs include 160 MLD Sewage Treatment Plant (STP) for the city of Delhi, 30 MLD STP with Tertiary Treatment and 20 MLD Ultrafiltration MBR systems as well as for advanced biological treatment HussainSagar Lake Project in Hyderabad.

Other jobs include

i) 20 MLD as Tertiary Treatment
ii) 30 MLD STP at Loni, Ghaziabad for UP Jal Nigam based on MBBR Technology,
iii) 23MLD STP at Kapashera for DJB based on SBR Technology.

Triveni's Product Range

Systems

The product includes High Purity System, Municipal Water systems, Municipal wastewater Systems, Industrial Wastewater Treatment systems, Recycle/Reuse systems, Micro-filtration/ Ultra Filtration (Submerged and Pressurized) system, Membrane Bio- Rector Systems, Reverse Osmosis/Nano filtration Systems, Ion exchange Processes, Condensate Polishing Units, Side Stream Filtration, Water Softening Systems

Equipments

The equipments includes Intake Screening System (Travelling water screen/Trash cleaning machines), Mechanical Screening Systems (Fine/Medium/Coarse), Sedimentation System (Circular/Rectangular), Media Filtration System, Biological Treatment – Aerobic Systems (Suspended Growth & Attached Growth), Anaerobic Treatment Systems (Digester/Gas Holders), Sludge Treatment Units (Thickener/Vacuum Filters/Belt Filter Press), Oil water Separation Units (Skimmers/API/DAF) and Chemical Treatment Units

SAMPLE COLLECTION AND ANALYSIS

In this context, a comprehensive study was initiated for monitoring the lake water quality during winter season. Five stations where located around the lake that are presented in the following Table 1.

Table 1. Sampling Stations around HSL

Sampling stations	Code
Front of NTR ghat	S1
Near Boat club	S2
Sanjeeh park	S3
Near rock garden	S4
Near Buddha statue	S5

The surface water samples where collected during February 2018 by grab sampling techniques, preservations and analysis was carried out as per standard methods (APHA 1998 and US EPA SW-846) (Suneela 2008). Two litres capacity of polyethylene bottle where used to collect samples, after collection of samples it was transported to Teegala Krishna Reddy College of Engineering and Technology for analysis. Physico-chemical parameters such as Temperature, pH, EC, TSS, Total dissolved solids, BOD, COD, TN and TP where analyzed. Similarly detailed study was performed in various treatment process of 30 mld treatment plant established by Triveni groups in patigadda (near Rasalpura).

RESULTS AND DISCUSSION

Water Quality Analysis

Industrial effluents tolerance limits notified by central pollution control board (CPCB) for some parameters are as follows. TSS for Inland and On-land surface waters are 100 and 200 mg/L (WQI-Wn: 0.0037).

COD for Inland surface water is 250mg/L. Drinking/irrigation/discharge water standards are presented in Table. 2. The water quality data at five locations is shown in Table 3. Water quality after treatment from section outlet and final outlet where presented in Table 4.

Table 2. Drinking and Irrigation Discharge Water Standards

Sl No.	Parameters	Limit as per BIS/ Guidelines for Quality of Irrigation Water IS 11624 (1986) (except pH, expressed as mg/L)	
		Acceptable	Permissible limits
1.	pH	6.5 – 8.5	6.5 - 8.5
2.	TDS	500	2000
3.	Calcium	75	200
4.	Chloride	250	1000
5.	Magnesium	30	100
6.	Sulphate	200	400
7.	Total Alkalinity	200	600
8.	Total Hardness	200	600

Table 3. Water Quality Analysis in February (Before Treatment)

Parameters	Units	Sampling Stations				
		S1	S2	S3	S4	S5
Temperature	(°C)	27.2	26.0	27.2	28	26
pH		7.8	8.2	8.1	7.7	8.0
EC	mS/cm	1.53	1.63	1.57	2.0	1.58
Total suspended solids	mg/l	380.2	373	380.2	373	345
Total dissolved solids	(mg/L)	768.4	814.6	786.9	715.2	645.1
Biological oxygen demand	mg/l	40.5	56.55	60.5	56.66	46.89
Chemical oxygen demand	mg/l	156	160	155	146	174
Total Nitrogen	mg/l	85	93	85	93	75
Total phosphorous	mg/l	12.6	20.85	12.6	21	19

Table 4. Characteristics of HSL Water from 30 MLD plant (After Treatment)

Parameter	Units	Section outlet	Treated water
Temperature	(°C)	26	25
pH		7.8	7.5
EC	mS/cm	1.66	1.33
Total suspended solids	mg/l	16.7	9
Total dissolved solids	mg/l	16	16
Biological oxygen demand	mg/l	14.2	5.1
Chemical oxygen demand	mg/l	36.5	34.1
Total Nitrogen	mg/l	7.35	6.52
Total phosphorous	mg/l	0.79	0.5

Physico-chemical parameters

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose because Water does contain different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Water must be tested with different physico-chemical parameters. Some physical test should be performed for testing of its physical appearance such as temperature, pH, turbidity, TDS, etc., while performing chemical tests such as BOD, COD, dissolved oxygen, alkalinity, hardness and other characters. Water quality analysis report mentioned in Table.3 reveals that pH values are higher than the desirable limit which are in the ranges between 7.8 – 8.2. The maximum value was observed in L2 and minimum value observed in L1, We as after treatment it was 7.5. EC values are in the ranges between 1.53 mS/cm to 2 mS/cm. The maximum value was observed in L4 and minimum value observed in L1, Where as after treatment it was 1.33 mS/cm. TSS values are in the ranges between 345 mg/l to 380 mg/l. The maximum value was observed in L1 and minimum value observed in L5, Where as after treatment it was 9 mg/l. TDS values are in the ranges between 645.1 mg/l to 814.6 mg/l. The maximum value was observed in L2 and minimum value observed in L5, where as after treatment it was 16 mg/l. BOD values are in the ranges between 40.55 mg/l to 60.5 mg/l. The maximum value was observed in L3 and minimum value observed in L1, Where as after treatment it was 6.1 mg/l. COD values are in the ranges between 146 mg/l to 174 mg/l. The maximum value was observed in L5 and minimum value observed in L4, Where as after treatment it was 34.1 mg/l. Total nitrogen values are in the ranges between 75 mg/l to 93 mg/l. The maximum value was observed in L5 and minimum value observed in L2, Where as after treatment it was 34.1 mg/l. Total phosphorous values are in the ranges between 12.6 mg/l to 21 mg/l. The maximum value was observed in L2 and minimum value observed in L1, Where as after treatment it was 0.5 mg/l. During the period of study the inflow quantity of water in the lake which where due to minimal rainfall intensity.

CONCLUSIONS

The water quality analysis gives the detailed pollution status of HSL that due to discharge of untreated domestic sewage and industrial effluents, washing clothes, vehicles, and immersion of idols.. The present study reveals that the nutrient loading of HSL have been exceeded the eutrophic condition that led to hyper-eutrophic state. Treated water discharged from the treatment plant of Triveni group reduces the pollution level in HSL, however constant discharges of contaminants led to persistent pollution. In order to preserve the ecosystem of HSL, continuous monitoring and treatment of inflow water is required.

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