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Physical & chemical analysis of water quality of Murna River in Shahdol city Madhya Pradesh, India

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Abstract
The increasing scarcity of water and its vital importance for human survival has made water quality a serious issue. Rapid industrialization for sustainable development is causing great concern for the pollution of surface water as most of the industries are discharging their waste directly into the nearby water stream without any treatment, this practice not only violates the environmental standards but also contributes to the deterioration of water quality. The present study was that the water parameters which were taken for the present study are above the pollution level of surface water which does not full fill their requirement for use for various purposes.

Keywords: Water pollution, pH, Water quality, alkalinity, hardness

Introduction
"Water is life" truly reflects the importance of water. The main source of water is rainfall, but after this the use of groundwater and surface water becomes very important. Groundwater is extremely important for our life, but its quality is deteriorating due to human activities. Factors such as urban drainage, domestic wastewater and industrial pollution are seriously affecting the groundwater. Water, the universal solvent has the property of dissolving most substances due to its high dielectric constant but the penetration of these substances causes water pollution (Gautam, 1990) [1]. This is not only a threat to human health but is also harmful to aquatic life. Therefore, it is very important to study the physical and chemical characteristics of water and adopt water conservation measures. If we do not protect our water sources, it will adversely affect our lifestyle and ecology. Emphasis on water awareness and its proper use is the need of the hour.

Material and Methods
The analysis was carried out for various water quality parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS), total hardness (TH), alkalinity, chloride and dissolved oxygen (DO) using the standard method mentioned in (APHA, 1985, WHO Guidelines) [2-6]. The reagents used for analysis were AR grade and double distilled water was used for preparing the solution.

Collection of Samples
Surface water samples were collected in one-litre glass bottles from the river bank between 9 a.m. and 12.30 p.m. at each selected site. After adding suitable preservatives such as magnesium sulphate, alkyl iodide and sulphuric acid at the sampling sites, the collected water samples were immediately transferred to the water testing laboratory for analysis of various physico-chemical parameters. A brief description of the sampling site is presented in Table 1.

Table 1: Brief Detail of Sampling Sites

S. No.	Site code	Sites	Description
1	Site I	Near to Budhi Mata mandir	Where the river Murna Exit the city
2	Site II	Near to Polytechnic Hostel	It is situated in the middle of the Murna River
3	Site III	Near to MPEB Colony	It is situated in the middle of the Murna River
4	Site IV	Near to Kalyanpur	Where the river Murna enters the city

Results and Discussions

The results of physical & chemical analysis of different sampling sites are presented in Table 2. The pH value of Murna River ranged from 6.1 to 6.3, 5.9 to 6.2, 5.4 to 5.6 and 6.0 to 6.4 at site I, II, III and site IV. The results obtained indicate that the water of Murna River at all the sites is slightly acidic, which can be attributed to the regular discharge of domestic sewage and disposal of automobile/workshop wastes in the river.

Electrical conductivity (EC) is a measure of the ability of a solution to carry electric current. It is a parameter for dissolved as well as solute substances and indicates the concentration of dissolved electrolytes. The acceptable value of EC for drinking water is 300 micromhos/cm (Srinivas *et al*., 2006) [3]. In the present study, (sampling sites II, III and site IV) which are filled with wastewater and domestic sewage from many households showed maximum levels of conductivity in water.

Total Dissolved Solids (TDS) indicate the general trend of water quality of surface water bodies. In natural waters, total dissolved solids are mainly composed of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium and other particles. The effect of presence of total dissolved solids (TDS) in river water is turbidity due to the presence of silt content and organic matter. During the present study, minimum values of TDS were recorded at site III (433 – 468 mg/l) and maximum at site I (668 – 693 mg/l). Water samples with higher TDS values cannot be used for drinking as well as construction purposes Total

Suspended Solids (TSS) Higher concentration of total suspended solids in a river is an index that it is more polluted. In the present study, the values for sites I, II, III and IV were in the range of 158-178 mg/l, 162 - 184 mg/l, 151 - 166 mg/l and 155 - 170 mg/l, respectively.

Total hardness depends mainly on the dissolved salts present in the water. If the value is higher than 180 mg/l the water is classified as very hard, so river water can be considered hard. Hard water also forms deposits that block plumbing. These deposits, called "scale", are composed mainly of calcium carbonate ($CaCO_3$), magnesium hydroxide $Mg(OH)_2$ and calcium sulphate ($CaSO_4$). The following equilibrium reaction describes the dissolution/formation of calcium carbonate scale:

$$CaCO_3 + CO_2 + H_2O \leftrightharpoons CO_2+ + 2HCO_3$$

As water passes through soil and rock, it dissolves very small amounts of minerals and keeps them in solution. Calcium and magnesium are the two most common minerals dissolved in water that make water “hard”. Calcium and magnesium ions can be removed by water softeners. In the present study, it is found that the total hardness is 205-228 mg/l at site I, 197 - 213 mg/l at site II, 192 - 206 mg/l at site III and 181 - 197 mg/l at site IV, respectively. This is due to domestic sewage, washing of clothes, animals being discharged into the river.

High value of alkalinity indicates the presence of weak and strong bases such as carbonates, bicarbonates and hydroxides in the water body (Absi *et al*., 1999; Jain *et al*., 1997) [4-5]. In the present study, the values for sites I, II and III were in the range of 388-412 mg/l, 355 – 373 mg/l, 295 – 323 mg/l and 334-349 mg/l, respectively. This may be due to the concentration of salts associated with dry weather, high carbonate content and discharge of domestic sewage into the river. High alkalinity in the study area is also due to the presence of high carbonate content in the water samples. Chloride (Cl-) is one of the major ions found in water and is usually combined with calcium, magnesium or sodium. This may be due to contamination from local sewage, local drains and domestic effluents.

Dissolved oxygen (DO) is an important water quality parameter for various purposes. The level of DO in a surface water body indicates its ability to support aquatic life. In the present study, DO varied between 3.4 – 3.6 mg/l at site I, 3.2 – 3.4 mg/l at site II, 3.5 -3.7 mg/l at site III and 3.3 -3.5 mg/l at site IV. The DO content in water is not constant but fluctuates depending upon the local temperature and depth of water bodies. The decrease in DO at site I may be due to the absence of little turbidity in the river water and dumping of effluents along with urban waste.

Table 2: Physical & chemical Characteristics of Water Samples of Murna River, Shahdol

S. No	Parameters	WHO Standard, 1984	Site I	Site II	Site III	Site IV
1	PH	7.0 – 8.5	6.1 – 6.3	5.9 – 6.2	5.4 – 5.6	6,0 – 6.4
2	EC (micros/cm)	0.300	0.833-0.918	0.812 – 0.878	0.702-0.840	0.645 –0.694
3	TDS (mg/l)	500	668 – 693	645 – 670	433 - 468	565 - 598
4	TSS (mg/l)	100	158-178	162 – 184	151-166	155-170
5	Total hardness (mg/l)	100	205-228	197-213	192-206	181-197
6	Alkalinity (mg/l)	100	388-412	355-373	295-323	334-349
7	Chloride (mg/l)	200	366-372	318-329	298-317	282-304
8	Dissolved oxygen (mg/l)	5.0	3.4-3.6	3.2-3.4	3.5-3.7	3.3-3.5

Conclusion

The study shows that the water of Murna River has become much polluted due to urban waste, domestic sewage. Direct discharge of human and animal waste into the river not only affects the water quality but also affects the health of people living in the downstream areas of Shahdol city, where the same water is used for washing clothes, bathing and sometimes drinking. Continuous dumping of urban runoff and waste material, especially sanitary waste, is affecting the water quality of Murna River. There is a great need to understand these small rivers better so that they can be managed effectively.

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