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Physico-chemical Parameters of Water, A case study of Drigh Lake District Qamabr-Shahdad-Kot Sindh

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Abstract: As a universal solvent, water can dissolve many materials, including inorganic or organic composite. The water quality is typically said to be the water portion that is available at the optimum level for acceptable plant and animal growth. Any of the significant variables that decide the development of living organisms in the water body are temperature, turbidity, salinity, dissolved oxygen, pH, alkalinity, hardness, etc. The Drigh Lake, a natural lake, is threatened by population areas that directly dump their household waste into the lake, causing a risk for the environment. To explain the situation, the water samples for various chemical and physical parameters including temperature, electrical conductivity, pH, alkalinity, turbidity, dissolved oxygen, etc. were collected monthly. The high degree of turbidity, hardness, total dissolved solids, pH, and alkalinity in the water quality was discovered in the contrast of data with the normative standards of the W.H.O (20-200).

Keywords: Drigh Lake; Qamber-Shahdad-Kot, Environmental risk, Physico-chemical Parameters; Freshwater

1. INTRODUCTION

Water dissolves several substances, including organic and inorganic compounds, as a universal solvent (Brohi *et al.*, 2020). The inconceivability of water in its pure nature may be ascertained by this excellent property of water (Mruthyunjaya, *et al.*, 2016). Water quality typically refers to the water portion available at the optimum level for acceptable plant and animal growth. The efficiency of the water body depends on the physicochemical properties. Aquatic organisms require a stable atmosphere for life and sufficient nutrients for their development (Sahito, *et al.*, 2020). Optimal efficiency can only be reached when physical and chemical conditions are at the maximum level (Brohi *et al.*, 2020b). Water is free from organisms and contaminants, and these elevated levels could affect health (Leghari, *et al.*, 1992). Water contamination is raising population, industrialization, fertilization of agriculture, and human operation Water must be free of human consumption. Including parameters, for instance, temperature, alkalinity, nutrients turbidities, strength, dissolved oxygen, etc., are all vital determinants for living entities' growth in the water body (Mahar *et al.*, 2000).

Consequently, the water quality assessment includes a review of the physical, microbiological, and biological parameters of the biotic and a biotic state of the ecosystem. The basic explanation behind lake observation is to research the quality of water to verify the extent of pollution and the actual state of water quality, including a natural condition. The quality of water fluctuates over time; its quality changes due to the flow of numerous polluted streams, which are the result of human activity and factors that are naturally driven (Han, *et al.*, 2019). Therefore, to include the underlying criterion for contamination evaluation and water quality (Sahito et al., 2020); the depth of the water quality of the lake was measured. Such analysis would be the optimal state of marine species and biota in the current environmental situation regarding the "chemical, biological and physical properties" of the lake. The assessment of water quality is critical for the ideal lake planning and management, not just for the short-term, also for long-term actions (Lashari , *et al.*, 2015).

2. MATERIAL AND METHODS

Study Area

Drigh Lake, in the Sindh region, is a well-known historical lake. It is 18 kilometers north-west of Larkana and 10 kilometers away in the district of Kamber-Shahdadkot from Kamber to Gaibi Dero route. The flood of 1885 formed Drigh Lake. It is accompanied by a little field used for rice crops and is filled with swamps which contribute to a larger number of aquatic plants within the lake, a semi-natural wetland, and a little brownish stream.

Location: Qambar-Shahdadkot
Latitude: North 27° 34'
Longitude: East 68° 02'
Area covered: 450 acres (182 hectares)

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The samples of water were taken from four different locations of the Drigh Lake **(Fig 1).**

Fig.1: location map of Study area for sample collection

Collection of samples

The polythene jar was used to collect the water samples from the study area. Next, sample water was used to wash the prewashed bottles. At a profundity of 0.5 m, the closed bottle was lowered into the lake, and then again the inner bottle was opened and closed to raise it to the surface. To prepare an optimized sample, the obtained samples in 3 replicates from four separate points were combined.

Physico-chemical parameters

For a span of one year, from January 2017 to December 2018, the samples of water were taken from the surface of the lake in a clean polyethylene pot to study the Physico-chemical characteristics related to the water quality of the lake. The samples were obtained from 8.00 to 4.00 a.m. during the morning hours used a bottle of one liter. In the monsoon, winter, and summer seasons, the chemical and physical parameters were analyzed. The pH, temperature, turbidity, electrical conductivity, salinity, total solids dissolved, total hardness, total alkalinity, and dissolved oxygen parameters were examined. Researchers have followed the normal water sampling protocols for the assessment of Physico-chemical parameters (Lashari *et al.,* 2015). In the survey area, parameters were measures directly, such as pH, temperature, electrical conductivity, etc., where extra parameters were deliberated in the laboratory.

3. RESULTS AND DISCUSSION

In samples of water taken from Drigh Lake, physical-chemical parameters, for instance, pH temperature, turbidity, electrical conductivity, dissolved oxygen, alkalinity, overall dissolved salinity, and water hardness, were analyzed. At the four points of the lake, these criteria were seasonally taken.

Temperature

Temperature serves an important role in the control of water Physico-chemical and biological parameters. It is known to be one of the most significant aspects of the aquatic environment, especially freshwater. The peak temperature in summer was recorded at 36°C due to heavy solar radiation, low water levels, a clean environment, and high atmospheric temperatures. Due to calm, low ambient temperatures and shorter photoperiods, the lowest temperature reported during the winter season was 16 °C (Mastoi *et al.,* 2014).

Electrical conductivity

Electric conductivity is defined as the ability of water to hold an electric current and has served as a water purity assessment . During summer, the maximum electrical conductivity was recorded was 7.54 Ω/cm, and the lowest measured in winter was 3.08 Ω/cm. A high degree of conductivity suggests both the emission status of the aquatic body and the trophic levels during the summer (Sahato and Lashari, 2005).

Turbidity

The representation of an optical property that reflects the light energy transmitted by the objects present in the water can be associated with water turbidity. The high turbidity value reported in the summer was 65 NTU because of the growth of aquatic vegetation and the decreased volume of water. During the monsoon, the lowest turbidity was 28 NTU due to water dilution arising from monsoon rains and comparatively low lake runoff (Mehar ,*et al*., 2000).

Total dissolved solids (TDS)

Maximum total dissolved solids (TDS) were observed at 1313 mg/L due to the introduction of dead organic compounds contributing to the decomposition of aquatic plants and animals that may be correlated with water concentration induced by evaporation at high temperatures during the summer. The rainwater has decreased the TDS concentration to 960 mg/LL during the monsoon (the lowest TDS in the data). The upper TDS value is 500 mg/L (Sahato and Lashari, 2005), as indicated by W.H.O, which indicates that TDS is recorded in the lake.

pH

High pH levels of lake water (8.59) associated with high decomposition activity of biotic and abiotic factors were documented by researchers in this analysis . Due to the formation of CO2 from the biological oxidation phase, the low pH of 6.2 was observed in the winter and has potentially led to pH depletion (Leghari, Jahangir, Khuhawar and Leghari, 2003).

Table 1: Mean ± SD and Min-Max range with Physico-chemical parameters and their analytical method during 2018 from selected stations of the study area

Variables	Abbreviations	Units	Analytical methods	Mean ±SD	Min-Max
Temperature	Temp	°C	Mercury thermometer	27.14±2.87	22-31
pH	pH	pH unit	pH meter	8.23±0.36	7.6-8.7
Alkalinity	Alkaline	mg L^{-1}	Titration (H_2 SO_4)	216.22±26.6	177.3-256.6
Dissolved Oxygen	DO	mg L^{-1}	Winkler method	8.01±0.67	7.3-8.7
Salinity	Saline	‰ (ppt)	Mohr method	0.17±0.047	0.01-0.2
Conductivity	EC	µS cm^{-1}	Conductivity meter	236.61±42.62	172.3-302.3
Total Dissolved Solids	TDS	mg L^{-1}	WTW LF 320 TDS meter	273.75±50.65	218.3-358.3
Chloride	Cl^-	mg L^{-1}	Titration (Silver nitrate)	144.23±26.08	114.7-187.2
Transparency	Trans	Cm	Secchi disc	58.94±10.21	42.3-73.3
Hardness	T-Hard	mg L^{-1}	Titration (EDTA)	226.8±66.76	130-338.3

Alkalinity

In summer, the maximum alkalinity value was recorded at 204 mg/L due to the deposition of organic matter caused by plant decay and decomposition and, in turn, the addition of carbonate and bicarbonate concentrations to the content of lake water. During the winter season, the lowest alkalinity of 162 mg/L concentration was observed and could be correlated with freshwater inflow and calcium carbonate ion breakdown in the water column (Lashari *et al.,* 2015).

Total hardness

As a result of the prevalence of high calcium and magnesium ion content compared to sulfate and nitrate in sewage waste applied during monsoon season, the maximum total water hardness was estimated at 224 mg/L during the monsoon period. Due to the low water volume and high rate of vegetation in the lake, the lowest amount of total hardness was reported as 170 mg/L during the summer season (Leghari, and Sultana, 1992).

Dissolved oxygen

The maximum concentration of dissolved oxygen during the winter season was 6.2 mg/L due to increased solubility of oxygen at lower temperatures, whereas the smallest dissolved oxygen was registered at 8.8 during the summer season, which may be due to high temperatures and the absorption of waste and other waste, and the dissolved oxygen content was greatly decreased.

Chloride

Due to daily run-offs filled with polluted water from the nearby slum region and water evaporation, In the summer, the highest chloride accumulation was reported at 113 mg/L. High concentrations of chloride suggest that organic matter, probably of animal origin, is present. The lowest chloride value during the monsoon season was 198 mg/L, and the dilution of the lake by rainwater may be attributed to it (Fig. 2.11). As per Solanki and Pandit, chloride amounts may be linked to the water's purity or impurity (Ghazanfar, *et al.,* 2000).

Salinity

Salinity did not rely on it during the current study phase. A maximum salinity of 0.3 was observed during the summer, and a minimum salinity of 0.8. Compared with the majority of the stations, it was more turbid during the year. The level of transparency varied from 44 cm in December to 15 cm in August.

4. CONCLUSION

Statistics from the Physicochemical Water Quality Study in Drigh Lake reveal that most of the associated concentrations of lake water, such as turbidity, total dissolved solids, pH, hardness, alkaline content, are above the top limit of the W.H.O guidelines. This current scenario would have a drastic impact on the growth of marine and terrestrial biodiversity in the water repository, and substantial domestic contamination will soon pose an added risk to the safety of the water. The civic body must take some steps and plans to tackle the rate of pollution in the lake to protect the biodiversity and aquatic life in the lake.

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