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Physico chemical analysis of Aquarium water and Narmada River water

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ABSTRACT

Water sample of The Narmada River, from Dongarwada region has been physiochemically evaluated for its suitability for domestic and irrigation purposes. In Physical and Chemical Parameters Such as Temperature, pH, T.D.S., Alkalinity, Total hardness, Dissolve Oxygen, B.O.D., C.O.D. And chloride was analyzed in the laboratory. The Physico Chemical parameters of water were determined as per standard methods of APHA (2005). The results indicate that the Narmada River water quality is suitable and safe for domestic and irrigation purposes. The objective of this paper is to study various water pollutants available in The Narmada River followed by a literature review.

Key words: Physico-chemical analysis, Narmada river, Dongarwada village.

INTRODUCTION

Water is necessary for the survival of all forms of life. Though 80% of earth's surface is covered by water, the fresh water supply has increasingly become a limiting factor because of various reasons. The expansion of industrial and exploding population are the major once. Acute shortfall of heavy rains, poor watershed management, abundant use of water for household and agricultural purposes have led to the overexploitation of the surface water sources especially from the river bodies. Many perpetual rivers become short-lived and even dried up (Thillai *et al.,* 2007).

On the other hand, surface water bodies become the dumping source for industrial effluent and domestic wastes. As a result, the naturally existing dynamic equilibrium among the environmental segments get affected leading to the state of polluted rivers (Geneva 2008 and Mahananda 2010). According to World Health Organization's (WHO) decision, water for the consumers should be free from pathogenic organisms and toxic substances (Thillai *et al.,* 2007). In spite of waste water resources in river and good monsoon, Ethiopia faces perennial problems of floods and droughts and high pollution of fresh water resources (Alemayehu *et al.*, 2004). In region of

Dongarwada, Hoshangabad, it is fed by both monsoons and its tributaries. Apart from the considerations related to the development of water resources there has been an increasing concern in all communities over the impact of water quality on public health and general environmental conditions. The largest area where environmental pollution appears is water resources. Water pollutions not only results in significant economic losses but may also lead to life threatening levels depending on the type and intensity of pollutants. Consequently, the society itself stresses the need for a better understanding of how water quality characteristics evolve in space and time under natural and man-made conditions.

MATERIAL AND METHODS

Physico-chemical parameters:
Collections of water samples were made at from The Narmada River, Dongarwada region and aquarium. All the sample collections and field observations were conducted between 9.00 A.M. to 12.00 Noon throughout the study period. The water samples collected from the river and aquarium in bottles were brought to the laboratory for analysis as per the standard methods described by APHA (1998) and Paka and Rao (1997).

The water samples were collected from five locations selected in the immediate surroundings of the area covered by river water. The samples were collected in from 10 to 11am. One composite sample from each site was collected per month during the study period. Physico-chemical properties such as water temperature, pH, Dissolve Oxygen (DO), Total Hardness, Biological Oxygen Demand (BOD), Total Dissolve Solid (TDS), Chemical Oxygen Demand (COD), Total Alkalinity, Chloride (Cl) of water were determined following standard methods given by Welch (1952), Trivedy and Goel (1984), Wetzel (1983) and APHA (2005).

15 water samples were collected from The Narmada River in different season (2014). Physicochemical analysis of each water samples was done with the help of "Soil plants water analysis a methods manual" by Dhyan Singh *et al*., (2000), "Laboratory Techniques in cell Biology, Plant Physiology and Environmental Science" by Choudhry *et al*., (1992).

Analysis of Temperature:
Check the alcohol column on thermometer to make sure there are no air bubbles trapped in the liquid. If the liquid line is separated, notify. Put the bulb end of the thermometer into the sample water to a depth of 10 cm. Leave the thermometer in the water for three minutes. Read the temperature without removing the bulb of the thermometer from the water. Let the thermometer stay in the water sample for one more minute. Read the temperature again. Record the temperature on the Hydrology Investigation Data Sheet. Calculate the average of the three measurements. All temperatures should be within 1.0˚ C of the average. If they are not, repeat the measurement.

Analysis of pH:
Standardize the pH meter with the three pH buffer solutions after giving warm up time. Then take about 30 ml of water sample and record the pH value. The electrical conductivity is directly proportional to the amount of salts (ions) and is expressed as dsm-1 Standardize the Electrical Conductivity meter with 0.01 N KCl and record the conductivity of water sample in dsm-1(Table 1 and 2). The total soluble salts can be determined as the electrical conductivity of the water sample using a conductivity meter. The electrical conductivity is directly proportional to the amount of salts (ions) and is expressed as dsm-1. Salt concentration (mg L-1) = E.C. (dsm-1) at 250C x 640 (Table 1).

Total Dissolved Solid (TDS):
Collect 1 liter of sample to a clean bottle container, label the container and deliver it to the lab. Shake the contents of the container thoroughly before drawing the sample for testing. Draw a measured volume of sample quickly from the container. Put the bulb end of the thermometer into the sample water to a depth of 10 cm. Leave the thermometer in the water for three minutes., the Aquameter, that is used with the Aquaprobes, automatically calculates the total dissolved solids value and displays it on the screen.

Dissolved oxygen (DO):
Oxygen participates in many important and biological reactions and is essential for living organisms to maintain their metabolic processes. Dissolved oxygen is considered as the best parameter for showing the effect of pollution on water bodies. DO- test is the basis of BOD- test and measuring primary productivity.

Oxygen present in sample water oxidizes the divalent manganese to its higher valency which precipitates as a brown hydrated oxide after addition of strong alkali-

azide solution. Upon acidification, manganese reverts to divalent state liberates iodine equivalent to DO content in the sample. The liberated iodine is titrated against N/40 sodium thiosulfate solution using starch as an indicator.

Sample was collect in a BOD bottle (300 ml). Avoid agitation. To the sample, add 2 ml $MnSO_4$ solution followed by 2 ml of alkali- azide reagent. Use separate slender volumetric pipette while adding these reagents to the sample. Now stopper and mix well by inverting and rotating the bottle several times. Allow the precipitate (brown coloured) to settle leaving a clear supernatant above. Add 2 ml conc. H_2SO_4. Mix well till precipitate dissolution is complete.

After the acidification, titration may be delayed, if necessary, for a few hours without appreciable change. Transfer 200 ml sample to a conical flask and titrate with 0.025 N or N/40 $Na_2S_2O_3$ solutions until a very pale yellow colour (straw) is observed. Add a few drops of starch indicator solution and continue titration to first disappearance of blue colour (colourless end point) (Table 1).

Total hardness (Ca^{+2} + Mg^{+2}):
For total hardness determination 50 ml of sample filled in a conical flask. Add 1 ml buffer solution followed by half tablet of total hardness indicator. Wine red colour will appear. Maintain the pH at 10 + or – 0.1. Add few drops of 4N NaOH. Titrate with 0.01M EDTA solution till the wine red colour changed to blue (end point). Calculate and round off the results to the nearest whole number (Table 1).

Biological oxygen demand (BOD):
The BOD test was measure of O_2 used by micro-organisms in the sample as they decompose the readily degradable organic matter which is present. BOD measurement is an easy and approximate index of organic pollution. The test involves measuring the DO in the sample initially and then after incubation for 5 days at 200 °C, the difference between the two values being the BOD. It has been found in practice that the BOD test is the most accurate when approximately 50 percent of the initial DO has been deleted after the 5 days incubation (Table 1).

Chemical oxygen demand (COD):
20 ml sample was diluted to 20 ml with distilled water. Add 10 ml standard K_2Cr2O_7 followed by 30 ml sulphuric acid which already contains silver sulphate. Mix well. If the colour turns green either take fresh sample with smaller aliquot or add more dichromate and acid. Final concentration of conc. H_2SO_4 should be always 50 percent. Connect the flask to condenser and reflux for 2 hrs. Cool and wash down the condensers with small quantity of distilled water. Remove the flask and add about 80 ml distilled water. Titrate against standard ferrous ammonium sulphate using Ferro in indicator till the colour changes sharply from green-blue to wine red. Reflux a reagent black under identical conditions (Table 1).

Chloride (Cl):
Chloride was determined in a slightly alkaline solution by titration with the standard silver nitrate, using potassium- chromate as indicator. Silver chloride is precipitated quantitatively before red silver chromate is formed. Take 50 ml sample in a conical flask. Adjust the pH of the sample in the range 6-8. Add 1 ml K_2CrO_4 indicator solution. Titrate with standard $AgNO_3$ solution till a permanent pinkish yellow to red colour appears. Repeat the titration with reagent blank (Table 1).

RESULTS

Physicochemical characterization of Aquarium water and Narmada River Water:
The physicochemical characterization using different parameter of aquarium water and Narmada River, Dongarwada region during the study shown in table 1.

The values of each parameter recorded during the study period were represented in table-1 and graph-1. Environmental temperature fluctuates seasonally. Which is an important physical parameter directly related to chemical reactions in aquatic ecosystem (Goel *et al.,* 1986).

The pH of water samples shows variation 6.76 to 6.91, the value of pH shows slitly acedic nature. The surface water temperature ranges from 25.74 ^{0}C to 26.33 ^{0}C in aquarium and Narmada River water. Dissolved oxygen (DO) was maximum (8.10 to 8.47 mg/L) during the study period. It showed an inverse relationship with temperature, which might be due to oxidation of oxygen as reported. Biological Oxygen Demand (BOD) was a measure of the degradable organic matter present in the water. BOD values range from 2.99 to 1.69 mg/L was shown during the study period. Total dissolved solids

Table.1: Physicochemical characterization of aquarium water and Narmada River Water, Dongarwada region, Hoshangabad

Parameters	Aquarium Water	Narmada River
Temperature (°C)	25. 74 ± 2.62	26.33 ± 1.65
pH	6.76 ± 0.43	6.91 ± 0.49
DO (mg/L)	8.10 ± 1.11	8.47 ± 1.18
BOD (mg/L)	2.99 ± 0.99	1.69 ± 0.61
TDS (mg/L)	68.50 ± 7.0	44.50 ± 8.35
COD (mg/L)	3.95 ± 0.62	5.15 ± 0.60
Total Alkalinity (mg/L)	114.50 ± 20.34	139.75 ± 10.31
Chloride (mg/L)	26.33 ± 1.78	28.25 ± 5.44
Calcium (mg/L)	24.30 ±1.0	17.31 ± 1.61
Magnesium (mg/L)	12.78 ± 2.65	10.70 ± 2.20

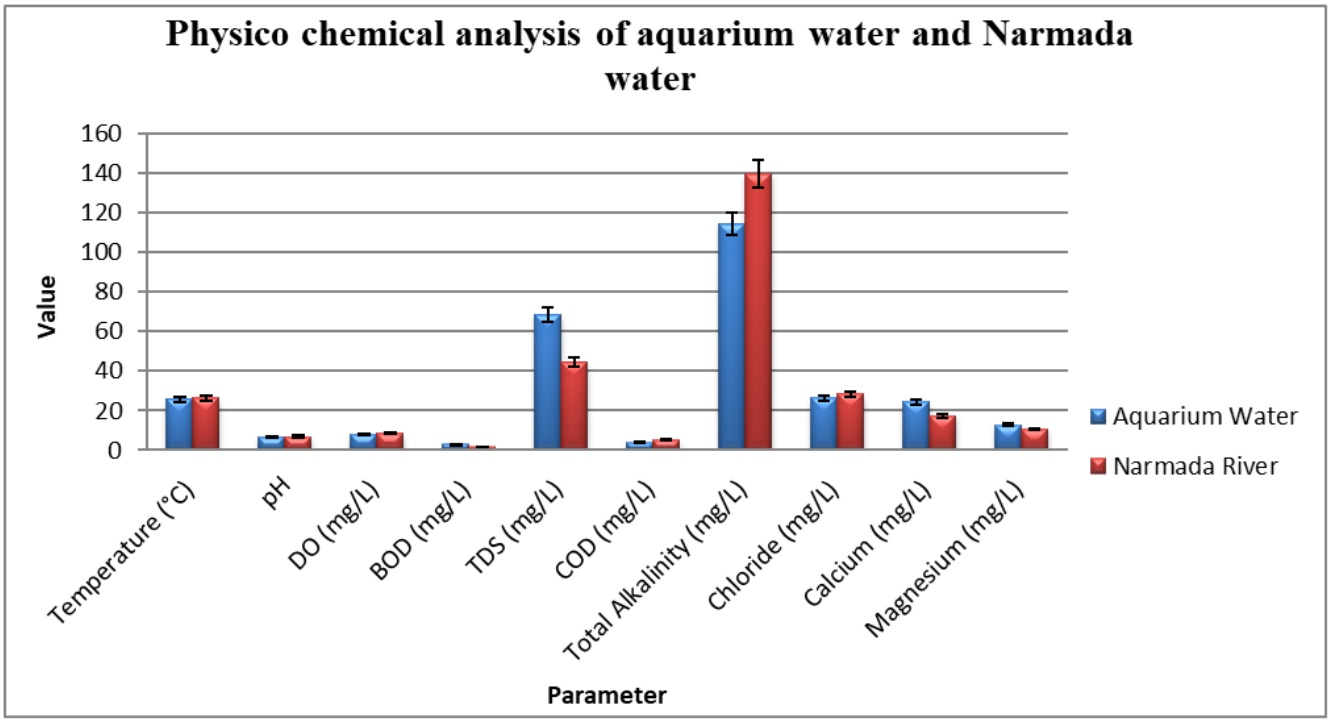

Fig. 1: Graph showing the physicochemical characterization using different parameter of Aquarium water and Narmada River water during the study period in the year 2014.

(TDS) were shown 68.50 to 44.50. Chemical oxygen demand (COD) is one of the essential constituents of an aquatic ecosystem. The abundance of chemical oxygen demand exerts certain specific effects of aquatic biomes. The 3.95 to 5.15 waters exhibited maximum COD as 5.15 mg/L during the study period.

The total alkalinity ranged from 114.50 mg/L to 139.75 mg/L during the study period. Chloride values were found ranging between 26.33 to 28.25 mg/L during the study period. The total calcium ranged from 24.30 mg/L to 17.31 mg/L during the study period. Magnesium values were found ranging between 12.78 to 10.70 mg/L during the study period.

CONCLUSION

The Narmada River, is one of the most important River of Hoshangabad, M.P. that feeding the city in many ways. It also contents all kinds of garbage. From the beginning the importance of the river was very much and increasing day by day. But at present that river is under pollution. Like other rivers in the city its water quality is

losing day by day. From the above chemical analysis we observed that most of the water parameters do not comply with the tolerance limit prescribed by WHO and other standards. In addition, the results show that the water is certainly unfit for drinking purposes without any form of treatment. Still it has the time to control the pollution of the river. So, it is very much necessary to conduct more research on this river and has to make awareness among the people about the pollution problem.

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