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Study of physico-chemical parameters of Dham river in consequence with aquatic life

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ABSTRACT

A study of Dham river water of district Wardha (M.S.) has been carried out to examine its suitability for aquatic life as well as domestic purposes. The samples from three stations viz., Pavnar Ashram (S_1) , Ghorad (S_2) & Morchapur (S_3) were collected. The data was analysed with reference to ISI & WHO standards. It is found that the water is safe for domestic purposes & aquatic life from the point of view of levels of pH, density, surface tension, viscosity, conductance, TDS, alkalinity, DO & chloride concentration. However, the water quality parameters such as total hardness & Ca^{++} hardness at some stations were beyond the permissible limit. So it is suggested to remove total hardness & Ca^{++} hardness to make it fit for consumption.

Key words: Dham river, Aquatic life, Physico-chemical parameters.

INTRODUCTION

Rivers are lifeline of living beings and constitute an integral part of both rural and urban community as a source of drinking water and fish culture.There are 14 major rivers in India that share 83% of the total drainage basin and contribute 85% of the total surface flow.Water used by the consumers must be free from disease causing bacteria, toxic substance and excessive amount of minerals & organic matter.[1]

The district Wardha is situated 76 Km away from Nagpur (M.S.) in the west. Wardha is surrounded by small towns and villages. The main income source of the people is agriculture.The crops yielded in this region are cotton , jowar , soyabean, sugarcane, bananas, pulses and some common vegetables.The prominent water source for domestic, agriculture & industrial purpose in this area is Dham river which also stands as a potential destination for fishing activities.

Fresh water becomes polluted due to three major reasons, excess nutrients from sewage, waste from industries, waste from mining and agriculture. According to recent reports, ground water contamination is increasing due to anthropogenic activities like disposal of waste, sewage, industrial waste.[3]

Due to rapid industrialization, urbanization, overexploitation of ground water & improper wastes water techniques, contamination of ground water in urban areas results.[4]

About 71% of the earth surface is occupied by water.[5] Out of this; about 97% is saline in nature while 2.94% water is trapped in the giant glaciers and polar ice caps. The water running off the landpicks are more soluble species in areas where weathering is still in its earlier stages.[6] Portability study of water samples in rural areas is the necessity to facilitate their better livelihood. This indicates that merely 1% quantity of water is available for drinking, agriculture, domestic and industrial consumption.

EXPERIMENTAL

The water of Dham river is utilized for various purposes like domestic , farming , industrial purposes etc.The effluents from industries & sewage water from villages polluted the river.Hence in order to know the impacts of pollution due to industrial effluents and waste water it was thought of interest to investigate the physico-chemical parameters of this river.

Stations

Water samples from three stations of the river Dham were collected at Pavnar Ashram (Station 1) , Ghorad (Station 2) and Morchapur (Station 3) of Wardha district in the month of Dec. 2008.All samples were collected between 11.00 am to 12.00 pm. Water samples were collected 2 m away from the bank & 0.3 m below surface was taken as the standard depth for sampling to avoid surface micro layer. The samples were collected in plastic and glass bottles and preserved at 4°C till the analytical work was carried out.

All the chemicals used in the study were of A.R. grades. Double distilled water was used throughout the study. Standard methods for the examination of water and wastewater published by APHA[7] and Bureau of Indian Standards[8] were adopted as a reference manual for analytical procedure.

RESULTS AND DISCUSSION

The Physico-chemical parameters such as colour, turbidity, temperature, density, surface tension, pH, conductance, TDS, hardness, alkalinity, DO, viscosity, chloride concentration were analysed for the selected three stations of Dham river for the month of December. Analytical results are tabulated in Table 1.

Table 1: Physico-chemical parameters of water from Dham River

S. No.	Parameter	Unit	S_1	S_2	S_3
1	Colour	-	colourless	colourless	colourless
2	Temperature	°C	25	26	27
3	pH	-	6.63	7.29	8.25
4	Turbidity	-	Not turbid visibly	Not turbid visibly	Not turbid visibly
5	Density	gm/cm^3	0.9968	0.9926	0.9962
6	Viscosity	mpoise	7.556	8.464	8.568
7	Surface Tension	dyne/cm	73.4159	68.97	72.82
8	Conductance	mM	0.467	0.40	0.999
9	Suspended Solids	ppm	280	223	161
10	Dissolved Solids	ppm	88	128.77	103.829
11	T.D.S.	ppm	368	351.77	264.829
12	Temporary Hardness	mg of $CaCO_3$/lit	112.6	169.6	126
13	Permanent Hardness	mg of $CaCO_3$/lit	156.2	154.92	140.2
14	Total Hardness	mg of $CaCO_3$/lit	268.8	324.52	266.2
15	Ca^{++} Hardness	mg of $CaCO_3$/lit	156.8	148	79.2
16	Mg^{++} Hardness	mg of $CaCO_3$/lit	112	296.8	187.2
17	Alkalinity of water				
(I)	Total Alkalinity	mg /lit	84	76	36
(II)	Phenolphthalein Alkalinity	mg /lit	0	0	0
(III)	Methyl orange Alkalinity	mg /lit	84	76	36
18	D.O.	ppm	1	16	2.885
19	Chloride	mg /lit	163.779	172.1	137.52

Temperature

The fluctuation in temperature of different stations may be due to the influence of environmental temperature due that point of time.**pH**: The pH is one of the most important factors that influence the aquatic production. In the present study the pH was found to be acidic at Station 1 & alkaline at Stations 2 & 3. The range of pH was 6.63-8.25. Swingle stated that water having pH range 6.5-9.00 is most suitable for fish culture. The higher alkaline state of pH at Station 3 might be due to enhanced chemical interaction that led to buffering & release of alkaline ions (bicarbonate & carbonate ions) or salts in the river water.

Density, Surface Tension & Viscosity

Density & Surface tension were found to be lowest at Station 2 & highest at Station 3. The viscosity is found nearly the same at Station 2 & 3 while it is comparatively least at Station 1.

Electrical Conductivity

Electrical conductivity is useful tool to evaluate the purity of water which is minimum at Station 2 & maximum at Station 3.

TDS

TDS are those which get dissolved in water and cannot be separated from water by filtration. They may be chemically organic or inorganic.

According to Trivedi & Goel , TDS are composed mainly of carbonates , bicarbonates , chlorides , sulphates , calcium , magnesium , phosphate , nitrate , sodium , potassium & iron. In the present investigation, the highest value of TDS was recorded at Station 1. The high value may be due to the evaporative loss of water & consequent increase in the concentration of salts present in water. The ISI standard for dissolved solids is upto 500 mg/lit & the maximum permissible quantity is 1500 mg/lit (WHO, 1984). The results showed that all the samples of water from all stations are within permissible limit of ISI standard.

Total Hardness

The total hardness of water samples ranges from 224.62-268.8 mg/lit. The acceptance limit of total hardness (as $CaCO_3$) is 200 mg/lit which can be extended to 600 mg/lit. (ISI, 1982). Ca^{++} & Mg^{++}hardness are important ions contributing towards total hardness. Hardness has no known adverse effects. Hardness above 200 mg/lit of water is not suitable for domestic use in washing, cleaning & laundary. The acceptable limit of Ca^{++} & Mg^{++} hardness for domestic use are 75 mg/lit & 200 mg/lit respectively (ISI).But according to Ministry of Rural Development , India , in ground water in case of non-availability of alternate water source, Ca^{++} & Mg^{++} hardness upto 200 & 400 mg/lit respectively can be accepted. In studied area, Ca^{++} content ranged from 79.2-156.8 mg/lit. It means all three stations have Ca^{++} content within the acceptable limit. Similarly Mg^{++} content is also within the permissible limit.

Alkalinity

The phenolphthalein alkalinity of all the water samples is 0. But the total alkalinity is found between 36 to 84 mg/lit.

According to ISI, the acceptable limit of total alkalinity of drinking water sample is 500 mg/lit & maximum desirable limit is 1500 mg/lit. The alkalinity may be due to the contamination and leaching process through surface water during rainy season.[9]

DO

In the present investigation, DO was found to be in the range of 1-16 mg/lit. This reveals that the DO at Station 2 is beyond the acceptable limit.

Chloride

Chloride value range from 137.52 to 172.1 mg/lit. The acceptable desirable limit[10] is 200 mg/lit. Results showed that all samples fall within acceptable limit. It produces a salty taste[11] at 250 mg/lit to 500 mg/lit.

CONCLUSION

In conclusion it can be stated that the different studied Physico-chemical parameters such as pH , density , viscosity , S.T. , conductance , TDS, alkalinity , DO , chloride concentration are within the permissible limit. However the water quality parameters like total hardness & Ca^{++} hardness were beyond the permissible limit at some stations. So it is suggested that the river water

should be treated to remove excess of total hardness and Ca^{++} hardnessta to make fit for consumption. Demonstration-cum-awareness camps for the purpose should be arranged in the rural areas. Total hardness and Ca^{++} hardness can be removed by ion exchange and boiling.

The Government should make firm policies and guidelines for the utilization of ground water. The above analysis of water also revealed that all the three stations under study are fairly suitable, productive and healthy for aquatic ecosystem. The values of parameters are well within the permissible limit (except some parameters) and therefore can support and sustain the dependent aquatic organisms.

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