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A STUDY ON THE SEWAGE DISPOSAL ON WATER QUALITY OF HARMU RIVER IN RANCHI CITY JHARKHAND, INDIA

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ABSTRACT: In this research paper physico-chemical characteristics of Harmu River at Ranchi were studied. The parameters studied were p H , Electrical conductivity, Total dissloved solids, Total suspended soilds, Total hardness, Calcium hardness, Magnesium hardness, A lkalinity, C hloride and Dissolved oxygen. The values of these parameters were found in excessive amounts as prescribed by World Health Organisation (WHO). It can be concluded that the water parameters which were taken for the present study are above the pollution level for surface water which does not satisfy their requirement for the use of various purposes. A brief attempt has been made to study the extent of change in the quality of water in comparison to water quality standards of World Health Organisation (WHO).

Key words: Water pollution, pH, Dissolved oxygen, Alkalinity, Hardness

INTRODUCTION

India is a country having various land forms and rivers. There are 14 major rivers in India. Water, the universal solvent because of high dielectric constant has the property of dissolving most of the substances but the access of these substances leads to water pollution [1]. The water bodies get polluted due to the discharge of effluents from the industries, domestic activities, and soil pollution from the nearby dumping sites and agricultural drainage. These factors results in the deterioration of water quality of the various water bodies [2] studied that the impact of the industrial effluents and domestic sewage on river Ganga at Allahabad and reported that all the pollution parameters are beyond the permissible limits and unfit for human consumption. [3] Studied the pollution potential of river Pandu contaminatied heavlily by the discharge of various industries. Untreated sewage discharge not only damage for aquatic life but also hazardous to human health used for drinking purpose in the downstream areas of the river [4]. Most of the cities and towns have developed along the banks of rivers because of the multipurpose-use of river water. But unfortunately some rivers are being polluted by indiscriminate disposal of sewage and industrial wastes [5].The present study is an attempt to make an assessment of the change in the physico chemical properties of Harmu River by the addition of sewage, domestic waste and garbage of Ranchi city.

MATERIAL AND METHODS

Study area

Geographically, Ranchi city is located on southern part of the chotanagpur plateau which forms the eastern edge of the Deccan plateau system. The area surrounding Ranchi city has been donated with the nature of attraction and it is referred to as *city of falls*. The most popular water falls are Dasham, Hundru, Johna, Hirni and Panchghagh which are all active perennially. The average elevation at the Ranchi city is 645 m above Mean Sea Level (MSL). As of 2011, India census Ranchi city has a population of 11, 26,741. The map of study area is presented in Figure 1.

Harmu River flows from west to north- east and it is the minor tributaries of Subarnarekha River. The Subarnrekha River and its tributaries consititute the local river system of Ranchi city.Harmu river also proivdes the necessary water requirements for few blocks of Ranchi city.During the survey it was found that forest cover in the bank of Harmu River has almost nonexistent. In addtion to there was a large and small slum encroachments along the bank of the river. This encroachment of bank of the river has a resulted into a drastic situation where the river Harmu (now becomes as a Drainage) has slowly dried up.

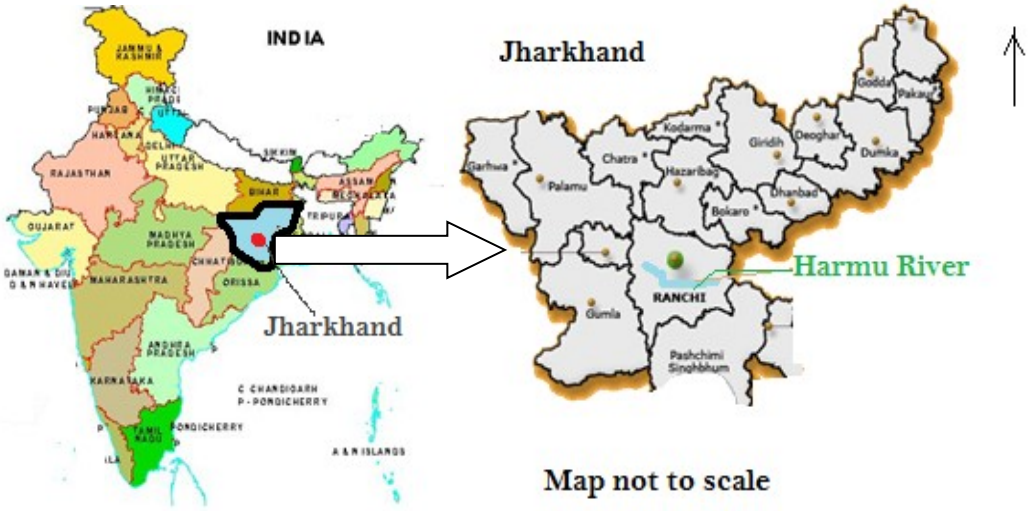

Figure 1. Map of study area

Climate

Ranchi city has a subtropical climate with a monsoonal effect. The year is divided into three distinct i.e., summer, (March to June), Rainy (July to October) and winter (November to February). Temperature ranges from 20^0C to 37^0C during summer and minimum 3^0C to 22^0C during winter. The annual rainfall is 1535 mm, and the mean average humidity is 60%.

Collection of Samples

The water samples were collected from surface near the margins of the small river between 9a.m. to 11.30a.m. in one litre glass bottles at each selected site. After addition of appropriate preservatives like magnesium sulphate, alkyl iodide and sulphuric acid at the sampling sites, the collected water samples were transfer red immediately to water testing laboratory, for analysis of various physico-chemical parameters. The brief details of sampling site are presented in the Table 1.

Table 1 Brief Detail of Sampling Sites

S.No	Site code	Sites	Description
1	Site I	Near to Harmu Muktidham	Where the River Harmu enters the city.
2	Site II	Near to Kadru Colony	Located in the middle of the course of the River Harmu through the city.
3	Site III	Near to Niwaranpur Colony	Where the River Harmu just leaves the city

Methodology

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 standard method as mentioned in APHA,1985.The reagents used for the analysis were AR grade and double distilled water was used for preparation of solution.

RESULT AND DISCUSSIONS

The results of the physico chemical analysis of different sampling sites are presented in Table 2.

pH of River Harmu ranged from a minimum of 5.6 to 6.2, 6.1 to 6.4 and 5.4 to 5.8 at site I, II, and site III respectively. The obtained results indicate that the water of RiverHarmu at all the sites is slightly acidic which can be attributed to the regular discharge of domestic sewage in the river and disposal of automobile /workshops waste.

Table 2. Physico- Chemical Characteristics of Water Samples of Harmu River, Ranchi

S.No	Parameters	WHO Standard,1984	Site I	Site II	Site III
			Ranges	Ranges	Ranges
1	pH	7.0 -8.5	5.6 - 6.2	6.1-6.4	5.4-5.8
2	EC(micros/cm)	0.300	0.880-0.982	0.671-0.731	0.784-0.821
3	TDS, mg/l	500	665 -684	467- 492	560-587
4	TSS, mg/l	-	167-185	134-155	151-172
5	Total Hardness, mg/l	100	216-245	197-217	186-231
6	Alkalinity, mg/l	100	410-434	240-257	315-330
7	Chloride, mg/l	200	340-342	260-274	286-295
8	Dissolved Oxygen, mg/l	5.0	3.3-3.4	3.2-3.7	3.5-3.9

Electrical conductivity (EC) is a measure of capacity of solution to carry an electrical current. It is parameter for dissolved as well as dissociated substances and indicates the concentration of dissolved electrolytes. The premissible value of EC for drinking water is 300 micromhos/cm (Sreenivas et al., 2006). EC were maximum at site I and the minimum were recorded at site II. In the present study, (sampling site I and site III) which are loaded with waste water and domestic sewage from several houses showed maximum levels of conductance in the water.

Total dissolved solids (TDS) indicate the general trend of the water quality of the surface water bodies. In natural water, total dissolved solids are composed mainly 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 the turbidity due to presence of silt content and organic matter. During the present study, minimum values of TDS were recorded at site II (467-492 mg/l) and maximum were at site I (665-684 mg/l).The water samples having high TDS value cannot be used as a drinking as well as construction purposes. The maximum values at site I may be due to the presence of several types of suspended particles, manmade religious activities, run-off from many bathing Ghats, dumping of solid wastes.

Total suspended solids (TSS) the higher concentration of total suspended solid in river is an index that it is more polluted. In the present study, the values of site I, II and III were in the range of 167-185 mg/l, 240-257 mg/l and 315-330 mg/l respectively.

Total hardness mainly depends upon the dissolved salts present in water.The water is classified as very hard if the values exceed 180 mg/l, therefore water of the river can be considered as hard. Hard water also forms deposits that clog 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 dissolving/formation of calcium carbonate sclaes:

$$CaCO_3 + CO_2 + H_2O \leftrightharpoons Ca^{2+} + 2HCO_3^-$$

As water moves through soil and rock, it dissolves very small amounts of minerals and holds them in solution. Calcium and magnesium dissolved in water are the two most common minerals that make water "hard." Calcium and magnesium ions can be removed by water softeners. In the present study, it has been found that total hardness ranges from 216-245 mg/l at site I, 197-217 mg/l at site II and 186-231 mg/l at site III respectively. This is due to discharge of domestic sewage, washing clothes, animals in the river. Alkalinity imparts a bitter taste and sour taste to water bodies. Alkalinity depends on pH, CO_2 and chloride. The high value of alkalinity indicates the presence of weak and strong base such as carbonates, bicarbonates and hydroxides in the water body [8, 9]. In the present study, the values of site I, II and III were in the range of 410-434 mg/l, 240-257 mg/l and 315-330 mg/l respectively. This may be due to dry season with concentration of salts, high carbonate content and discharge of domestic sewage in the river. The 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 anions found in water and are generally combined with calcium, magnesium, or sodium. The maximum chloride contents were recorded at site I (340 -342 mg/l) and minimum at site II (260-274 mg/l). This may be due to contaminated with local sewage, local drains and domestic effluents.

Dissolved oxygen (DO) is an important water quality parameter for various purposes. DO levels in surface water body indicate the ability to support aquatic life. In the present study, DO vary from 3.3-3.4 mg/l at site I, 3.2 -3.7mg/l at site II and 3.5 -3.9 mg/l at site III. The amount of DO in water has been reported not constant but fluctuates, depending on the local temperature and depth of the water bodies.The decrease in DO at site I may be attributed to absence of little turbulence in the river water and dumping of effluents along with urban garbage.

CONCLUSION

The study reveals that the water of the river Harmu is deteriorated very badly as a result of addition of urban waste, domestic sewage, which enters the river from both the banks during its course through the heart of Ranchi city. Direct discharge of human and animal waste not only imparts the quality of water but also affects the health of the people down stream of Ranchi city where the same water is used for washing, bathing and sometimes for drinking purposes. The urban runoff and continuous dumping of waste materials especially sanitary waste are affecting the water quality of river Harmu.There is considerable need for better understanding of these small rivers so that they can be managed effectively.

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