



The Arid region of Rajasthan physico chemical characteristics of Kodamdesar Lake.

Swati Panchariya¹, Dr. Sapna Nehra²

Research Scholar¹, Supervisor²

(Chemistry) Nirwan University Jaipur.

Swati Panchariya – Bikaner, India.

Abstract:

The arid region of Rajasthan constituting the Rajasthan desert has a very limited water resources particular of lakes. Water an indispensable component of an ecosystem, is necessary resources for the sustainability of life on the earth. The fresh water bodies all over the arid region of Rajasthan are getting polluted thus, decreasing the suitability of the potable water. Bikaner forms an important part of the arid region of Rajasthan. Ponds present in and around the Bikaner city and a few lakes of the district were the main sources of drinking water during past. "Kodamdesar lake" is an artificial lake situated in the Kodamdesar village Bikaner at a distance of 26 km is south-west of Bikaner city. The analysis of water quality provides important data about the various changes caused by various biotic and abiotic factors during different seasons. Present study deals with the determination of some physicochemical characteristics of water viz. BOD, COD, DO, nitrate, sulphate and fluoride during the year 2021-2022. Significant variations were observed during different seasons in these parameters.

Introduction:

Water is the most useful natural resource on the blue planet. Physical, chemical and biological interactions determine the quality of water. Continuous circulation, transformation and accumulation of energy and matter at different tropic level of aquatic ecosystem, are causing the changes in the quality of water day by day. Lakes are an important water resources for domestic, industrial, agricultural, fishery, recreational and energy production purpose. Increased human population has greatly contributed toward discharge of large amount of waste material and pollutants which has converted the fresh water reservoir to impend contamination sink giving rise to water pollution problem (Venkatesan,20071; Aelhikan et al., 20092).The ecosystem of lakes is complex and fragile as the rate of discharge of pollutants into them is much more than the rate of self cleaning ability, and therefore they tend to readily accumulates such pollutants (Abid et al.,20083).

Bikaner district is located between 27°11' and 29°03' N latitude and 71°54' and 74°12' E longitude and lies in north-western part of Rajasthan. The major part of the district covers desolate and dreary region and forms an important part of the Great Indian Desert. It is characterized by plain area undulating or interspersed with shifting sand dunes. There are no hills, reevaluates or streams of any significance. Climate range arid to extreme arid with extreme temperature and low and scanty rainfall. The year may be divided into three distinct seasons viz. winter (November to February) summer (March to June) and rainy (July to October). The Kodamdesar lake is situated about 26 km at Kodamdesar in the south - west of Bikaner city. This lake is situated nearby Kodamdesar Bheru Temple in Bikaner, during summer lake water is used mainly for drinking and bathing purpose. Its bank on one side is green and wooded, while the other side is covered by the composing palace and garden watered from the lake.

The measurement of DO, BOD and COD could indicate the level of pollution in a given water reservoir (Manahan 1992⁴; Kolo *et al.*,2010⁵). The wastes consisting mainly of phosphate containing detergents and nitrate help in growth of aquatic weeds causes interference with the dissolved oxygen, biological oxygen demand, conductivity and turbidity (Parashar *et al.*,2006⁶).In the present study, seasonal variations in PH, water temperature, nitrate, sulphate, dissolve oxygen(DO) and biological oxygen demand (BOD) were analyzed to know the pollution status of the lake water.

Material and Methods:

Random composite water samples were collected fortnightly in acid washed water sampling bottle for the period of two years (2021-2022). Collections were done during morning hours. The water temperature and pH was determined by thermometer and digital pH meter, respectively. Nitrate, sulphate, fluoride, DO, BOD and COD were determined seasonally in winter, summer and rainy according to standard method of APHA⁷. **Table - 1**

Physico - chemical analysis of Kodamdesar lake in Bikaner District during different seasons (2021-2022).

Parameters	Year	Winter	Summer	Rainy
Water temp. (°C)	2021	16.6±1.23	28.2±1.54	25.2±1.78
	2022	17.0±1.06	27.8±1.32	25.0±1.82
pH	2021	8.2±0.52	8.0±0.09	8.0±1.02
	2022	8.3±0.62	8.0±0.42	8.3±0.83
DO (ppm)	2021	8.8± 0.72	3.5± 0.64	5.5± 0.66
	2022	8.5± 1.12	3.0± 0.95	5.6± 1.08
BOD (ppm)	2021	3.0± 0.38	5.8± 0.58	5.2± 0.72
	2022	3.5± 0.25	8.5± 0.63	5.5± 0.49
COD (ppm)	2021	20.3± 1.63	33.4± 2.32	24.2± 1.45
	2022	20.7± 1.54	30.6± 1.72	26.7± 1.28
SO ₄ ⁻² (ppm)	2021	15.6±2.12	12.2±1.84	14.6±2.62
	2022	14.2±2.34	13.9±1.53	15.0±2.19
NO ₃ ⁻¹ (ppm)	2021	3,9±0.32	6.7±0.68	3.4±0.56
	2022	3.8±0.47	6.5±0.55	3.6±1.03
F ⁻¹ (ppm)	2021	0.62±0.06	0.71±0.07	0.70±0.02
	2022	0.65±0.02	0.68±0.04	0.75±0.05

Results and Discussion:

Fresh water is a finite source, and essential for the existence of life on the earth, without its adequate quantity and quality, sustainable development will not be possible (Kumar,19978). The addition of various kinds of pollutants and nutrients bring about a series of change in the physico- chemical characters of water which may lead to make it unfit for drinking and other purposes. The result of physico- chemical characteristics of water with different seasons for two years are presented in the Table-1.

Water temperature - Among the several environmental factors, role of water temperature is an important one as it determines the reactivity of several other physico- chemical and biotic factor of aquatic system. It determines the status of oxygen in water body. The temperature varied from 16.6° to 28.2° with maximum in the summer season followed by rainy and minimum in winter season in both years. This suggests that fluctuations in an aquatic environment are less violent than those in the aerial.

pH - pH is a measure of relative acidity or alkalinity. In natural water, pH remains slightly alkaline (Sharma et al.,19849). It regulates most of the biological processes and biochemical reactions. The overall average seasonal pH ranged from 8.0 to 8.3 which are nearly within the maximum permissible limit specified by WHO and BIS. Table - 1 showed the maximum value of pH during winter and minimum in summer in both years which are in accordance with Mishra et al. (200810) and Tara et al. (201111).

Dissolved oxygen (DO) - The amount of DO in natural water depends on many physical, chemical and biochemical factors. Analysis of DO is a key parameter to determine the pollution status of water bodies. The optimum value of DO for good water quality is 4 mg/L to 6 mg/L which ensure healthy aquatic life in a water body. The range of DO in the present study, was observed from 3.0 mg/L to 8.8 9 mg/L. The DO was highest in winter season and lowest in summer. Same trend of variation in DO were also observed by Barupal and Gehlot (201612) in an arid zone lake. This can be explained on the ground that rise in water temperature increase the metabolic rate of organisms and also reduce the solubility of oxygen in water (Hazelwood and Paker, 196113). Concentration of DO below 5 mg/L may adversely affect the functioning of aquatic ecosystem (Sisodia and Moundiotia, 200614).

Biological oxygen demand (BOD) - It is an effective indicator of organic quality of water (Clair et al., 200315). In the present investigation, BOD was ranged between 5.2 mg/L to 8.5 mg/L with increasing during summer season and decreasing during winter season. Similar results have also been recorded by various workers (Abir, 201416; Prasannakumari et al., 200317). High BOD during the summer may be due to suitable environment for microbial growth.

Chemical oxygen demand (COD) - The COD of water increases with increasing concentration of organic matter. Its values varied between 22.3 mg/L to 33.4 mg/L and observed to be higher during summer and lower during winter. The fluctuations in COD indicate the variations in degree of organic pollution during different seasons. The average seasonal COD during both the years, was much beyond the permissible limit as prescribed by WHO (10 mg/L).

Sulphate (SO₄)- The presence of sulphate in drinking water can also result in a noticeable taste. Water containing magnesium sulphate at level above 600 mg/l act as a purgative in human. The major physiological effect resulting from the ingestion of large quantities of sulphate are catharsis, dehydration and gastrointestinal irritation. Sulphate was estimated maximum (15.6 mg/L) in winter season and minimum (12.2 mg/L) in summer season.

Nitrate (NO₃) - Nitrates are contributed to fresh water through wastes from human body and cattle, sewage, industrial waste and farm land run off leaching from soil. Nitrate was estimated maximum (4.7 mg/L) in the summer season and minimum (2.4 mg/L) in rainy season. Similar results were also recorded by Yadav (2013¹⁸).

Fluoride (F⁻)- Presence of high concentration of fluoride in water, is also a great problem in the area. People who use surface water resources for drinking, are affected by many health problems. Concentration of fluoride was observed to be maximum (0.75 ppm) during summer and minimum (0.62 ppm) during winter season, these value are within the standard limits. High concentration of fluoride often significantly above 1.5 mg/l constitute a severe problem.

Conclusion:

The composition of water in any water reservoir is depend on various chemical and physical constituents and their concentration which are mostly derived from the natural factor in the drainage basin and catchment area of a particular region and varies with seasonal difference in runoff of volume, weather condition and water level. Present study showed that all the parameters studied show seasonal variations. Lake water remains alkaline throughout the year. DO, BOD and COD were much beyond the permissible limit. It may be due to bathing, disposal of waste material, drainage from agricultural field and dumping of waste material in catchment area of lake. Present finding reveals medium eutrophic nature of the lake.

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