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Study of Physico - Chemical Properties of Loni Dam, Rewa, Madhya Pradesh, India

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Abstract: ***The present study shows the physico - chemical properties of Loni dam. The study is carried out from July 2021 to June 2022, and the variations is noted on the monthly basis. The analysis of various parameter like, Temperature, Transparency, pH, dissolve oxygen (DO), Free CO_2, Conductivity, Carbonate Alkalinity, Bicarbonate alkalinity, Total alkalinity, TDS, calcium hardness. Magnesium hardness, Total hardness, Chloride, Phosphate, Nitrate, Potassium, Sodium, Reactive silica, Ammonia and Sulphate are carried out. The result of present finding was compared with the Indian and other standard for water quality parameters. The present finding shows that there is any significant variation in physico - chemical parameters and or they in normal range, that indicates the quality of water in Loni dam.***

Keywords: Physico - chemical, Loni dam, Abiotic, Biotic, fresh water

1. Introduction

Water is the most important vital inorganic substance on earth surface. It covers 71% of earth surface. Most of the water is present on earth surface is marine water almost 2.6% of the total water is present as fresh water. Water is one of the most vital substance on earth for the survival for life. Fresh water present in rivers, dams, lakes and ponds etc. In recent decades the quantity of dams, stores and tanks is increases rapidly. Water is the home of fishes and other aquatic flora and fauna. So, their quality manners so much. Water quality is depending on different component of water like biotic and abiotis factors, if they are in permissible range than water quality is good and it is suitable for aquatic life. The present study is carried out in Loni dam Rewa, MP. It is one of the unique water body in Madhya Pradesh, which is located in North of the Rewa district near Uttar Pradesh border at distance of 90 km from Rewa district headquarter. The longitude of Loni dam is 25°88'19" N and latitude 81°34'11"E. The Loni dam project was completed in 1965.

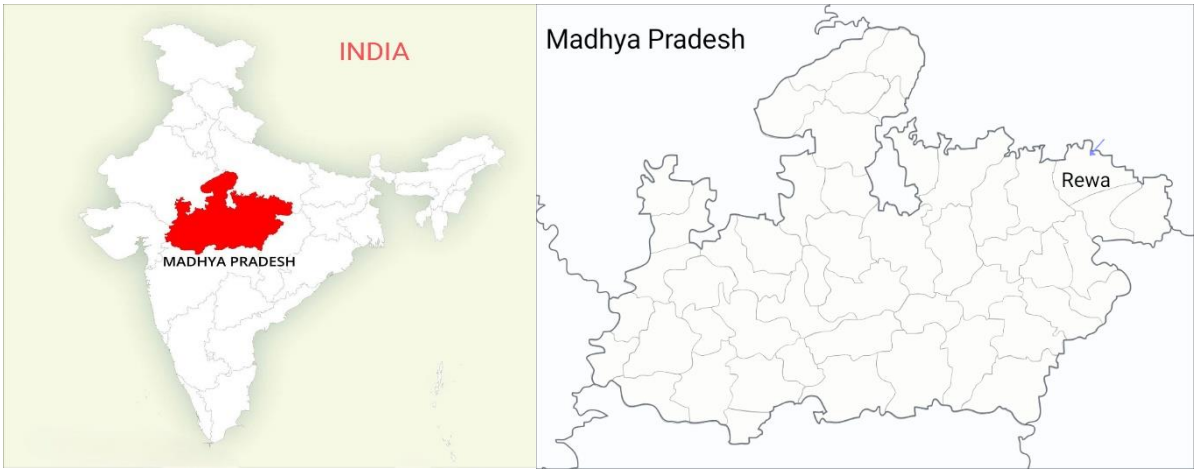

Figure: Showing Loni Dam, Rewa, Madhya Pradesh, India

2. Material and Methods

The various physico - chemical parameters will be analyzed according to the standard methods for water established by Adoniand APHA, Trivedi and Goel (1986), Kodarkar (1992), Manivasakan (1996), and APA, AWWA, WPCF (2005), Some of these physico - chemical parameters will be analysed at the sampling site and others will be done in the laboratory. For the convenience of the study 04 research sites Station A, Station B, Station C, and Station D was established about 1/2 km. of distance each at ecologically significant areas.

3. Result and Discussion

1) Temperature:

- Temperature is one of the important factor which effects both abiotic and biotic component of an ecosystem variation in temperature either air or water temperature affect the whole aquatic life. The average variation of air temperature from 21.85°C to 38.57°C and water temperature from 18.27 °C to 38.16 °C.

2) Transparency: -

- The transparency depends upon the total amount of suspended and dissolve solid in water. Transparency is measured on Secchi disc. Transparency is directly proportional to light enter in to an aquatic ecosystem. Light effect aquatic life because it directly effects the photosynthesis and if photosynthesis affected then productivity also effected, then whole aquatic ecosystem is disturbed. Range of transparency in Loni dam varies from 65.54 cm to 103.88 cm.

3) pH: -

- pH depend on the total [H+] ion concentration present in water. pH of natural water is slightly basic which varies from 6 to 8. pH show correlation with turbidity, TDS, conductivity and total alkalinity. The pH of water bodies is due to dissolve gases, salt. The pH of Loni dam varies from 7.56 to 8.66 which is normal in range.

4) Dissolved oxygen (DO): -

- Oxygen is essential for the respiration of animal and plants of aquatic ecosystem. The amount of oxygen is dissolved in water is very low as compared to the air. It depend on diffusion by air, photosynthesis by aquatic macrophyte and microphytes. Dissolve oxygen directly proportional to aquatic biodiversity, but it is decrease when blooms occurs in the water body. The range of DO is 7.38 to 10.75 mg/litre.

5) Free carbon dioxide (CO2) -

- The carbon di - oxide is essential for photosynthesis of aquatic plants. The macro and microphytes are able to use bound carbon dioxide by the soluble bi - carbonate salts. Carbon dioxide react with water and from carbonic acid. Only small amount of Carban dioxide enter into aquatic ecosystem. In Loni dam free carbon dioxide range from 2.87 to 12.97 mg/litre.

6) Conductivity -

- Conductivity is directly proportional to TDS in water, that means high value of TDS, greater amount of the ion in water. That result into the higher conductivity. The electrical conductivity range between 28.4 to 78 µmhos/cm.

7) Carbonate alkalinity: -

- The carbonate alkalinity are recorded in all 04 station during the period of study. The minimum value of carbonate alkalinity is 80 and maximum value of carbonate alkalinity is 156 mg/l.

8) Bicarbonate alkalinity: -

- Average range of bicarbonate alkalinity were in recorded in all four station of Loni dam during the study period. It range varies from 62.51 to 78.91 mg/l.

9) Total alkalinity: -

- Alkalinity of the water body play an important role in aquatic ecosystem. It maintain the enzymatic activities inside ecosystem. The average range of total alkalinity between 62.37 to 82.25 mg/l.

10) TDS: -

- Total dissolved solid in a water body refer to as dissolved and suspended solid matter in water. TDS varies from season to season and also differs in different ecosystems.

TDS play an important role in ecosystem because it supplies the inorganic nutrients to the plants for their growth and synthesis. The range of TDS varies from 72.77 to 103.05.

11) Calcium hardness: -

- One of the most abundant element in natural water is calcium and it is an important element for aquatic ecosystem. Calcium associated with different anion like bicarbonate and carbonate to cause hardness of water. Range of calcium hardness is 62.59 to 93.72 mg/l.

12) Magnesium hardness: -

- Magnesium ion is essential element of chlorophyll of plant. so it is essential element for photosynthesis. Magnesium is present in water in the form of its bicarbonate and carbonate. Its ranges varies from 1.56 to 3.54 mg/l.

13) Total hardness: -

- Total hardness of water is total of the cation like calcium, magnesium, ferrous and manganese present in that water. Total hardness is mainly depends on temperature and trophic states of dam. It range varies from 62.59 to 93.72 mg/l.

14) Chloride: -

- It is anion present in all natural water, there maximum concentration present in sea water. High concentration of chloride ion in a water effects animals and cause heart and kidney diseases. The average range of chloride is 8.65 to 12.35 mg/l.

15) Phosphate, Nitrate and Sulphate: -

- Phosphorus is essential nutrient for primary producer. It is present in very small quantity in ecosystem. So they act as limiting factor for eutrophication. Main source of phosphorus is weathering of rocks which contain Phosphorus. Then average range of phosphorus is 0.06 to 07 mg/l. Nitrogen fixation from atmosphere is the natural source of nitrogen in an ecosystem. In other hand domestic sewage waste and agriculture run off water contains nitrates. Nitrate is the observable from of nitrogen element into the ecosystem and nitrogen is the essential element for protein synthesis. The average range varies from 0.47 to 0.80 mg/l. These element are needed in small quantity but play important role in synthesis process.

16) Sodium and potassium: -

- Sodium and Potassium element is essential for both flora and fauna for their growth and development they also help in maintain homeostasis condition. The concentration of Sodium varies from 5.39 to 8.9 mg/l and the Potassium from 0.72 to 2.25 mg/l.

17) Reactive silica and Ammonia: -

- Reactive silica amount varies from 0.39 to 2.05 mg/l. The value of ammonia recorded during the study period is 0.008 to 0.475 mg/l.

Table 1: Mean values of monthly Physico - chemical parameters of Loni Dam from July 2021 to June 2022.

Name	Jul-21	Aug	Sep	Oct	Nov.	Dec.	Jan-22	Feb	Mar	Apr	May	Jun-22	Min.	Max.
Air Temp.	29.87	28.97	29.35	30.42	29.02	25.75	21.85	23.72	25.4	31.38	36.97	38.57	21.85	38.57
Water Temp.	28.37	26.55	27.45	28.3	25.97	22.47	18.27	20.68	30.25	33.07	37.23	38.16	18.27	38.16
Transparency	66.23	65.54	69.12	90.14	91.32	100.1	103.88	97.28	80.93	69.35	70.43	66.91	65.54	103.88
pH	7.57	7.7	7.48	7.66	8.18	7.56	8.09	7.87	8.35	8.66	7.62	7.97	7.84	8.66
DO_2	8.07	8.15	8.1	7.38	10.75	10.37	10.38	10.02	8.81	7.46	7.68	7.67	7.38	10.75
Free CO_2	6.96	8.62	4.1	2.87	3.42	4.17	12.97	7.05	6.3	5.89	4.52	3.54	2.87	12.97
Conductivity	59.7	54.95	44.85	37.47	28.4	29.95	35.82	45.62	61.27	64.57	71.8	78	28.4	78
Carbonate Alkalinity	80	89.25	95.75	109.75	120.75	135.5	151	149.25	156	130.5	126	107.5	80	156
Bicarbonate Alkalinity	74.62	71.13	66.67	64.67	62.51	63.58	66.41	69.86	69.17	72.23	75.47	78.91	62.51	78.91
Total Alkalinity	74.63	71.27	66.63	64.63	62.37	63.55	66.3	69.77	75.07	78.28	82.25	78.91	62.37	82.25
TDS	96.42	89.47	83.7	79.95	75.41	75.61	72.77	75.16	77.51	82.53	96.66	103.05	72.77	103.05
Calcium Hardness	68.25	69.48	67.4	63.42	61.27	64.98	67.21	70.53	68.31	76.45	84	90.28	61.27	90.28
Magnesium	3.25	3.25	2.92	1.68	1.56	2.49	2.82	2.52	2.33	3.34	3.47	3.54	1.56	3.54
Total Hardness	71.55	72.58	70.32	64.94	62.59	67.57	69.96	73.17	70.66	79.75	87.37	93.72	62.59	93.72
Chloride	12.35	9.22	9.34	10.64	9.3	9.1	8.65	9.92	9.6	10.44	11.2	11.7	8.65	12.35
Phosphate	0.57	0.67	0.7	0.36	0.06	0.2	0.23	0.3	0.23	0.25	0.22	0.31	0.06	0.7
Nitrate	0.8	0.72	0.77	0.65	0.47	0.67	0.58	0.59	0.61	0.67	0.68	0.65	0.47	0.8
Potassium	1.56	0.97	0.72	1.68	1.22	1.36	1.49	1.25	0.83	1.55	2.04	2.25	0.72	2.25
Sodium	6.3	5.39	5.54	6.05	7.04	7.03	6.59	6.18	8.1	8.31	7.83	8.9	5.39	8.9
Reactive Silica	0.67	1.15	1.55	1.87	2.05	1.83	1.73	1.18	0.81	0.39	0.89	0.63	0.39	2.05
Ammonia	0.475	0.126	0.073	0.043	0.038	0.024	0.01	0.008	0.042	0.058	0.038	0.081	0.008	0.475
Sulphate	0.014	0.019	0.021	0.025	0.029	0.021	0.054	0.054	0.082	0.064	0.066	0.067	0.014	0.082

Table 2: Correlation Matrix of Physico - chemical parameters of Loni Dam from July 2021 to June 2022

	Air Temp.	Water Temp.	Transparency	pH	DO2	Free CO2	Conductivity	Carbonate Alkalinity	Bicarbonate Alkalinity	Total Alkalinity	TDS	Calcium Hardness	Magnesium	Total Hardness	Chloride	Phosphate	Nitrate	Potassium	Sodium	Reactive Silica	Ammonia	Sulphate
Air Temp.	1.0																					
Water Temp.	0.91	1.0																				
Transparency	- 0.70	- 0.75	1.0																			
pH	- 0.11	0.12	0.06	1.0																		
DO2	- 0.70	- 0.75	0.79	0.09	1.0																	
Free CO2	- 0.58	- 0.53	0.22	0.19	0.30	1.0																
Conductivity	0.68	0.82	- 0.77	0.17	- 0.71	-0.072	1.0															
Carbonate Alkalinity	- 0.49	- 0.30	0.67	0.53	0.52	0.26	- 0.18	1.0														
Bicarbonate Alkalinity	0.65	0.69	- 0.71	0.034	- 0.61	0.032	0.94	- 0.27	1.0													
Total Alkalinity	0.62	0.77	- 0.68	0.22	- 0.63	-0.005	0.96	- 0.05	0.91	1.0												
TDS	0.84	0.77	- 0.81	- 0.28	- 0.69	-0.247	0.80	- 0.63	0.86	0.72	1.0											
Calcium Hardness	0.74	0.75	- 0.53	0.11	- 0.51	-0.130	0.86	- 0.04	0.87	0.84	0.75	1.0										
Magnesium	0.46	0.46	- 0.66	- 0.07	- 0.49	0.260	0.76	- 0.28	0.83	0.76	0.71	0.75	1.0									
Total Hardness	0.73	0.74	- 0.55	0.09	- 0.52	-0.102	0.87	- 0.06	0.89	0.85	0.75	0.99	0.78	1.0								
Chloride	0.70	0.67	- 0.57	- 0.14	- 0.64	-0.346	0.67	- 0.45	0.74	0.64	0.79	0.56	0.42	0.56	1.0							
Phosphate	0.06	0.00	- 0.57	- 0.53	- 0.48	0.118	0.17	- 0.73	0.22	0.03	0.37	- 0.04	0.39	- 0.01	0.13	1.0						
Nitrate	0.27	0.26	- 0.65	- 0.54	- 0.64	-0.026	0.39	- 0.65	0.42	0.33	0.56	0.19	0.61	0.22	0.42	0.81	1.0					
Potassium	0.65	0.52	- 0.11	- 0.01	- 0.32	-0.193	0.44	- 0.06	0.55	0.47	0.56	0.68	0.35	0.66	0.67	- 0.34	- 0.02	1.0				
Sodium	0.47	0.64	- 0.15	0.59	- 0.15	-0.249	0.56	0.39	0.45	0.60	0.28	0.65	0.25	0.63	0.34	- 0.62	- 0.28	0.54	1.0			
Reactive Silica	- 0.44	- 0.63	0.70	- 0.32	0.60	-0.067	- 0.91	0.10	- 0.87	- 0.91	- 0.62	- 0.70	- 0.74	- 0.72	- 0.62	- 0.17	- 0.41	- 0.29	- 0.52	1.0		
Ammonia	0.15	0.12	- 0.50	- 0.29	- 0.30	0.083	0.26	- 0.67	0.39	0.22	0.51	- 0.02	0.33	- 0.00	0.62	0.51	0.62	0.06	- 0.20	- 0.38	1.0	
Sulphate	0.15	0.40	- 0.01	0.64	- 0.10	0.118	0.55	0.67	0.42	0.62	0.05	0.59	0.23	0.57	0.09	- 0.52	- 0.36	0.28	0.77	- 0.51	- 0.43	1.0

4. Conclusion

During the study period the physico - chemical parameter doesn't show significant changes from permissible limit. So it shows that the water quality of Loni dam is good during the study period the biological and physico - chemical properties of Loni dam is good for fish culture activities. The important role of present finding helps to fisherman to apply their fish farming strategies and improve their fish culture activities efficiently.

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