STUDY OF WATER QUALITY PARAMETERS OF EKBURGI DAM WATER IN WASHIM (M.S.) REGION

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ABSTRACT :The present study is focused on the determination of physico-chemical parameters of water samples of Ekburji reservoir in Washim district of Maharashtra (India) during January 2018 to December 2018. The main purpose of analyzing water quality is to understand about pollution status of Ekburji reservoir and to suggest weather the reservoir water is safe or not for various purposes. The methods employed for the analysis is as per standard methods and results were compared with WHO/BIS standards limits. From the results it was found that the accumulated water ofEkburji reservoir is moderately contaminated mainly due to discharge of contaminated domestic sewage water of Chandrabhaga River into the reservoir and anthropogenic activities which shows water can never be of any use for drinking, cooking purposes directly or without purification but it is useful for agricultural, irrigation and fishery purposes only.

Key words: Ekburji reservoir, Surface water, Physico-Chemical Parameters, BIS, Domestic sewage water.

I. INTRODUCTION

Quality of water depend upon pollution of the area where water reservoir is situated and pollution of that area is depends upon the population, urbanization, number of automobiles, number of industries, agricultural activities and forest in that area. For confirming the good quality of water resources large number of physico–chemical and biological parameters are to be studied in details and must be found in normal range. The purpose of analyzing physico-chemical and microbiological characteristics of water is to determine its nutrient and pollution status because about 70% rivers and streams, not only of India but of all the countries contain polluted water1. It is an established fact that polluted water is one of the biggest killers in the world's poorest countries2. The main causes for pollution of water sources are washing of clothes, cleaning of animals, domestic waste, insecticides and pesticides used in agriculture and land drainage. The water quality is also affected by impurities such as dissolved impurities, suspended impurities, colloidal and biological impurities. Dissolved impurities include inorganic salts, organic salts and gases. Suspended impurities include clay, sand, oil globules, vegetables and animal matter. Colloidal impurities contain clay and finely divided silica, colloidal particle of 10-4-10-6 mm size. Biological impurities include bacteria, fungi, algae, microorganisms and other forms of animal and vegetable life3. Reports by the Central Pollution Control Board show Maharashtra releases maximum sewage (45.11%) into its water bodies in a year causing damage to human as well as aquatic life4. We get water from rivers, lakes, tanks and ponds. In spite of such abundance, there is shortage of soft water in the world.

In Washim district there are several reservoirs created by minor irrigation department, Govt. of Maharashtra. Ekburji reservoir is one of the minor reservoirs and is located in the Maharashtra plateau, the tropical region of Maharashtra state in India. Ekburji reservoir is located in the vicinity of Ekburji village (2006'N and 770 11' E) at an elevation of about 548.78 meter above mean sea level (MSL). Ekburji Dam was constructed as a part of irrigation projects by Government of Maharashtra in the year 1964. It is an earthen fill dam on Chandrabhaga River near Ekburji village in Washim district. The height of the dam above the lowest foundation is 23.7 m while the length is 830 m and total surface area 218 Km2. The volume content is 566 Km3 and the gross storage capacity is 14,100.00 Km3. It is used for the irrigation purpose and provides drinking water to the Washim City. The main scope of this reservoir is agricultural irrigation, fish culture and drinking purposes. The source of water to this project is Chandrabhaga River and some nearby currents draining into its reservoir.

Assessment of water quality of any region is an important aspect for developmental activities of that region because rivers, lakes, manmade reservoirs and ponds are used for water supply to domestic, industrial, agricultural and fish culture purposes. Many authors5-9 have studied the physico- chemical characteristics of surface and ground water of different parts of countries because there is almost a global shortage of water and the world's most urgent and front rank problem today is supply and maintenance of clean drinking water. A review of literature shows that no scientific study has been made with respect to ecological factors of this region. Hence it was decided to study the water quality of Ekburji reservoir. Definitely it will be the novel contribution to the present problem of water pollution. The data collected will be definitely useful for the people and authority of the Ekburji reservoir

II. MATERIALS AND METHODS

The water samples from all the sites viz east, west, south and north directions of Ekburji reservoir for the analysis were collected at regular intervals of one month for a period of one year from January 2018 to December 2018 between 8 a.m. to 10 a.m. Sampling was carried out in cleaned rinsed polythene bottles with necessary precautions and preserved according to standard method10&then brought to the laboratory for analysis of physico-chemical parameters following standard methods11, 12

Temperature of water samples were measured in the field immediately after collection of water with the help of mercury glass thermometer and other physico-chemical parameters were analyzed in the laboratory.pH of water was measured by pen digital pH meter.Electrical conductivity was measured using multi-range conductivity meter. Turbidity was measuredby digital turbidity meter.Dissolved oxygen (DO) was measured by Winkler's azide method,BOD and COD was by dichromate titration,

hardness by EDTA method, total alkalinity was by standard volumetric method usingphenolphthalein indicator,chlorides was by Mohr's method, fluorides was by SPADNS spectrophotometric, nitrates, sulphates and phosphates were estimated by UV spectrophotometric method. Study was carried out in P.G.department of Chemistry, R.A.College Washim. AR Grade chemicals and reagents, double distilled water and Borosil glassware's were used throughout the work.

S.N.	PARAMETERS	TECHNIQUE / INSTRUMENT	WHO STANDARD	INDIAN STANDARD
1	Temperature	Thermometer	-	-
2	Odour	Physiological sense	Acceptable	Acceptable
3	pH	pH meter	6.5 – 9.5	6.5 – 9.5
4	Conductivity	Conductivity meter	-	-
5	Turbidity	Turbidity meter	-	5-10 NTU
6	DO	Redox titration	4 – 6 mg/ml	4 – 6 mg/ml
7	BOD	Incubation followed by titration	6 mg/ml	30 mg/ml
8	COD	C.O.D. digester	-	10 mg/ml
9	Total Hardness	Complexometric titration	200 mg/ml	200-600 mg/ml
10	Ca Hardness	Complexometric titration	5-6 mg/ml	75-200 mg/ml
11	Mg Hardness	Complexometric titration	150 mg/ml	30 -100 mg/ml
12	Alkalinity	Acid-Base titration	-	200-600 mg/ml
13	Chlorides	Argentometric titration	250 mg/ml	250-1000 mg/ml
14	Nitrates	UV/Visible spectrophotometer	3 mg/ml	45 mg/ml
15	Sulfates	Spectrophotometer	250 mg/ml	200-400 mg/ml
16	Phosphates	Spectrophotometer	-	0.1 mg/ml
17	TDS	TDS meter	-	500-2000 mg/ml
18	Fluorides	Spectrophotometer	-	1.0 -1.5 mg/ml

Table-2: Maximum **Acceptable Level of Chemicals in Water for Human Consumption (WHO)**

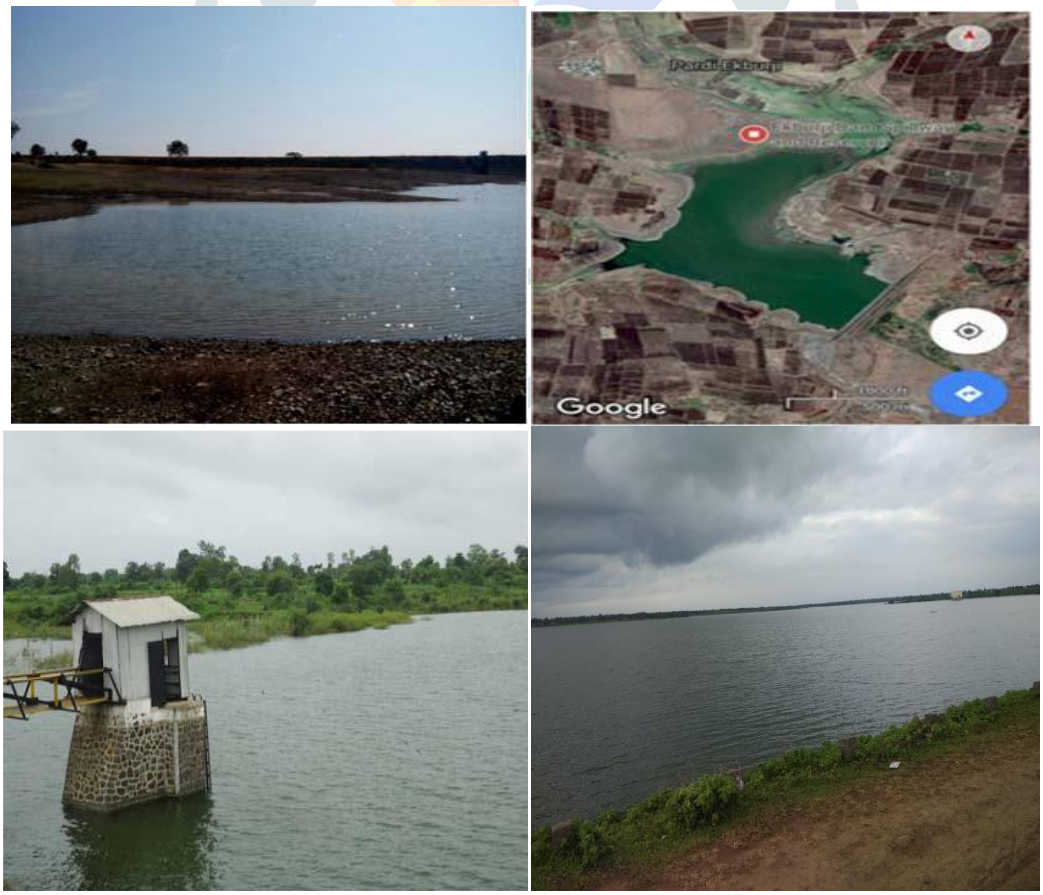

Table 2: Physico-Chemical Characteristics of Ekburji Reservoir Water during 2018

Parameter	JAN	FEB	MAR	APR	MAY	JUNE	JULLY	AUG	SEPT	OCT	NOV	DEC
Temperature	22.5	24.8	27.5	31.8	33.2	32.0	28.6	26.0	25.2	24.0	22.4	21.9
Odour	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac
TDS	300	342	402	443	402	490	498	499	390	380	353	301
pH	7.65	8.08	8.22	8.30	8.70	8.65	8.09	8.00	7.90	7.82	7.60	7.64
Conductivity	300	305	325	379	410	411	404	377	331	323	315	302
Turbidity	3.8	4.1	4.3	4.8	4.9	5.1	5.4	5.6	5.7	4.1	4.0	3.8
DO	6.8	6.6	5.9	5.1	4.5	4.5	5.2	5.7	6.2	6.5	6.7	6.8
BOD	5.5	5.9	6.4	7.1	8.5	8.7	8.3	7.4	6.7	5.9	5.6	5.2
COD	9.9	10.2	10.8	11.6	12.0	12.9	12.6	12.9	11.6	11.1	9.8	9.6
Tot. Hardness	294	301	318	334	350	350	349	333	310	303	289	290
Ca Hardness	105	118	129	175	202	208	199	173	130	125	110	109
Mg Hardness	55	63	76	125	134	150	145	135	119	106	89	58
Alkalinity	269	275	283	285	295	299	290	278	284	268	261	265
Chlorides	251	276	301	375	440	461	423	401	338	303	256	249
Nitrates	26.20	31.44	35.7	41.95	45.9	45.8	39.8	38.2	37.2	35.2	29.3	27.1
Sulphates	144	154	165	174	189	186	173	170	168	162	155	145
Phosphates	0.99	1.05	1.08	1.17	1.20	1.39	1.62	1.68	1.78	1.42	1.14	0.98
Fluorides	0.52	0.58	0.62	0.66	0.70	0.70	0.75	0.81	0.78	0.62	0.58	0.54

*****All the results are reported in mg/L except Temp (^{0}C), EC in µS/cm and Turbidity in NTU

III. RESULTS AND DISCUSSION

The values of various parameters during the study period are presented in Table 1.The comparison of the Physico-Chemical data of water has been made with drinking water standards of WHO/BIS13 Table 2.

1. Water Temperature: - Steady change in the atmospheric temperature with the change in the seasons results in the corresponding change in water temperature. The maximum 33.20C and minimum 22.50C temperature of reservoir water were observed in the months of May and January respectively. High summer temperature and bright sunshine accelerate the process of decay of organic matter resulting into the liberation of CO2 and nutrients.

2. pH: - The pHof water plays important role in the growth of flora and fauna of aquatic body and also indicate whether the water is safe or not for drinking, fishery and irrigation purposes. In thepresent study, pH of the water was slightly alkaline in nature, probably due to contamination of water by soap, detergents used for washing clothes. pH increased during summer months and decreased during monsoon and winter. Higher values during summer may be due to increased photosynthesis of the algal blooms resulting into the precipitation of carbonates of Ca and Mg from bicarbonates causing higher alkalinity. The decrease in pH during winter may be due to decrease in photosynthesis, while in monsoon it may be due to greater runoff water.

3. Conductivity: - Electrical conductivity usually used for indicating the total concentration of ionized constituents of water. The standard value of electrical conductivity is 300 µS/cm. It signifies the total dissolved salts14. Water having more conductivity is unfit for domestic and fishery. The EC varies from 300 - 411µS/cmin the reservoir indicates sufficient minerals and salts dissolved in water and such water can be used for aquatic and irrigation purposes in respect of EC.

4. Turbidity: Higher turbidity levels are associated with higher levels of disease causing micro-organisms such as viruses, parasites and some bacteria. These organisms can cause short term symptoms such as nausea, cramps, diarrhea and headaches. This prevents growth of the aquatic plants by reducing rate of their photosynthesis and has become obstacle for self-purification of water. In present study, higher values were recorded in June to September (monsoon) and March to May (summer). Increased turbidity during rainy months was due to soil runoffs, domestic wastes and suspended impurities from sewage which enter the reservoir through Chandrabhaga River. Higher value in summer was due to human and animal fecal waste which directly enters into the reservoir water.

5. TDS: In winter and summer the values of TDS of most locations were found within permissible limit of 500 mg/l for drinking purpose. These indicate that the water at some locations of reservoir is suitable for drinking, aquatic and irrigation purposes in respect of TDS.The total dissolved solids fluctuate from 300 mg/l to 499 mg/l the maximum value (499 mg/l) wasrecorded in the month of June-August. It is due to heavy rainfalland minimum value (300 m/l) in the summer and winter.

6. DO: - Concentration of DO indicate water purity and determine the distribution and abundance of various algal groups. Low dissolved oxygen gives bad odour to water due to anaerobic decomposition of organic wasteand fishes are killed in low

DO water. The minimum4.5 mg/l was recorded in the month of May - June and maximum6.8 mg/l in the January - December. This lower DO concentration primarily may results from excessive algae growth caused by phosphorus and also warmer and saltier water of the reservoir in summer. As the algae die and decompose, the process consumes DO.This may cause aquatic life in stress in summer and indicate higher microbial load and pollution of the water

7. BOD:-BOD test is of great value in the analysis of sewage, highly polluted water and industrial influents. It is a very important indicator of the pollution status of a water body. In present study, BOD values ranges from 5.2 to 8.7 mg/l clearly showed higher concentration during most of the summer and rainy months andcomparatively low during winter. Higher BOD values indicates greater amount of organic matter or food available for oxygen consuming bacteria in the summer and rainy season water of reservoir.

8. COD: - COD is a measure of pollution in aquatic ecosystems. Variation of COD is varied from 9.6 to 12.9 mg/l. The maximum values of COD indicate the higher degree of pollution. In the present study higher concentration of COD in summer and rainy months may be due to high temperature,high sun radiation and lowering water leveland higher concentration of suspended solids indicating the presence of high non-biodegradable organic and inorganic matter.

9. Water Hardness: - Hardness of water is the property which prevents the lather formation with soap. Water having hardness 300-600 mg/l and above is considered as very hard water which is difficult to drink. The total hardness of reservoir was found in the range 290-350 mg/l which indicate that the water is not so safe for drinking, cooking and industrial purposes but useful for agricultural purposes. The total hardness of reservoir was higher during summer months which may be due to increased concentration of salts by excessive evaporation. Since the study area is free from industrial pollution, the hardness was observed because of deposition of calcium and magnesium salts coming from the nearby area.

10. Total Alkalinity-Alkalinity plays an important role in controlling enzyme activities. Its concentration is affected directly by rainfall. In the present investigation alkalinity ranges from 261 mg/l to 299 mg/l whose level reduced in the post-rainy months and higher during summer and rainy months.

11. Chloride: - Chloride is one of the important indicators of pollution and present in sewage, effluents and farm drainage. Man and animals excrete high quantities of chlorides therefore it indicates sewage contamination. High chloride has poisonous effect on animals, plants, fish and aquatic communities. In the present study, it ranges from 250 to 460 mg/l.

12. Nitrates, Sulphates, Phosphates and Fluorides:

The nitrates in the reservoir water were very high 26.2 - 45.8 mg/l.This may be due to leaching of nitro phosphate fertilizer and surface runoff from nearby lands into the water.Sulphates occur naturally in water as a result of leaching from gypsum and other common minerals.Sulphates concentrations in water were ranges from 144 - 189 mg/l. The highest concentration of sulphates was observed during summer-rainy season from May to August. Sulphur is utilized by all living organisms in the form of both mineral and organic sulphates. The phosphate content of reservoir water was found in the range of 0.97-1.78 mg/l.The phosphate in reservoir was observed probably due to the presence and decomposition of aquatic vegetation which releases phosphate. Also phosphates may occur in reservoir as a result of domestic, detergents and agricultural effluents with fertilizers. The concentration of phosphate was more in summer and rainy months during which the blooms of algae were observed. As it is very essential plant nutrient, its low concentration affects the growth of aquatic flora. In present study fluoride concentration was ranges from 0.52-0.81 mg/l which is within the maximum permissible limits.

IV. CONCLUSION

It is found that all parameters of permissible limits of drinking water are not set for all by different agencies and do not show uniformity (i.e.APHA, WHO, ICMR and ISI). pH of water is above seven this means that aquatic environment is suitable for fishery. Turbidity values were maximum in summer and rainy months. The values of conductivity, hardness, calcium, magnesium, biological oxygen demand and chemical oxygen demand were higher during summer and monsoon months. Hardness of water is more indicates more dissolved salts are presents in the water which is useful for agricultural crops but such water is not fit for industrial purposes directly. Comparing present values with the maximum acceptable level prescribed by WHO/BIS for human consumption, it can be concluded that the water of Ekburji reservoir is moderately polluted and cannot be used for drinking, domestic and industrial purposes without purification. Before supplying to urban population this must be treated by water department to maintain water quality as required for drinking purposes. However, it is necessary to analyze the biological parameters like total viable bacteria, Coliform, E. coli, etc. to assess the suitability of water for drinking purpose. A regular monitoring of water bodies with required number of parameters with reference to the quality of water is necessary to prevent the deterioration of water quality as well as environmental hazards.

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