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Research Article

STUDY OF PHYSICO-CHEMICAL PARAMETERS OF GULAB SAGAR WATER BODY IN JODHPUR (RAJASTHAN) DURING 2014-2016

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ABSTRACT

The present work deals with water quality parameters in relation to investigate the abiotic factors on changing scenario of Gulab Sagar water body at Jodhpur, Rajasthan. This water body is situated inside the main city of Jodhpur and has been recently identified as tourist spot. The sample of water from Gulab Sagar water lake, Jodhpur were collected for two years from May 2014-2016 for each month and collected sample was evaluated for the study of Physico- Chemical Parameters. The main aim of testing water quality is to interpret the data and to take correct measures to conserve it. It will also tell us about nature of water, field conditions, pollution levels, climate etc. The investigation of water is very important in the recent years due to industrialization, population growth and abundance increase in the agricultural activities.

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INTRODUCTION

Water is the most important component of our life. We cannot live without water. Any variation from normal composition leads to water pollution. Water of good quality is required for living organism. Water is a basic need of all living organism on the earth. Most of the water on this planet is stored in ocean and ice caps, which is difficult to recover for our diverse needs. Most of our demand for water is fulfilled by rain water, which gets deposited on surface of ground water resources. More than 73% of the earth's surface is covered by water to an average depth of 3,800 m. In India several large reservoirs exist besides large natural lakes and innumerable small tanks and ponds. Reservoirs are made by constructing dams across the rivers to serve a variety of purposes like industrial process, irrigation, navigation, domestic water supply, fish culture, recreation and generation of hydroelectricity (WHO, 1985).

Studies of fresh water systems, and the human impact on such systems, are quite timely. Such studies pave the way to prime regulatory mechanism for the ecosystem as a whole, and may reveal both the rate and direction of whatever changes take place within the system (Varshney, 1989). In India reservoirs, which cover three million hectares of surface area are considered the prime resource, with regard to aquatic production potentials and more than 56% of the total reservoir area in the country is found in Orissa, Maharashtra, and in the

Southern States (Sugunan, 1997). Indian lakes can also be considered as urban lakes, non-urban lakes, coastal estuarine lakes and ephemeral lakes (Reddy and Char, 2004). Globally, 3240 km³ of fresh water is drawn, and used annually; 69% of this is used for agriculture, 23% for industry, and 8% for domestic purposes. Agriculture consumes a major share of fresh water.

More than half the water diverted or pumped for irrigation, does not reach the crop; and problems of water logging and salination due to this, are increasing. The second largest consumer of fresh water is industry. In the developing countries 95% of the used water is not subject to cleansing treatment before it is released to surface waters. So we must look into all the aspects of water uses to ensure the quality of water available for all the present and future needs. Owing to population explosion pressure, and increasing pollution of water resources, at least 30,000 human deaths are caused daily by contaminated water and poor sanitation. More than 1.7 billion people have no direct access to freshwater; this number is likely to double within the next 25 years (WHO, 1992).

Study Area

Jodhpur district is situated between 25051'08" & 27037'09" North latitude and 71048'09" & 73052'06" East longitude covering geographical area of 22,850 sq km. This district comes under arid zone of the Rajasthan State. Jodhpur district

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is part of Jodhpur Division. The district is divided into 5 subdivisions namely Jodhpur, Shergarh, Pipar City, Osian & Phalodi and comprises of 07 tehsils & 09 blocks. Total number of villages in the district is 1157. Gulab Sagar Lake is located about 6kms from Jodhpur city center near Sardar Market in old city area (23°03' and 30°12' N latitude and 69°39' and 78°07' E longitude). Measuring 150x90m in size with the capacity of 4.48m cusecs of water. Gulab Sagar Lake is actually a water storage constructed in 1788 by Gulab Rai, the mistress of Maharaja Vijay Singh (Figure 1). Earlier the place was occupied with another water source called 'Bawri', which was converted into Gulab Sagar. It took around 8 years for completing the construction of Gulab Sagar. The lake gets water through a canal from Bal Samand Lake.



Figure 1 View of Gulab Sagar Lake

MATERIALS AND METHODS

Water samples were collected in polythene bottles of two litres capacity once in a month from the different sites of Gulab Sagar water body for a period of two years (May 2014 to April 2016). These collected samples were then preserved in Refrigerator and Analysis of water was done. The recorded data was divided into mainly three seasons:

1. Summer season (February to May)
2. Monsoon season (June to September)
3. Winter season (October to January)

The Standard methods of APHA (2005) were used to analysis sample of water and various Physico – chemical and Biological parameters were studied.

Physical Parameters

Atmospheric Temperature

Temperature is very important factor required which directly influence the Aquatic habitat. The variation in temperature occur seasonally and in some water bodies even over a period of 24 hours. Temperature reflects on the dynamics of living organisms. Atmospheric temperature measurement is made by taking a mercury thermometer.

Temperature of water body

All the metabolic and physiological activities of life processes are directly influenced by water temperature. It is the most common ecological factor which greatly affects the characteristics of any water body. Temperature of water body is made by taking a sample of water and immersing the thermometer into it for a sufficient period of time and the reading is expressed in degree Celsius ($^{\circ}\text{C}$).

Chemical Parameters

Dissolved Oxygen(DO)

All organisms have a specific need of oxygen and low oxygen in water can kill fish and other organisms present in water. The dissolved oxygen was determined by adopting modified Winkler's method (1988).

Free Carbon dioxide(CO_2)

The main source of free Carbon dioxide in surface water bodies is mainly from respiration and decomposition by Aquatic organisms. It is the end product of both aerobic and anaerobic oxidation. Free CO_2 was estimated by Welch method.

pH

The pH of solution refers to its hydrogen ion activity and is expressed as the algorithm of the reciprocal of the hydrogen ion concentration in moles per litre at a given temperature.

Total Hardness

Hardness of water is an important consideration in determination the suitability of water for domestic and industrial uses. The data obtained can be used as a basis for the need for softening processes of water. Total hardness was estimated by EDTA titration method.

Alkalinity

Alkalinity of water is quantitative capacity to neutralise a strong acid and is characterised by the Hydroxyl ions capable of combining with hydrogen ions. The total alkalinity was estimated by Welch method using phenolphthalein and methyl orange as an indicator.

Biological Oxygen Demand (BOD)

Biological Oxygen Demand is the rate of consumption of oxygen in aerobic degradation of the dissolved organic matter in water. Biological Oxygen Demand is very important which indicates water pollution.

Chloride

Chloride in the form of chloride ion is one of the important inorganic anion in water bodies. The high chloride concentration is considered to be an indicator pollution due to organic waste of animal origin.

Phosphate

Phosphorus is the most important nutrient of autotrophs and biological productivity of a system. In the waterbodies Phosphorus occurs in organic and inorganic forms. The major sources of Phosphate in water bodies are industrial effluents, domestic sewage, detergents and soaps, agricultural run off etc.

Chemical Oxygen Demand (COD)

Chemical oxygen demand testing is mainly done to measure the amount of organic compounds in water during the testing of COD, organic matter is converted to CO_2 and H_2O . COD is defined as the amount of oxygen required by organic matter present in water for its oxidation by strong chemical oxidant.

Nitrate

Nitrates are important plant nutrients and is the highly oxidized form of nitrogen. Unpolluted natural water contains low concentration of nitrate where as high concentration of nitrate in potable water may lead to serious problems in specially young ones as it reduces nitrites in their intestinal tract which may leads to Methaemoglobinaemia.

Sulphate

Sulphur is very important element and is required by all life forms. Sulphate is the salt of sulphuric acid. The main source of sulphate in water bodies comes from industries (mining and smelting operations, textile mills paper mills etc.).

RESULT AND DISCUSSION

The following are the results obtained from Table 1 and Table 2.

Atmospheric Temperature

The observations recorded tells that the atmospheric temperature around Gulab Sagar water body ranged between 23.45 °C to 43.37 °C during the study period 2014 – 2015 where as the atmospheric temperature ranged between 24.01 °C to 44.19 °C during the study period (2015 – 2016).

Temperature of Water body

The temperature of water ranges from 20.01 °C to 33.58 °C during the year (2014 – 2015) and the temperature ranges from 20.20 °C to 34.80 °C during the year (2015 –2016).

Dissolved Oxygen

During the period of study (2014 – 2015) the minimum value was 2.15 mg/l and the maximum value noted was 4.69 mg/l where as during the period (2015 – 2016) the minimum value was 1.38 mg/l and maximum value was 3.81 mg/l .

Free Carbon Dioxide

During the period of study (2014 – 2015) the values of free carbon dioxide ranged between 3.02 mg/l to 8.16 mg/l where as during the period of study (2015–2016) the value of free carbon dioxide ranged between 1.35 mg/l to 3.82 mg/l .

pH

The PH of Gulab Sagar water body ranged between 6.85 to 8.06 which indicates that this water body was alkaline throughout the study period.

Total Hardness

The values of Total Hardness ranged between 87.25 mg/l to 148.01 mg/l during the period of study (2014 – 2016).

Alkalinity

The values of Alkalinity ranged between 26.00 mg/l to 101.08 mg/l.

Biological Oxygen Demand(BOD)

During the present study of Gulab Sagar water body the values of Biological Oxygen Demand (BOD) ranged between 8.00 mg/l to 20.00 mg/l.

Chloride

During the present study the values of Chloride ranged between 19.45 mg/l to 39.86 mg/l . In the present study the higher values of chloride shows its pollution status.

Phosphate

In the present study of Gulab Sagar water body the values of phosphate ranged between 0.058 mg/l to 0.096 mg/l . The maximum values were recorded during the months of monsoon which can be due to rain water bringing in high input of Phosphate.

Chemical Oxygen Demand (COD)

In the present study during the year (2014 – 2016) values of Chemical Oxygen Demand (COD) ranged between 6.00 mg/l to 22.00 mg/l. In the present study the maximum values of Chemical Oxygen Demand (COD) were recorded in summer which can be due to low level of water and high decomposition activity.

Nitrate

In the present study of Gulab Sagar water body during the year (2014 – 2016) the values of Nitrate ranged between 0.10 mg/l to 0.60 mg/l.

Table 1- Monthly variation in Physico-Chemical Parameters in Gulab Sagar water body, Jodhpur during the year 2014-2015.

S.No.	Parameters	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Min.	Max.
1	Atm. Temperature	43.37	42.57	35.25	34.56	34.00	32.05	27.14	23.45	25.36	31.54	36.1	43.17	23.45	43.37
2	Temperature of Water	33.58	33.01	31.10	30.08	28.15	26.10	25.47	20.01	22.34	23.68	27.84	31.01	20.01	33.58
3	D.O	3.050	3.47	2.15	3.01	3.10	2.94	2.65	2.97	4.69	4.52	3.63	3.10	2.15	4.69
4	CO ₂	3.02	3.50	3.68	3.46	3.72	3.02	5.03	7.87	4.15	6.05	8.16	4.07	3.02	8.16
5	Ph	7.92	7.07	6.75	7.05	7.25	6.85	7.02	7.04	8.18	8.08	8.00	8.01	6.85	8.18
6	Total Hardness	146.12	145.56	149.05	141.82	130.18	109.42	87.25	90.15	98.06	103.11	110.86	145	87.25	149.05
7	Alkalinity	80.50	82.14	79.87	85.06	80.64	60.90	39.18	26.00	35.41	42.50	49.81	51.00	26.00	85.06
8	BOD	18.00	17.00	17.00	14.00	8.00	10.00	11.00	9.00	10.00	13.00	14.00	16.00	8.00	18.00
9	Chloride	38.20	36.51	30.05	24.50	19.45	23.00	28.15	33.18	34.82	35.40	37.65	39	19.45	39.00
10	Phosphate	0.082	0.081	0.09	0.089	0.079	0.085	0.064	0.058	0.06	0.076	0.085	0.089	0.058	0.09
11	COD	19.00	18.00	13.00	11.00	10.00	9.00	7.00	6.00	10.00	15.00	17.00	18.00	6.00	19.00
12	Nitrate	0.40	0.42	0.41	0.45	0.43	0.25	0.25	0.10	0.30	0.35	0.23	0.25	0.10	0.45
13	Sulphate	3.70	3.60	3.10	2.80	2.50	2.10	1.80	1.05	1.20	1.60	3.00	3.80	1.05	3.08

Table 2 -Monthly variation in Physico- Chemical Parameters in Gulab Sagar water body, Jodhpur during the year 2015-2016

S.No.	Parameters	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Min.	Max.
1	Atm. Temperature	44.19	43.15	34.02	35.19	33.30	32.10	27.52	24.01	25.70	32.15	37.47	44.01	24.01	44.19
2	Temperature of Water	34.80	34.25	30.54	31.74	27.50	26.27	25.24	20.20	23.01	24.10	28.00	31.42	20.20	34.80
3	D.O	2.85	2.50	2.05	2.94	2.75	2.80	2.40	3.81	1.89	1.72	1.52	1.38	1.38	3.81
4	CO2	2.05	2.01	2.15	2.80	2.75	2.96	2.25	3.82	1.98	1.42	1.46	1.35	1.35	3.82
5	Ph	8.05	6.90	6.10	7.18	7.97	6.25	7.10	7.15	7.92	7.81	8.03	8.06	6.10	8.06
6	Total Hardness	146.28	148.01	141.24	140.75	132.47	111.15	89.86	88.17	103.04	106.24	131.81	147.06	88.17	148.00
7	Alkalinity	89.05	94.26	101.08	99.48	68.15	41.21	31.04	34.56	46.00	59.80	71.00	86.00	31.04	101.10
8	BOD	19.00	20.00	16.00	13.00	9.00	11.00	12.00	10.00	11.00	12.00	13.00	15.00	9.00	20.00
9	Chloride	37.02	39.86	31.25	25.14	20.36	18.74	24.28	25.25	29.20	24.08	36.92	37.35	18.74	39.86
10	Phosphate	0.087	0.085	0.075	0.096	0.082	0.091	0.07	0.052	0.046	0.09	0.092	0.094	0.046	0.096
11	COD	20.00	19.00	15.00	13.00	12.00	11.00	9.00	10.00	8.00	16.00	20.00	22.00	8.00	22.00
12	Nitrate	0.52	0.48	0.58	0.59	0.60	0.41	0.18	0.20	0.25	0.46	0.42	0.30	0.18	0.60
13	Sulphate	3.90	3.30	3.08	3.00	2.75	2.80	2.20	1.60	1.00	2.90	3.10	3.50	1.00	3.90

In the present study the maximum value of nitrate were recorded during the monsoon season which can be due to influx of Nitrogen rich rain water.

Sulphate

The present study during the year (2014 – 2016) the values of sulphate ranged between 1.05 mg/l to 3.90 mg/l. It was also found during the study that the maximum values of sulphate were recorded during summer which can be due to the activity of biodegradation.

CONCLUSION

The results obtained from the present investigation shows that there were not considerable differences in the physico - chemical and biological parameters during both the years of study (2014 – 2016). A glimpse of observations on physico - chemical parameters indicate that in this water body domestic as well as industrial effluents were thrown which has severely affected its water quality. The values of Sulphate, Phosphate, Nitrate, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) recorded were higher which indicate mild pollution in this water body. During rainy season all the effluent laden water of the city is poured into this water body which further increases the risk of pollution.

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