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Determination of Physico-Chemical Parameters of Deoli Bhorus Dam water

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ABSTRACT

In the present study, water samples were collected from two different locations of Deoli Bhorus Dam of Chalisgaon Tahsil Dist. Jalgaon in Maharashtra State, India for physico-chemical analysis. The laboratory test of the collected water samples were performed for analysis of various parameters such as pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Acidity, Total Hardness (TH), Chloride and Phosphorus. The methods employed for the analysis as per standard methods recommended by APHA, WHO, ICMR. The obtained values are compared with the standard limits. The results of this study reveal that the physico-chemical parameters are within the maximum permissible limit of WHO with some slight variations in some parameters. Hence, water is safe and suitable for domestic, irrigation and drinking purposes.

Key words: physico-chemical parameters, Deoli Bhorus dam, water.

INTRODUCTION

Water is life. The quality of water is vital concern for mankind because it directly linked with human health. Now a day, the menace of water born diseases and epidemics still looms large on the horizons of developed and developing countries. The polluted water is the culprit in all such cases. Water sources were polluted by domestic wastage in rural areas whereas industrial wastages discharged into natural water sources in urban areas [1-3]. We need water every day for various domestic, irrigation and drinking purposes. Economy of our country is agro based economy. Most of the people who live in villages get their jobs in agriculture field due to irrigation facilities in that sector. When there is no revolution in industry and agriculture, water quality was near about good. But due to industrial and agriculture revolution water which is collected in the various water resources highly polluted in various ways [4-6]. So it was not suitable and safe for domestic, irrigation as well as drinking purposes.

Water is basis of all kind of life. Due to wrong consideration, the percolated ground water considered to be suitable, safe for the drinking and irrigation purpose owing to natural geological filtration process. Few studies have found that the ground water to be contaminated. One of the major reasons of ground water pollution in India is unplanned urban development without adequate attention to sewage and waste disposals [7-12]. Water is polluted due to various phenomenon. The rapid growing population and improved living standards, the pressure on the present water resources is increasing day by day [13, 14].

Industrialization without provision of proper treatment of wastages and effluents as well as excessive applications of fertilizers and pesticides for agriculture purposes are two main reasons of water pollution. To meet the increasing demands, it is imperative to recognize the fresh water resources and find out remedial methods for improvement of water quality. Water is the universal solvent [15]. It dissolves the minerals from the rock in which it is stored. Therefore, the physical and chemical parameters of the particular area will be changed. The quality of water varies with depth of water. Seasonal changes are governed by the extent and composition of dissolved salts depending upon subsurface environment. Bacterial contamination and total dissolved solids are two main criterions for judging the quality of water for drinking purpose. The main objectives of the physico-chemical study are to know the

distribution of solutes in the dam water and suitability of the ground water for domestic, agriculture and drinking purposes.

The purpose of present study is to find out any impurities exertive on receiving water of Deoli Bhorus dam. This dam water is used for domestic purpose, aquatic animals as well as agriculture purpose. This dam is one of the minor irrigation project located on Girna sub canal in Chalisgaon Tahsil of Dist. Jalgaon of Maharashtra State, India. This dam encompassage gross common area 270 hectors, C.C.A. common area 240 hectors and actual irrigated area 214 hectors. Deoli, Bhorus, Kargaon, Bhilakhed, Dhon, Digar etc are the villages having over 10,000 population and domestic animals are benefited by this dam for domestic , irrigation and drinking water purposes.

MATERIALS AND METHODS

Study Area

Deoli Bhorus dam is one of the minor irrigation project located on Girna sub canal of Chalisgaon Tahsil Dist. Jalgaon in Maharashtra State, India. It is situated at 20^0 27' 35sec north latitude and 75° 01' 20sec east longitude at the height of sea level 345.72 meter. It falls under C.O.F. (control of flow) type. The storage capacity of this dam is bottom still level 100.05m, full supply level 102.22m, gross storage 2.094mcm (Metric Cubic Meter), live storage 0.0810mcm and dead storage 0.200mcm. This dam encompassage gross common area 270 hectors, C.C.A. common area 240 hectors and actual irrigated area 214 hectors. The Fig. 1 shows the location of the present study area.

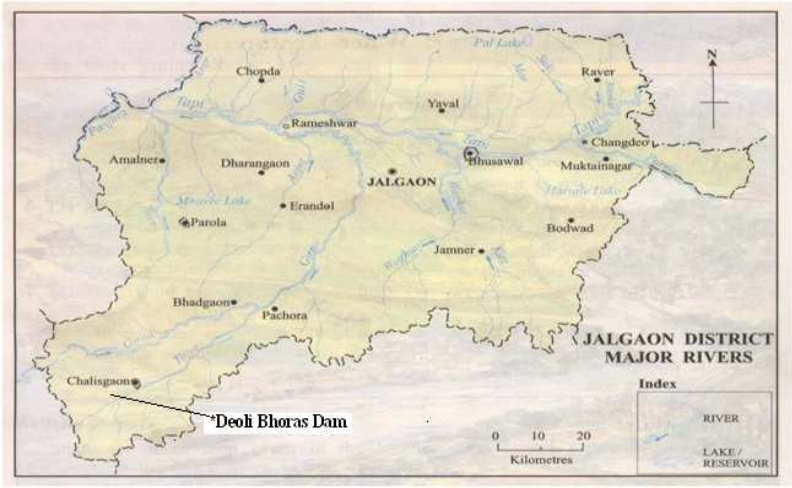

Fig.1 shows the location of the present study area.

Preparation of water samples

The water samples were collected in polythene bottles of capacity 1 to 2 liter in the month of Dec 2006 to Nov 2007 at 15 days intervals between 9.00 a.m. to 7.00 p.m. The samples from reservoir sites will be collected from outgoing canal water, intake structure in case water is pumped. When there is no discharge in canal, sample will be collected from the upstream side of the regular structure. These samples were collected from approximately 15-20 cm below the water surface. Care must be taken not to catch any floating material or bed material into the container. The standard procedures were adopted for the determination of physico-chemical parameters.

Table 1 Methods employed for determination of physico-chemical parameters

Sr. No.	Parameters	Methods employed
01	pH	pH metry
02	Temperature	Thermometry
03	Total dissolved solids (TDS)	Conductometry
04	Dissolved Oxygen (DO)	Wrinklers method
05	Alkalinity	Titration
06	Acidity	Titration
07	Hardness as Calcium	EDTA titration
08	Chloride	Titration
09	Phosphorus	Calorimeter

Determination of water quality parameters

The analysis of various physico-chemical parameters namely pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Acidity, Total Hardness (TH), Chloride and Phosphorus were carried out as per the method described in APHA (1992). The instruments used were in the limit of precised accuracy. The chemicals used were of AR grade. Utmost care was taken during sampling to avoid any kind of contamination. Temperature and pH were measured at the time of sampling itself. The methods employed for determination of physico-chemical parameters are given in the Table 1.

The standard limits of water quality parameters in drinking water prescribed by ISI, ICMR, BIS and WHO is shown in the Table 2.

Table 2 Drinking water parameters prescribed by ISI, ICMR, BIS and WHO

Water Parameters	ISI		ICMR		BIS		WHO	
	MPL	HDL	MPL	HDL	MPL	HDL	MPL	HDL
pH	-	6.5-8.5	6.5-9.2	7.-0-8.5	8.5-9.0	7.0-8.3	6.5-9.5	7.0-8.5
Temp.(^{o}C)	-	-	-	-	-	-	-	-
TDS (mg/L)	2000	500	1500	500	2000	500	-	-
DO (mg/L)	-	-	3.6	7.6	-	-	-	-
Alkalinity(mg/L)	200	600	-	-	600	200	120	-
TH (mg/L)	600	300	600	300	600	200	600	200
Chloride (mg/L)	250	-	250	-	250	-	250	-

MPL (Maximum Permissible Limit), HDL (Highest Desirable Level), ISI (Indian Standard Institute), ICMR (Indian Council of Medical Research), BIS (Bureau of Indian Standard), WHO (World Health Organization)

RESULTS AND DISCUSSION

The monthly values of physico-chemical parameters pH, phosphorus, chloride, acidity and dissolved oxygen of Deoli Bhorus dam water at the location A of the present study area were shown in Fig. 2 whereas temperature (^{o}C), total dissolved solids, alkalinity and total hardness shown in Fig. 3.

1. pH of the collected water sample

It was observed that pH of the water normally remains higher in summer and in rainy seasons. It depends on photosynthetic activity. It was relatively more in winter. It was almost same during summer and monsoon. The variation occurs in the pH values due to change in the values of CO_2, carbonate and bicarbonate in the water [16-19]. The lower values of pH may cause tuberculation and corrosion while the higher values may produce incrustation, sediment, deposition and difficulties in chlorination for disinfections of water [20]. In the present study the pH values in all the collected water samples ranges from 7.0 to 8.1 which are all within the limit.

2. Temperature (^{0}C)

There is a closed relation between the atmospheric temperature and water temperature. Air temperature is one of the most important ecological factors which control the physiological behavior of the aquatic system and distribution of the microorganisms [21, 22]. The temperature of the collected water samples varies in between 19 ^{0}C to 28 ^{0}C.

3. Total Dissolved Solids (TDS)

It was reported that alkaline ponds were richer in solids than acidic ones. The quantity of TDS was proportional to the degree of pollution [23, 24]. The TDS were recorded more during rainy season. This is because of the addition of solids from ran off water. The value of TDS in the collected water samples varies from 233 mg/L to 490 mg/L.

4. Dissolved Oxygen (DO)

DO is one of the most important parameter in assessing water quality and understanding the physical and biological process prevailing in the water. The importance of DO was reported by many researchers because DO in aquatic ecosystem brings out various biochemical changes and it influence on metabolic activities on organisms [25-27]. A good quality water should have the solubility of oxygen 7.0 mg/L at 30 ^{0}C. DO was maximum in winter while minimum in summer season. The DO of the collected water samples is about 9.24 mg/L to 9.34 mg/L. It is quite close to the prescribed values.

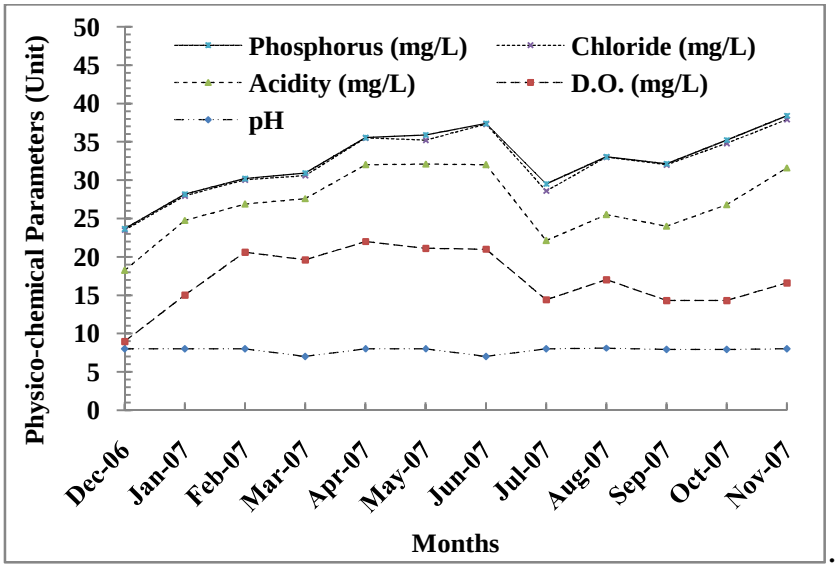

Fig. 2 shows monthly values of physico-chemical parameters pH, Phosphorus, Chloride, Acidity and Dissolved oxygen of Deoli Bhorus dam water at the location A of the present study area.

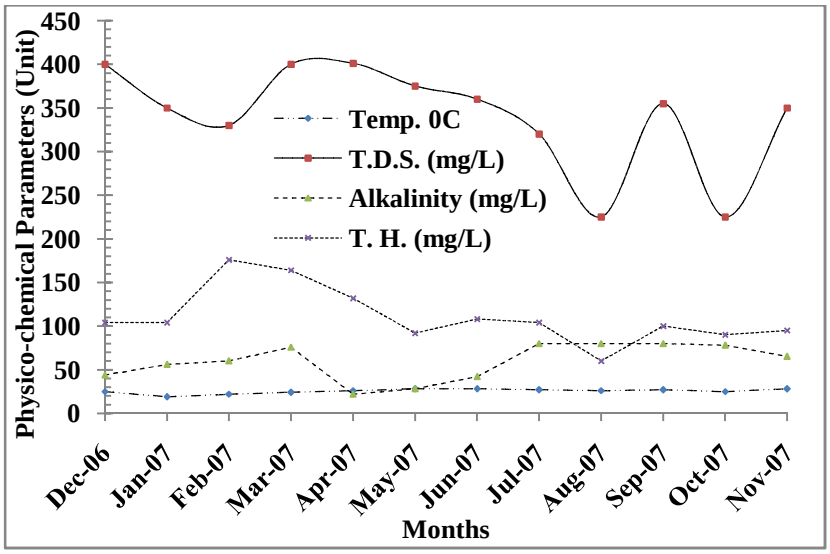

Fig. 3 shows monthly values of physico-chemical parameters Temperature (^{o}C), Total Dissolved Solids, Alkalinity and Total Hardness of Deoli Bhorus dam water at the location A of the present study area.

5. Alkalinity

Alkalinity of water is measure of its capacity to neutralize acids. This is due to the primarily salts of weak acids or strong bases. Bicarbonates represent the measure form of alkalinity. Bicarbonates are formed in considerable amount from the action of carbon dioxide upon basic materials in soil and other salts of weak acids [28, 29]. Alkalinity in the dam water caused by bicarbonate as carbonates values in all the collected samples ranges from 59.25 mg/L to 75.25 mg/L.

6. Acidity

The acidity in all the collected water samples of Deoli Bhorus dam was found in the range of 9.78 mg/L to 9.89 mg/L.

7. Total Hardness (Calcium and Magnesium (Mg^{2+}))

The total hardness in all the collected water samples of Deoli Bhorus dam was found in the range of 110.75 mg/L to 120.91 mg/L.

8. Chloride

High chloride ion concentration indicates organic pollution in the water. The chloride concentration on fresh natural water is quite low generally less than that of sulphate and bicarbonates. Chloride is a natural substance present in all portable water as well as sewage effluents as metallic salt. Many researchers reported that rainfall add chloride directly. It is low in summer as compared to rainy season and occupying the intermediate position in winter [30, 31]. The chloride concentrations in most of the samples were higher than highest desirable level 200 mg/L by ICMR. Yet these values are well below the maximum permissible limits 500 mg/L.

9. Phosphorus

The amount of phosphorus in all the collected water samples of Deoli Bhorus dam was found in the range of 0.200 mg/L to 0.308 mg/L.

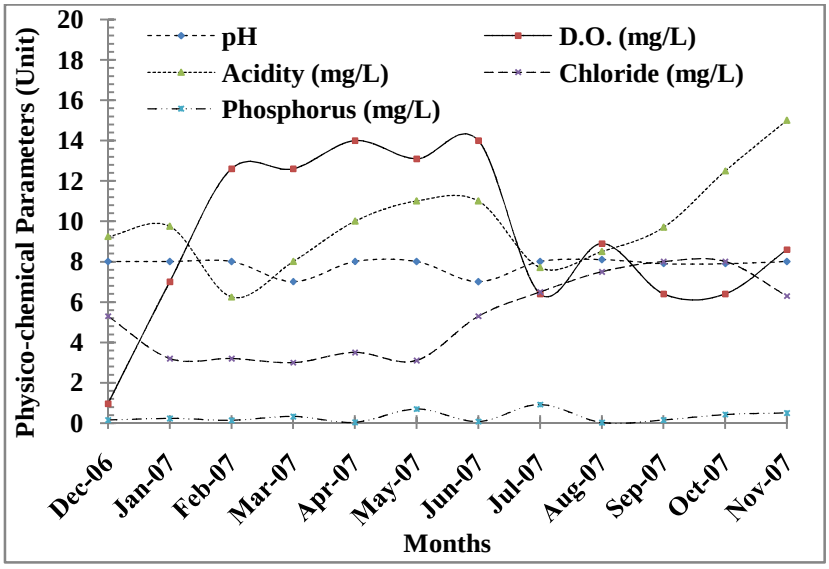

Fig. 4 shows monthly values of physico-chemical parameters pH, Phosphorus, Chloride, Acidity and Dissolved oxygen of Deoli Bhorus dam water at the location B of the present study area.

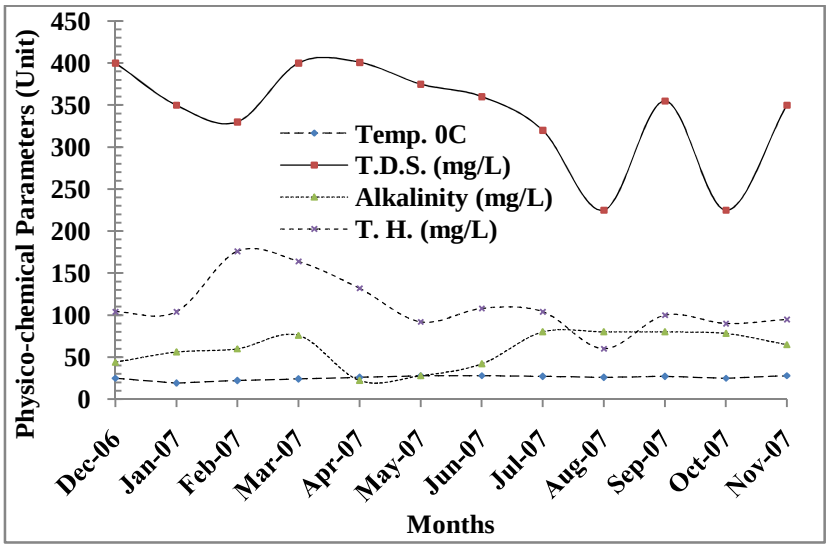

Fig. 5 shows monthly values of physico-chemical parameters Temperature (^{o}C), Total Dissolved Solids, Alkalinity and Total Hardness of Deoli Bhorus dam water at the location B of the present study area.

The monthly values of physico-chemical parameters pH, phosphorus, chloride, acidity and dissolved oxygen of Deoli Bhorus dam water at the location B of the present study area were shown in Fig. 4 whereas temperature (^{o}C), total dissolved solids, alkalinity and total hardness shown in Fig. 5.

The results and values of physico-chemical parameters of Deoli Bhorus dam water of Chalisgaon Tahsil of Dist. Jalgaon in Maharashtra state of India are given in Table 3.

Table 3 Reported values of different parameters of Deoli Bhorus dam water samples.

Sr. No.	Parameters	Dam water (Average)		WHO	ISI
		Site A Sample	Site B Sample		
01	pH	7.8	7.8	7.0 - 8.5	6.5-8.5
02	Temperature (^{0}C)	25.33	25.41	-	-
03	TDS (mg/L)	329	341	-	500
04	DO (mg/L)	9.34	9.24	-	-
05	Alkalinity (mg/L)	75.25	59.25	120	200
06	TH (mg/L)	120.91	110.75	200	300
07	Chloride (mg/L)	5.35	5.24	-	-
08	Acidity (mg/L)	9.78	9.89	-	-
09	phosphorus (mg/L)	0.200	0.308	-	-

CONCLUSION

The analysis of the water quality parameters of Deoli Bhorus dam shows that pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Acidity, Total Hardness, Chloride and Phosphorus values are well within the permissible limits. The TDS of the sample A, B was well below the desirable limit. The result of study reveals that, quality of dam water is though fit for domestic and drinking purposes need treatments to minimize the contaminations especially the alkalinity. Hence, it is suggested that this dam water is not much suitable for drinking purpose. There is an increasing awareness among the local people of that area to maintain the dam water at their highest quality and purity levels. Efforts of this study may prove to be useful in achieving the same.

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