Research Article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Assessment of Physico-chemical Properties of Water and Seasonal Variations in Algal Diversity from January 2023 to October 2023 in Kot Dam, Shakambari Conservation Reserve, Rajasthan

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DOI - https://doi.org/10.37794/IJSRR.2023.13107

ABSTRACT

Present time algal diversity is determined using a Physico-chemical method that offers an alternative method for estimate the biological parameters of algae beyond water quality and in-situ testing. This paper represents the outcome of a study of algal diversity with Physico-chemical parameters of water in Kot Dam of Shakambari Conservation Reserve, Jhunjhunu (Rajasthan) during January 2023 to October 2023. In this paper, an approach is planned to evaluate the biological parameters of algae, which are significant factors in controlling eutrophication using demonstrating and investigation techniques. Algae growth rate and respiration rate were estimated using one-dimensional water quality model for water quality data obtained from Kot Dam. Total 54 algal species both non filaments and filamentous belonging to *chlorophyceaecyanophyceaebacillariophyceae* and *euglinophyceae* were recorded in the month of January to October 2023. Overall *chlorophyceae* species were observed to be in the highest species richness the occurrence of algal community and it was co-related with physico-chemical properties of water. pH of water was positive co-relation with *chlorophyceae* and *cyanophyceae* species.

KEY WORDS-algal growth, Physico-chemical parameters, Growth rate, pH, Water quality model

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INTRODUCTION

Water is a vital source of revenue for life on earth and helps maintain various economic sectors. Water quality is crucial for the environment, with its diverse uses including irrigation, water supply, infrastructure, tourism, and recreation[1]. Rephrase through human activities, the physical, biological, and chemical properties of water have been impacted by degradation in water quality from both point-source and non-point-sourced sources over time[2].Agriculture, urban storm runoff and other land uses are the most common sources of non-point pollution[3].The absence of adequate planning and regulations has resulted in numerous environmental issues due to the devastation caused by water[4].In addition, the discharge of domestic sewage, agricultural field runoff, municipal waste disposal, and mine discharge can all contribute to a decline in the water quality of the river[5,6].

Proper evaluation of water quality is essential for accurately assessing the associated hazards[7]. The quality of water for drinking and irrigation purposes must be regularly checked as a result of the various waterborne diseases that affect humans[8]. Algae, the predominant organisms in water bodies contribute to the primary production of an aquatic ecosystem[9].

Species composition and abundance are determined by the control of nutrients, light, and fowregimes in aquatic systems, which affect productivity[10]. Algae have been proposed as an indicator species in the aquatic environment due to their abundance and diversity pattern of populations[11].Their ability to assess water quality is due to their high nutrient requirements, rapid reproduction rate, short life cycle, heavy metal adsorbent, and quick reaction to qualitative and quantitative changes in water chemistry, such as increased water pollution caused by domestic or industrial wastes, as well as their general composition that can tolerate and adapt toenvironmentalconditions[12].

Rephrase the location of algal indicators at the bottom of aquatic food webs and their ability to react to various pollutants resulted in a notably different interpretation of ecosystem conditions than that of animal indicators[13].In the mid1970s, algae were utilized to evaluate water quality, and since then, they have become an invaluable monitoring tool for water[14&15].In water quality, algae communities inhabit bodies of water where they provide evidence in two ways: by differential sensitivities and recovery rates of species to substances in the water by concentration and accumulation of substances into theircells[17].

Algal blooms in water are attributed to two primary elements: natural approaches together with circulate, upwelling relaxation and river fow and anthropogenic loadings of nutrients leading to eutrophication[19]. Inopportunely, the latter is often assumed to be the main cause of all blooms, which is not the case in many instances[20]. Algal bloom can be unsafe for the water ecosystem because it blocks rays of sunlight from attaining the benthic area; it also produces dangerous pollution along with microcystins and hepatotoxins which increase the mortality price of different aquatic organisms in the water body[18]. The variety and succession of algae groups in different rivers and its relation to water chemistry, specially the fluctuations and changes in pH, temperature, conductivity and nutrients pleasant have been mentioned via many people[20&21]. Algae are the maximum ubiquitous natural inhabitants of water and usually inhabit aquatic environments[22].

MATERIALS AND METHODOLOGY

Study site: The studies work turned into accomplished from the Kot Dam of Shakambari conservation Reserve, Jhunjhunu District. Shakambari conservation Reserve is surrounded by using Aravalli Hills and spans over 13,100 hectares of agricultural area. The whole geographical region is 131 km^2.

Figure 1- Kot Dam of Shakambari Conservation Reserve

Water sampling–Water samples will collect monthly from the Kot Dam for the bodily chemical analysis in the 1-liter bottle before eight am. A few physico-chemical parameters will examine instant and others inside the laboratory consistent with American Public health association (APHA), Water pollutants control Federation (WPCF), and American Water affiliation (AWA)[14].

Algal sampling-The algal samples will collect from Kot Dam of Shakambari conservation reserve. The Algal samples will collect by plankton net of No.18nylon bolting cloth (mesh size 0.072 mm) and will transfer into the glass bottle and preserve in 4% formalin solution. The identification of Algae will on the basis of their morphological feature up to the level of species according to literature in the laboratory and microscopic study.

Water Testing **-** The samples were collected and analyzed for pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Alkalinity, Phosphate, Chloride, Nitrate. Standard methods were followed for collection, preservation, analysis and interpretation[5, 6,7, 8, 9, 10, 11, 12,13]. Standards for the potable water quality have been taken from Bureau of Indian standards (BIS) and Central Pollution Control Board (CPCB) [14,15].

Physicochemical traits of Dam water might be evaluation inside the duration of 10 months. bodily elements which includes temperature, electrical conductivity (EC), colour, smell, overall suspended solids (TSS), total solids (TS), total dissolved materials (TDS), turbidity and chemical parameters which includes pH, alkalinity, hardness, dissolved oxygen (DO), biochemical oxygen call for (BOD), chemical oxygen demand (COD), salinity, chloride, fluoride, phosphate & nitrate had been examined -

(a) Temperature–The usage of centigrade thermometer.

(b) Turbidity– Using turbidity meter.

(c) Hydrogen ion attention (pH)–With the aid of the usage of pH meter.

(d) Free carbon dioxide- The usage of titrimetric method.1 hundred ml pattern titrate with 0.1 N NaOH + phenolphthalein indicator

(e Biological oxygen demand (B.O.D.) –By using Winkler's modified method[22].

(f) Dissolved oxygen (DO) - By means of using Winkler changed method[12].

300 ml sample in BOD bottle + 2 ml. Manganese sulphate + 2 ml. Alkali-iodide-azide reagent → shake bottle of 15 minute, ppt seem + 2 ml. conc. H_2SO_4 → ppt dissolve.

Then this 100 ml. solutions titrant with 0.1.2 N. Sodium thiosulphates with starch indicator[15].

RESULTS AND DISCUSSIONS

Chemical analysis of water high-quality, along with organic/inorganic pollutants, and salinity, inorganic vitamins, natural nutrients is descriptive. However, performing continuous analysis is not beneficial because of unique time and value restrictions. but, organic measurements can monitor all capabilities of water great over time and arrange for an immediate measure of the ecological impact of environment variables. Bio-monitoring offers a dependable and relatively cheaper manner of recording situations at numerous locations.

Table1. Physico-chemical properties of water sample during research work (winter season):-

Parameters	1 January 2023	20 January 2023	10 February 2023	1 march 2023
pH	6.94±0.62	6.21 ±0.025	6.12 ±0.045	7.3±0.26
Temp.(surface)	12.4±0.05	14.1±0.05	19.4±0.06	23.7±0.06
Alkalinity	290.6±7	389.4±5.4	526.9±5.8	603.4±6.9
TDS	368±7.1	275±5.7	227±2.9	303±6.5
DO	3.5±0.07	3.3±0.06	3.1±0.06	2.8±0.1
BOD	11.9±0.08	17.3±0.3	18.2±0.3	15.3±0.4
COD	51±1.8	46.4±0.9	42.2±0.7	38.5±0.6
TotalHardness	155.81±6.8	134.53±2.9	111.±13.3	±6

Table 2. Physico-chemical properties of water sample during research work (spring season):-

Parameters	20 March 2023	10 April 2023	01 May 2023	20 May 2023
pH	7.4±0.62	8.21 ±0.025	8.12 ±0.045	7.3±0.26
Temp.(surface)	22.4±0.05	24.1±0.05	29.4±0.06	33.7±0.06
Alkalinity	290.6±7	389.4±5.4	526.9±5.8	603.4±6.9
TDS	368±7.1	275±5.7	227±2.9	303±6.5
DO	3.5±0.07	3.3±0.06	3.1±0.06	2.8±0.1
BOD	11.9±0.08	17.3±0.3	18.2±0.3	15.3±0.4
COD	51±1.8	46.4±0.9	42.2±0.7	38.5±0.6
TotalHardness	155.81±6.8	134.53±2.9	111.±13.3	106.1±6

Table 3. Physico-chemical properties of water sample during research work (summer Season):-

Parameters	10 June 2023	01 July 2023	01 September 2023	1 October 2023
pH	6.94±0.62	8.21 ±0.025	9.12 ±0.045	11.3±0.26
Temp.(surface)	32.45±0.05	34.1±0.05	29.5±0.06	27.7±0.06
Alkalinity	290.6±7	389.4±5.4	526.9±5.8	603.4±6.9
TDS	368±7.1	275±5.7	227±2.9	303±6.5
DO	3.5±0.07	3.3±0.06	3.1±0.06	2.8±0.1
BOD	11.9±0.08	17.3±0.3	18.2±0.3	15.3±0.4
COD	51±1.8	46.4±0.9	42.2±0.7	38.5±0.6
TotalHardness	155.81±6.8	134.53±2.9	111.±13.3	106.1±6

Statistical regression analysis of Physico-chemical parameter: Correlation analysis measures the know-how of the relationship among dependent and unbiased variables. If the correlation coefficient is nearer to +1 or -1, it indicates the opportunity of linear relationship among the variables. A low cost suggests that dependent variable may be linearly associated with unbiased variables.

Table 4. Correlation between Physico-chemical parameters of water:

Parameters	pH	Temp	TDS	DO	BOD	COD	Alkalinity
pH	1						
Temp	0.4643	1					
TDS	-0.0641	0.7637	1				
DO	-0.2166	-0.416	0.332	1			
BOD	0.0366	0.6694	-0.3051	-0.4292	1		
COD	0.0438	-0.358	0.2382	0.0723	-0.5186	1	
Alkalinity	0.9124	0.4527	-0.0339	-0.1184	-0.0697	0.0697	1

Following parameters have been estimated to measure the water quality:

1. **pH.:** pH is very important parameter, since the aquatic life is controlled by chemical changes in aquatic environment. Thus, pH is having primary importance in determining the quality of waste water. Exceptional value of pH may redirect contamination by strong base such as NaOH and $Ca(OH)_2$. The range of desirable pH of water prescribed for drinking purpose by ISI and WHO is 6.5 to 8.5. The average pH value of water samples collected from Kot Dam water in very minimum 6.72.

2. **Temperature (Temp):** Temperature is one of the most significant biological features. Salts in water, behavioral characteristics and solubility of gases of organisms all are determined by temperature. In the present study, the average temperature of site varies between minimum of 12 ^{0}C and maximum of 34^{0}C. High water temperature recorded during pre-monsoon season (June2023).
3. **Total Dissolve Solids (TDS):** TDS contented in water is a measure for salinity. A large number of salts are found dissolved in waste water, the common ones are Carbonates, Bicarbonates, Iron, Chlorides, Sulphates and Nitrates of Calcium, Magnesium and Manganese, etc. A high content of dissolved solid elements affect the density of water, influence osmoregulation of organisms and decreases solubility of gases (like oxygen).
4. **Dissolved Oxygen (DO):** DO is very essential for metabolism of all aquatic organisms that possess aerobic respiration. According to vijayanan [25], assessment of dissolved oxygen is a prime characteristic in all pollution related ecological studies. Present investigation shows average minimum value 2.8mg/L and maximum value 3.5mg/L.
5. **Biological Oxygen Demand (BOD):** BOD may be defined as the rate of consumption of oxygen by microorganisms in aerobic degradation of the dissolved organic matter in water. Increase in BOD can be due to heavy discharge of waste water effluent of domestic sewage. Low BOD content is an indicator of good quality water, while a high BOD indicates polluted water. According to UN Department of Technical Cooperation for Development the maximum permissible BOD content is less than 100 to 300mg/L. The experimental data of present investigation shows average BOD value of minimum 11.09 mg/L and maximum 15.8mg/L.
6. **Chemical Oxygen Demand (COD):** COD determination is a measure of the oxygen equivalent of that portion of the organic matter in a sample that is susceptible to oxidation by a strong chemical oxidant. COD value is useful in specifying toxic condition and presence of biologically resistant substances. COD test is used to measure the load of organic pollutant in the waste water. The COD and BOD values both are a measure of the relative oxygen-depletion effect of a waste contaminant. Present investigation shows average COD minimum value 38 mg/L and maximum value 51 mg/L from the water sample.
7. **Alkalinity:** The value of total alkalinity gives an idea of natural salts present in water. Total alkalinity shows lowest average value 290 mg/L and higher average value 604 mg/L from the water sample.

Algal species and their diversity in Kot Dam water: Algal diversity of Kot Dam in Shakambari Conservation Reserve and in this study a total of 48 algal species was recorded. A summary of algal flora distribution Table 4 & Table 5 and their distributions a represented-

Table 5. Algal species and their diversity in Kot Dam water:

Class	January 2023	February 2023	March 2023	April 2023	May 2023
Cyanobacteria	02	01	07	05	05
Euglenophyceae	06	04	05	08	02
Bacillariophyceae	11	17	15	03	03
Chlorophyceae	08	07	00	01	06
Ulvophyceae	01	01	00	00	02
Trebouxiophyceae	04	02	01	05	09
Zygnematophyceae	07	05	10	08	08
Charophyceae	02	01	01	01	01
Total	41	38	39	31	36

Table 6. Algal Diversity in Kot Dam water:

Class	June 2023	July 2023	August 2023	September 2023	October 2023
Cyanobacteria	06	04	05	08	02
Euglenophyceae	02	01	04	01	03
Bacillariophyceae	11	15	09	16	18
Chlorophyceae	08	07	02	03	05
Ulvophyceae	01	01	00	00	00
Trebouxiophyceae	03	04	03	05	04
Zygnematophyceae	09	05	08	10	08
Charophyceae	01	01	02	00	01
Total	41	38	33	43	41

CONCLUSIONS

In the present study, we investigated and predicted the modifications in water satisfactory and evaluated the danger of algal boom in Kot Dam induced by water transfer.

Our look at confirmed that the growth of algal species might be decreased with the aid of eight.7% in Dam water.

The main features of each section are as follows:

Result 1: surface water quality and algal growth , increased concentration of ions and increased oxygen concentration, limited phytoplankton density due to overflow from the Kot dam and the toxic effect substances on algae is reduced.

Result 2: Deep water quality and low algal growth, low oxygen concentration; extremely high nutritional component, nitrogen is mainly in the form of ammonia of nitrogen; eutrophication or super nutrient systems; dominance of small central diatoms and Chlorella; Heavy metal concentrations far exceed levels that are protective for aquatic life.

Result 3: increased depth, breadth, speed and depth of water; improve water quality with the restoration of dissolved oxygen concentrations; nutritional value and chlorophyll corresponding to the eutrophication system; evidence of toxic effects on algae.

Table 7 Algal Species present in Kot Dam During Research Work.

1.	*Staurastrumsenarium (Ehrenberg)Ralfs,1848*
2.	*Staurastrumsexangularevar.crassumW.B.Türner,1893*
3.	*Staurastrumtripyrenoideum A.M.Scott&Prescott, 1961*
4.	*Xanthidiumperissacanthum Scott&Prescott,1961*
5.	*XanthidiumsubhastiferumWest,1892*
6.	*Arthrodesmuscurvatus var.americanusScott&Grönblad,1957*
7.	*Staurodesmusconvergens (Ehrenbergex Ralfs)S. Lillieroth,1950*
8.	*Staurodesmusunguiferus W.B.Türner,1892*
9.	*MicrasteriasfoliaceaBaileyexRalfs,1848*
10.	*MicrasteriaspinnatifidaRalfs,1848*
11.	*Micrasteriasradians W.B.Türner,1893*
12.	*MicrasteriastropicaNordstedt,1870*
13.	*DesmidiumbengalicumTürner,1893*
14.	*Hyalothecadissiliens var. hiansWolle,1885*
15.	*SpondylosiumincurvatumW.B.Türner,1893*
16.	*Spondylosiumplanum(Wolle)West andG.S.West,1912*
17.	*SpirogyramaravillosaTranseau,1938*
18.	*Spirogyraparvula (Transeau)Czurda,1932*
19.	*Spirogyraflavescens (Hassall)Kutzing,1849*
20.	*ZygnemagangeticumBhashyakarlaRao,1937*
21.	*Zygnemopsisindica(Randhawa)Randhawa,1937*
22.	*CharafragilisDesvaux,1810*
23.	*CharaglobulaisThuiller,1799*
24.	*CosmariumquadrumLundell,1871*
25.	*Cosmariumquadrum var.sublatum (Nordstedt)West &G.S.West, 1912*
26.	*CosmariumradiosumWolle, 1884*
27.	*CosmariumsubcostatumNordstedt,1876*
28.	*Cosmariumtrilobulatumvar.abscissum(Schmidle)WilliKrieger&Gerloff,1962*

29.	*CosmariumtumidumP.Lundell,1871*
30.	*Cosmariumundulatum var.wolleiWest, 1892*
31.	*Euastrumansatumvar.pyxidatumDelponte,1873*
32.	*Euastrumcoralloidesvar.trigibberumLagerheim,1888*
33.	*Euastrumceylanicum(W.&G.S.West)Krieger, 1937*
34.	*Euastrumdenticulatum F.Gay,1884*
35.	*EuastrumspinulosumDelponte,1876*
36.	*EuastrumstigmosumW.B.Turner,1892*
37.	*Staurastrumarctiscon (EhrenbergandRalfs)P. Lundell,1871*
38.	*StaurastrumbloklandiaeCoesel andJoosten, 1996*
39.	*StaurastrumcontectumW.B.Turner,1893*
40.	*Staurastrumcorniculatumvar. variableNordstedt,1887*
41.	*Staurastrum gracilevar.nanumWille,1880*
42.	*Staurastrumindentatumf.minusA.M.Scott&Prescott, 1961.*
43.	*StaurastrumleptocladumNorsdstedt,1870*
44.	*OocystiskumaoensisK.P.Singh,1960*
45.	*NephrocytiunlanutumWest andWest,1894*
46.	*Cylindrocystissubpyramidata W &G.SWest,1901*
47.	*Netriumdigitus(Brébissonex Ralfs)Itzigsohn&Rothe,1856*
48.	*ClosteriumcalosporumWittrock,1869*

ACKNOWLEDGEMENTS

We are thankful to the Department of Botany, Government College, Kota and University of kota for providing library and laboratory facilities as well as valuable suggestions during the Research work.

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