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Study on Water Quality and Trophic Status of Sulekere Tank, Maddur Tq, Mandya Dist, Karnataka

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Abstract: *Sulekere tank is situated on Mandya-K.M. Doddi road. It is Located at 12 Km from Mandya city towards North-West direction. The tank water mainly used for agriculture and aquaculture. The lake's Water shed area is covered by agricultural lands. On these lands uncontrolled and over use of fertilizer have been identified as the main source of excess nutrients in the tank. In addition to this the domestic and industrial wastewater also been identified as the main sources of excess nutrients in the tank. In order to evaluate the status of tank and to assess the pollution level through the characterization of water the present study was conducted*

Keywords: Sulekere tank

I. INTRODUCTION

Water is considered as the elixir of life. The surface freshwater in the form of lakes & rivers is hardly 0.01% of total water on the earth. Lakes & tanks are known to be the ecological barometers of the health of a city. They regulate the microclimate of any urban centre (Geetha Karthi et al, 2002). Lakes are more complex & fragile ecosystems than rivers. They do not have a self cleansing ability & therefore they readily accumulate pollution. Lakes and reservoirs require more concerted attention than is applied generally to rivers & stream basins (Pradhyumna, 2002).

Eutrophication refers to the natural or artificial addition of nutrients such as nitrogen and phosphorus in a form which increases the productivity of water and brings consequent changes in plant and animal life in the water body perhaps reducing its utility and beauty and threatening its very existence in the course of time. When the effects of eutrophication are undesirable as when the value of a lake as a source of water supply and recreation is diminished, eutrophication is considered as a form of pollution (Sharma, 1986).

To develop Trophic State Criteria, Limnologists generally use one or more of the following Lake water quality parameters: Chlorophyll 'a', Total Phosphorus and Ortho Phosphorus, Total Nitrogen, Secchi Disc Transparency and Primary Productivity. (Sakamoto, 1968, US National Academy of Sciences, 1972, Dobson, 1974, US EPA-NES, 1974, Shannon and Brezonik, 1972, Carlson, 1977, Vollenweider and Kerekes, 1980). (Table 1)

Table 1: Summary Of Trophic State Criteria Of Sakamoto, The Academy And Dobson

Trophic condition	Sakamoto	Academy	Dobson	U.S. EPA-NES	
	Chlorophyll 'a' mg/m^3			Total Phosphorus mg/m3	Secchi Disc Transparency, m
Oligotrophic	0.3-2.5	0-4	0-4.3	<7	<10	>3.7
Mesotrophic	1-15	4-10	4.3-8.8	7-12	10-20	2.0-3.7
Eutrophic	5-140	10	8.8	>12	>20	<2.0

Source : Reckhow, 1979.

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1.1 Study Area:

Sulekere tank is situated on Mandya - K.M. Doddi Road. It is located at 12km from Mandya city towards North – West direction. The tank is situated at 77°51′ 15″ longitude and 127° 35′ 50″ N latitude. Sulekere tank is receiving water mainly from Hebballa stream, rainfall, Agricultural run-off, and Pickup canal. One of the main inlet Hebballa stream starts from Chikka Mandya, it carries the surplus water of upstream tanks, wastewater from Mysore Sugar Co. Ltd., Mandya Wastewater from Indian Bone Mill, and Habeeb Oil mill and Domestic wastewater of Mandya city.

Other inflow is the pick up canal near Madarahalli and main source for this pick up canal is Maddur branch of visweshwaraiah canal. In addition to these sources, part of Hebballa stream water also added near Boothana Hosur.

Another in flow is a small stream formed due to Agricultural run off. The main source for this stream is over land agricultural run off and seepage water from its upstream water spread area.

The tank has 3 outlets and a over flow weir. First outlet is north nala, which runs about 22Km, The second outlet is south nala which runs about 16km, the third outlet is Muttanahalli nala, which runs about 2.5km and it has a over flow weir which is rectangular in shape has a body wall length of 100 mts. and finally it joins Shimsha river near Mattada Doddi. The land, which is irrigated under lake, is 5280 acres and under channels is 6910 acres.

The tank water mainly used for agricultural purposes and also for psciculture. Also tank water is used for washing of cloths, and cattle wash. This study is carried out to know the status of the tank.

II. MATERIALS AND METHODOLOGY

Sampling sites for the water body / lake are selected to represent the water quality at different points and depths. Generally three sampling sites are selected as shown in table-2.

Table 2: Water sampling sites

SL. NO.	Sampling sites
	INLETS
1	Hebballa stream near Hemmige
2	Pick-up canal near Madarahalli
3	Agricultural run-off near Soonaganahaali
	WITHIN THE TANK
4 – 8	Five surface stations
	OUTLETS
9	North nala
10	South nala
11	Muttanahalli nala
12	Over flow weir

The parameters analysed to assess the water quality are broadly divided into:

- Physical parameters: pH, Electrical Conductivity, Colour, Temperature, Transparency, Turbidity
- Chemical parameters: Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Total solids, Total dissolved solids, Total suspended solids, Total Hardness, Chlorides, Sulphates, Total Alkalinity, Iron, Total phosphorus, Total Nitrogen, Calcium, Magnesium, Sodium, Potassium
- Biological parameters: Qualitative analysis of Phytoplankton, Chlorophyll-a, E-Coli

The water samples were analysed as per the procedure laid down in the Standard methods

III. RESULTS AND DISCUSSIONS

During the study period between September 2021 and January 2022, three inlets, 4 outlets, 5 surface stations were considered in the Sulekere Tank. Further this chapter is divided into the following sections:

- Composition of inflows
- Composition of water within the tank
- Composition of outflows
- Trophic status Classification of Sulekere tank

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- Algal growth limiting nutrient in Sulekere tank

3.1 Composition of inflow:

The Sulekere tank receives water mainly from three inlets. These inlets are identified as station 1, station 2 and station 3. Local people named the station 1 as Hebballa, which receives water from Mandya tank. The station 2 is the pick up canal, which receives water from V.C. Nala, and Hebballa stream Station 3 is formed due to agricultural runoff. For this stream, seepage water of upstream areas are also be added. During the study period September 2002 to January 2003, from these three inlets 30 surface water samples were collected and analysed for various water quality parameters. These data are presented in Table No.3.

In all inlet stations, Calcium concentration is high beyond the permissible limit. Sulphate and Chloride concentrations within the WHO standards. Total phosphorus value greater than 0.01 mg/L, hence it causes more algal blooms in the tank.

In all inlets, BOD is greater than 3 mg/L is unfit for water supply and bathing purpose.Based on the BOD. values the incoming water can be Classified as weak sewage, which is less than 110mg/L (Metcalf Eddy.1982)

Turbidity of all inlets was found to be very high. Similar observations was made by Raushan Kumar (1999) in the Sharavathi basin recorded the high turbidity of 10NTU.

Sulphate and Chloride values does not exceed WHO standards (Ayers and West cot 1985; Wilcox, 1948) TDS content shows permissible values in all inlets station. Calcium content is high, beyond the permissible limit. Similar, observations were made by Yamuna and Balasubramanian (2000). They studied the water quality variations in the Lakes of Mysore District, Karnataka. They concluded that COD, BOD values are higher due to fertilizers and chemicals used for the crop yield.

3.2 Composition of water within the tank

Review of Table 3.1 shows that the average composition of water within tank Similar observations were made by Nagarathna and Hosamani (2001-02) in Sulekere tank, Maddur Taluk, which was indicated by DO varies from 1.2-7.38 mg/L, phosphate varies from 0.18-1.23 mg/L, nitrate varies from 0.04-0.2 mg/L, and chlorophyll-a varies from 5.45-7.53 mg/L.

Average BOD and COD values within the tank were 12.65mg/L 32.0 mg./L respectively. Higher concentration of BOD within the tank shows that water contained organic matter, because of addition of sugar factory wastewater and domestic wastewater. Organic matter exhausts the oxygen resource of tank water and creates unpleasant taste, odor and generally reaches septic conditions. As per IS 2296-1974 to use as raw water for public water supply and for bathing Ghats, the BOD values should be 3 mg/L, hence this value exceeds the limits, and it is not fit for such purposes.

Total phosphorus and Total Nitrogen data within the tank water was 0.93 mg/L and 27.3 mg/L respectively. Since the value of total phosphorus is greater than 0.01 mg/L, it causes more algal blooms within the tank.

3.3 Composition of outflow water

The Sulekere tank has got three outlets and a over flow weir. During the study period from these three outlets 40 samples were collected (10 samples from each station) and samples analysed for 25 water parameters.

BOD and COD data demonstrates that the outgoing water varies about 13-21 mg/L and 38-52 mg/L respectively. As per IS 2296-1974 to use as raw water for public water supply and for bathing Ghats the BOD values should be 3 mg/L, hence this value exceeds the limits, it is not fit for such purposes.

In all outlets, water is faecally contaminated due to human activities and cattle wash.

IV. THE TROPHIC STATUS CLASSIFICATION OF SULEKERE TANK

In order to classify the trophic status of Sulekere tank, Trophic State criteria of Sakamoto, the US Academy and Dobson , US UPA-NES Trophic Status Index (Table 1) and Carlson's Trophic Status Index were used. The parameters used for the classification surface Total Phosphorus, Chlorophyll 'a' and Secchi Disc Transparency. The data shows that the study period arithmetic mean concentration of surface Total Phosphorus, Surface Chlorophyll 'a' and Secchi Disc Transparency with in the Tank were 0.93 mg/m^3, 26.1 mg/m^3 and 0.78 m respectively. These values are compared

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with Table1, which yields Trophic Status classification of the study Lake, and the data are reported in Table4. Review of the Table 4 indicates that out of nine trophic status, all were EUTROPHIC. Based on this analysis, it can be concluded that Sulekere tank can be classified as "EUTROPHIC" during the study period between September 2021 and January 2022.

V. CONCLUSION

The physico-chemical analyses of water of inflows & outflows show that. Waters of Hebballa and Pick-up canal were faecally contaminated due to human activities. Presence of coliform bacteria concludes that water are under threat for the consumption of animals and humans.

From the study of chlorophyll-a, surface Total Phosphorous and Secchi Disk Transparency data, we can conclude the Sulekere tank to be "Eutrophic" (as per Sakamoto, Academy, Dobson, USEPA-NES, and Carlson).

The ratio of Total Nitrogen and Total Phosphorous within the tank was found to be 29.35, which concludes that Phosphorous was the algal limiting nutrient during the study period.

Table 4: Trophic Status Classification Of Sulekere Tank Based On Sakamoto, The US Academy, Dobson, USEPA - NES and Carlson's TSI

Based on	Chlorophyll mg/m^3	Surface Total Phosphorus mg/m^3	Secchi Disc Transparency m
Sakamoto	Eutrophic	*	*
Academy	Eutrophic	*	*
Dobson	Eutrophic	*	*
US EPA-NES	Eutrophic	Eutrophic	Eutrophic
Carlson	Eutrophic	Eutrophic	Eutrophic

Indicates that the parameters were not used in the Trophic State classification.

Table 3 Arithmetic Mean Values Of Physico-Chemical And Biological Water Quality Parameters Analysed For Surface Water Samples During Study Period Between Sept. 2021 – Jan. 2022

Sampling points	1	2	3	4	5	6	7	8	9	10	11	12
Temperature,°C	23.9	24.2	23.9	24.7	24.6	24.7	24.5	24.7	24.9	24.7	24.9	25.1
DO, mg/L	3.91	3.82	5.01	4.23	4.56	4.59	4.11	4.89	2.58	3.02	2.60	5.34
pH	8.17	8.11	8.03	8.22	8.32	8.31	8.26	8.28	8.21	7.95	8.10	8.27
Colour, CU	20	12	8.9	11.5	8.0	10	10	10	10.5	11	10	10
Turbidity, NTU	19.9	15.7	13.9	15.69	12.33	13.96	13.83	13.99	8.51	8.99	8.19	9.26
SS, mg/L	353	327	265	288.5	287.3	291.3	288.5	256.6	272.1	277.3	274.2	297.2
TDS, mg/L	278.7	277	256	275.6	268.6	270.3	276.8	271.6	271.9	266.5	256.4	272.1
Total Solids, mg/L	630.7	605	621	564.1	555.9	550.6	565.5	554.2	554	563.8	540.6	569.3
EC, µmhos/cm	463.1	466	599	461.6	450.8	455.8	467.6	455.1	454.1	477.5	444	453.7
Chloride, mg/L	78.66	70.0	76.05	66.13	69.5	68.54	73.6	71.04	78.43	93.52	97.31	76.03
Sulphate, mg/L	60.52	57.3	64.7	47.89	55.17	49.7	54.5	51.68	50.97	48.24	57.97	53.45
Alkalinity, mg/L	261.8	221	235	215.7	213.1	229.6	213.3	232.6	245	211.7	231.3	231.2
Total Hardness, mg/L	286.8	224	235	229.6	202.8	227.3	214	211	252.1	218.3	215.3	230.9
Ca^{++}, mg/L	57.5	47.5	44.9	48	45.7	42.3	44.6	48.3	56.7	47.3	48.1	47.6
Mg^{++}, mg/L	35.07	26.9	31.2	24.7	21.7	29.76	27.26	25.04	26.4	24.42	23.34	27.33
Iron, mg/L	0.66	0.35	0.36	026	0.24	0.36	0.38	0.45	0.31	0.62	0.41	0.15
TP, mg/L	2.35	0.78	0.95	1.27	0.93	0.77	1.18	0.50	0.82	1.52	1.17	1.1
Total Nitrogen, mg/L	35.4	25.8	32.9	28.8	26.1	26.5	27.9	27.1	19.3	17.9	19.9	14.0
BOD, mg/L	24.57	19.1	11.1	14.63	18.08	10.54	9.89	10.15	13.36	13.82	21.15	14.96

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COD, mg/L	51.97	48.2	36.0	34.04	23.68	38.25	32.68	31.41	38.5	39.4	51.8	59.4
Na^+, mg/L	243.4	224	187	160.9	151.1	160	151	169.8	176.2	148.3	158.3	234.1
K^+, mg/L	31.6	25.2	30.3	23.7	24.8	26.2	26.3	27.8	19.2	24.1	26.2	24.2
SDT, m	-	-	-	0.7	0.78	0.82	0.91	0.73	-	-	-	-
Chlorophyll-a, mg/m^3	-	-	-	30.55	19.33	27.99	25.3	27.14	-	-	-	-
E-Coli, MPN/100	30	12	-	5	-	-	-	-	13	18	18	16

Table 3.1: Average Composition of Water Within Sulekere Tank During The Study Period (September 2021- January 2022)

SL No	PARAMETERS	WITHIN TANK (4+5+6+7+8)	SL No	PARAMETERS	WITHIN TANK (4+5+6+7+8)
1	Temperature, ^oC	24.66	14	Calcium, mg/L	45.78
2	DO, mg/L	4.47	15	Magnesium, mg/L	25.69
3	pH	8.27	16	Iron, mg/L	0.33
4	Colour, CU	9.9	17	TP, mg/L	0.93
5	Turbidity, NTU	13.96	18	Total nitrogen, mg/L	27.3
6	SS, mg/L	282.4	19	BOD, mg/L	12.65
7	TDS, mg/L	272.5	20	COD, mg/L	32.0
8	TS, mg/L	558.0	21	Sodium, mg/L	158.6
9	EC,µmhos/cm	458.2	22	Potassium, mg/L	25.76
10	Chloride, mg/L	69.76	23	SDT, m	0.78
11	Sulphate, mg/L	51.78	24	Chlorophyll-a, mg/m^3	26.1
12	Total Alkalinity, mg/L	220.86	25	E-Coli, MPN/100ml	1
13	Total hardness, mg/L	216.9	26	TN/ TP	29.35

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