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Studies on Physicochemical Parameters to Assess the Water Quality of Lower Dudhana Dam for Drinking Purpose in Parbhani District

Gangadhar B. Gundlewad¹

¹P. G. Department of Chemistry, Shri Shivaji Mahavidyalaya, Parbhani.

Abstract: The paper describes the studies of physicochemical parameters of the water samples from Lower Dudhana Dam in parbhani district of Maharashtra State during the monsoon, winter & Summer season. Some important parameters like temperature, pH, total hardness, Calcium hardness, magnesium hardness, Dissolved oxygen, total alkalinity, chloride, total dissolved solids, fluorides & electrical conductivity were analyzed for water samples. The analytical results reveal that some treatment is required to use the water for domestic purpose.

Keywords: Physicochemical parameter, Dudhana Dam, surface water, ground water.

I. INTRODUCTION

Now-a-days the world is facing severe ecological crises of pollution of environment as well as water. Water pollution is a phenomenon that is characterized by the deterioration of the quality of water as result of various natural and human activities¹. Fresh water is the most important material for life on earth without which life on earth cannot exist. Surface water and ground water is used for irrigation, industries and domestic purposes. The water from lakes, rivers, ponds, reservoirs, and streams is called surface water. Because of various pollutants water gets unfit for drinking. The chief source of water pollution is increasing use of fertilizers and pesticides for farming. The excess of these wash away with rain water and goes to river, lake, reservoir, etc. and causes health problem to the animals². Hence it is important to check the quality of water from reservoirs before it is utilized for drinking and other domestic purpose.

Lower Dudhana Dam is a water reservoir located on Dudhana River in Selu taluka of Parbhani District of Maharashtra State. It is situated between 18.45 to 19.10 North Latitude, 76.13 to 77.00 East Latitude and 357 m above sea level. The water from this dam is mainly used for the drinking and irrigation purpose in Parbhani and Jalna district of Maharashtra. Its storage capacity is 353 Mmc & irrigation potential is about 44.482 thousand hectore.

II. MATERIAL AND METHODS

Water samples were collected during monsoon (June to September), winter (Oct. to Jan) & summer (Feb. to May) season in the year 2015-2016. The samples were collected in a 3 liter capacity sterilized bottles using standard procedure^{3,4}. The instruments were used in the limits of precise accuracy and chemicals used were of analytical grade. The water samples were collected from different corner and center of the dam. Care has been taken to avoid accidental contamination of samples. Parameters like DO, Residual chlorine, temperature and H₂S paper test has been done immediately. The analysis of various physicochemical parameters was carried out as per methods described by S. K. Mantri. The parameters and methods selected for the said examination are given in table no. 1

III. RESULT AND DISCUSSION

The physical and chemical parameters of water found in various seasons have been shown in table no. 2

A. Color

Pure water is colorless. However, color may be contributed by the end product of organic matter and algal metabolism. Divalent species of iron (Fe²⁺) and manganese (Mn²⁺) also contribute color to the ground as well as surface water. The water studied is colorless in all seasons.

B. Odour

When water comes into contact with many substances in nature of human use, it may change its odor and taste. These substances may be minerals, metals salts from soil, etc. Some substances produced by algae may change the taste and odor of water. Water

samples of the study area were found to be odorless. Temperature: It was found that the temperature of water samples was in the range of 25°C to 36°C. It is necessary to measure the temperature because under certain condition due to mixing of effluent from deferent units with deferent temperatures the thermal reaction may occur. Also the solubility of the most of substances largely depends on temperatures. Thus it is very essential to measure the temperature.

TABLE I

PARAMETERS, METHODS, STANDARD VALUES AND UNIT EMPLOYED IN PHYSIC-CHEMICAL EXAMINATIONS OF SAMPLES.

Sr.No.	Parameters of Water Analysis	Methods	Standard Values as guided by ICMR		Unit
			Desirable Concentration	Max. Permissible	
01	Color	By Sight	--	--	--
02	Odour	Smelling	--	--	--
03	Temperature	Thermometric	--	--	°C
04	pH	pH meter	7-8.5	6.5-9.2	
05	Dissolved Oxygen (DO)	Azide modification	7		Mg/L
06	Total Alkalinity	Titrimetric	200	600	Mg/L
07	Total Hardness	Titrimetric	300	600	Mg/L
08	Calcium Hardness	Titrimetric	75	200	Mg/L
09	Magnesium Hardness	Titrimetric	50	150	Mg/L
10	Carbonate Hardness	Titrimetric	300	600	Mg/L
11	Non-Carbonate Hardness	Titrimetric	300	600	Mg/L
12	Chlorides	Argentometric	200	1000	Mg/L
13	Sulphate	Turbidity meter	200	400	Mg/L
14	Nitrate	Ion Metric	20	50	Mg/L
15	Total Dissolves Solids	Conductivity meter	500	1500	Mg/L
16	Fluoride	Ion Selective Electrode	1.0	1.5	Mg/L
17	Electrical Conductivity	Conductivity meter	--	--	Mmhos

C. pH

The pH value is the logarithm , to the base 10 of the reciprocal of hydrogen ion concentration in grams per liter; i. e. $pH = -\log_{10} [H^+]$. The hydrogen ion concentration is an important quality parameter of natural waters and waste waters as it instantaneously indicates the acidic or alkaline condition of water. The pH of water studied varies between 7.7 to 8.1 showing slight alkalinity.

D. Dissolved Oxygen (DO)

One of the most important water quality parameter is the amount of dissolved oxygen present. Oxygen is considered as poorly soluble in water. Its solubility is related to temperature and pressure. DO is about 7mg/L in at 35oC in fresh water. As the temperature increases the concentration of dissolved oxygen in water decreases because of increased biological oxidation. DO in water studied is found to be 6.8 to 7.9mg/L.

E. Total Alkalinity

The desirable limit of total alkalinity is 200mg/L. In natural water, most of alkalinity is caused due to CO₂. Alkalinity in itself is not harmful to human being still the water supplies with less than 100mg/L is desirable for domestic use. The test samples show total alkalinity in the range of 335 to 480 mg/L.

F. Total hardness

Hardness is defined as concentration of multivalent metallic cations in solution. Hard water is generally considered to be those waters that can require considerable amount of soap to produce foam. During investigation the hardness varies between 450mg/L to 600mg/L so the water is fit for drinking in all seasons.

G. Calcium hardness

Calcium is common constituent of natural water and imparts an important contribution to the hardness of water. It reduces the utility of water for domestic use. The maximum permissible limit of calcium hardness is 200mg/L. In the present investigation the calcium hardness varies between 140 to 210mg/L.

H. Magnesium hardness

Magnesium is also a common part of water and the main source of magnesium is the rocks. The maximum allowed value of magnesium according to ICMR is 150mg/L. In the present study, the Mg ranges from 90 to 155mg/L.

I. Chloride

Chloride is the common ion found in the industrial effluents. In natural fresh water, high concentration of chloride is result of pollution. Pollution is due to organic wastes of animals and industrial effluents. Chlorine concentration above 250mg/L makes the water salty in taste. In present study the amount of chlorine is found in between 250 to 310mg/L.

J. Total dissolved solids (TDS)

Total dissolved solids is another important parameter for the quality of drinking water. The maximum permissible limit of TDS is 1500mg/L. Beyond this limit water gives a peculiar taste and reduces its potability. Higher concentration of TDS causes gastrointestinal irritation. The water tested in this study give TDS between 800 to 1200mg/L.

K. Fluoride

Fluoride is released to the ground water through weathering of primary silicates and associated accessory minerals. It is also partly redeposit in soil profile. The guideline value of fluoride is 1.5mg/L. In this investigation the fluoride is found in between 0.8 to 1.1 mg/L.

L. Electrical conductivity

Conductivity is a measure of current carrying capacity, thus gives a clear idea of soluble salts present in water. The total concentration of soluble salt in irrigation water can be expressed in terms of electrical conductivity. As pollution level increases, there is increase in the conductivity. The samples give conductivity from 4.0×10^{-3} to 6.0×10^{-3}

TABLE III
THE PHYSIC-CHEMICAL CHARACTERISTICS OF THE SAMPLES.

Sr. No.	Parameter	Monsoon	Winter	Sumer
01	Color	Colourless	Colourless	Colourless
02	Odor	Odourless	Odourless	Odourless
03	Temperature	30°C	25°C	36°C
04	pH	7.9	7.7	8.1
05	Dissolved Oxygen (DO)	7.9 mg/L	7.1 mg/L	6.8 mg/L
06	Total Hardness	490 mg/L	450 mg/L	656 mg/L
07	Calcium Hardness	140 mg/L	182 mg/L	210 mg/L
08	Magnesium Hardness	90 mg/L	105 mg/L	155 mg/L
09	Total alkalinity	390 mg/L	335 mg/L	480 mg/L
10	Chlorine	300 mg/L	250 mg/L	310 mg/L
11	Total dissolved Solids (TDS)	800 mg/L	900 mg/L	1200 mg/L
12	Fluoride	1.1 mg/L	0.92 mg/L	0.8 mg/L
13	Electrical Conductivity	6.0×10^{-3}	4.0×10^{-3}	3.50×10^{-3}

IV.CONCLUSION

In the present investigation we have studies various parameter for the quality of water. Obtained results were compared with the standard values & permissible values for use of water for domestic & drinking purpose. It was found that the TDS of water during summer is quite high. It requires some treatment to decrease the TDS. The total hardness is also seems to be high. However we lead

to the conclusion that the water is suitable for domestic & irrigation purpose. The water quality should be improved in terms of TDS & Hardness to use it for drinking purpose.

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