

Deterioration of Water Quality at Some Selective Area

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Abstract: *Degradation in environment, by uncontrolled exploitation of natural resources, generation and release of untreated municipal Solid waste and industrial effluents. Urbanization and rapid population growth are main cause of generation of these waste and deterioration of water, air and land quality. The impact of Solid Waste in quality of ground water at some of the specific area in Raipur City is studied in present work. We also try to review the present Solid waste disposal system and existing sewage carry methods. The outcome results will helpful to give an idea about water treatment plan and safeguard process for solid waste management.*

Keywords: MSW, Water Quality, Solis Waste, Disposal System

1. Introduction

Raipur is the capital city of the recently formed state of Chhattisgarh in central India. The city is administered by the *Raipur Municipal Corporation (RMC)*. With a population of 1 million the city sprawls across 188 km² and consists of 41 villages.¹ Traditionally, Raipur's economy has been based on agricultural-processing and serving as a regional hub for trade and commerce for a variety of local agricultural and forest products.² Today Raipur is an important regional, commercial and industrial destination for coal, power, steel and other industries. Raipur is the largest market of steel and iron in India. Raipur has witnessed a high growth rate in population, along with rapid increase in infrastructure and residential colonies. Due to increased population, urbanization, and industrialization the quantum of Municipal Solid Waste generated increased many fold and unmanaged municipal solid waste disposal particularly have lead to the serious socio-environmental problems.³

A major problem in urbanized areas is the collection and disposal of domestic wastes. Because a large volume of sewage and solid waste are generated in a small area, the waste cannot be adequately disposed off by conventional methods. The intensive use of natural resources and the large production of wastes in modern society often pose a threat to ground and surface water quality and have already resulted in many incidents of water contamination.^{5,6}

The quality of supply water depends on a large number of individual hydrological, physical, chemical and biological factors. The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health. Some of the heavy metals are extremely essential to humans, for example cobalt, copper, etc., but large quantities of them may cause physiological disorders.

The present study was aimed to analyze the effect of ground and surface water quality due to rapid urbanization, industrialization and unscientific way of dumping of solid waste (municipal solid waste and industrial waste).^{7,8}

2. Study Area and Methodology

To analyze the effect of uncontrolled and unscientifically dumped municipal solid waste on the ground and supply water, different kinds of water sources were selected, which are generally used by the surrounding for their routine use. Eight water source locations of the MSW dumps area of Sub-urban area of Raipur near Saron and Atari Village were selected for this study.(Fig-1). The water samples were collected for all three kind of sources at varying distances from MSW dumps area in four groups, 0-10m, 11-20m, 21-50m, 51-80m distances according to availability.⁹

Water samples were collected in the plastic bottles of 250 ml from well, Bore well, pond and tap water. Samples collected were analyzed within 1 day to avoid special preservation required. Standard testing methods are used to evaluate different parameter.^{10,11}

The study area and sampling location are shown in Fig. 1. The sampling points with standard methods are used are shown in Table-1



Figure 1: Sampling Location and sampling points

Table-1 Sampling Points type of sampes.

Sampling Point	Location of Sample	Type of Sample
1	Atari	Pond
2	Atari	Bore well
3	Atari	Tap Water
4	Ring-Road	Tap water
5	Saron	Pond
6	Saron	Bore Well
7	Saron	Open well
8	Saron	Tap water

The collected samples were analyzed for different parameters like pH, Total alkalinity, Total Hardness, TDS, COD, BOD, Chloride, Sulphate etc. The Standard methods were used.¹²

TDS	Gravimetric
COD	Potassium Dichromate method
BOD	BOD incubator
DO	Winklers Method
Chloride	Silver Nitrate
Sulphate	Turbidometer

Table 2: Methods Used for Sample Analysis

Parameter	Method
pH	pH Meter
Conductivity	Conductometry
Total Alkalinity	HCl-Titration
Total Hardness	EDTA-Titration
TS	Gravimetric

3. Result and Discussion

The observe values of physical and chemical parameters of water samples are listed in Table3 and Table-4.

Table 3: Physical Characteristics of Water samples(S-1 to S-8)

Parameter	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Temperature (°C)	24 (1.35)	28 (1.1)	25 (0.6)	26 (1.0)	23 (1.5)	28 (0.5)	24 (1.4)	25 (1.1)
Appearance	Dirty	Clear	Hazy	Clear	Dirty	Clear	Dirty	Clear
Odour	salty	Bearable	Bearable	Bearable	salty	Bearable	Bearable	Bearable
Conductivity µS/cm	1780 (6.55)	546 (2.5)	230 (3.6)	240 (3.7)	2360 (10.23)	560 (3.5)	2230 (12.34)	235 (4.5)
Turbidity NTU	16	8	8	5	7	6	12	5
pH	8.6(0.5)	7.6(1.0)	7.5(1.0)	7.8(1.0)	8.2(0.6)	7.5(1.0)	8.3(0.5)	7.5(1.0)

Table 4: Chemical Characteristics of Water samples(S-1 to S-8)

Parameter	Unit	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Total Alkalinity	mg/L as CaCO ₃	1300	760	476	350	1050	870	680	350
Total Hardness	mg/L as CaCO ₃	1140	570	390	180	960	630	420	150
TS	mg/L	12	06	04	03	09	03	06	04
TDS	mg/L	5470	2330	1020	1160	4500	2380	4800	1240
COD	mg/L	44.6	20.2	11.5	10.3	36.2	18.4	28.5	10.2
Chloride	mg/L	657	343	210	250	453	320	520	210

Temperature -The desirable temperature range necessary for potable water is from 7 to 11. This parameter is essential for the occurring rate of reaction in water. In our study the temp range was obtain from 26 to 28, as the minimum and maximum from spot 2 and 4 respectively. This temperature was two times greater than the standard temperature.

Hydrogen ion concentration (pH)-The recommended pH range necessary from drinking water is from 6.5 to 8.5. The investigation in our samples are shows that the pH value of water obtains from 7.0 to 8.5, it is the indicating the nature of water is from slightly basic nature to strong basic nature. The high pH was showed from the sample of pond near solid waste dump area. The reason may be discharged of wastes containing high quality of OH⁻ and HCO₃⁻ ion.

Conductivity: The measurement of electrical conductivity is directly related to the concentration of ionized substance in water and may also be related to problems of excessive hardness or other mineral contamination. The conductivity values in the ground water samples varied widely from 178 to 560. High conductivity of water sample shows an alarming condition towards mixing of electrolytes from solid waste.

Alkalinity: Table-4 represents the variation in total alkalinity of water samples ranged from a minimum of 350 mg/l. and maximum of 1300 mg/l. in S-1 and S-4. The alkalinity of some places was above the BIS desirable level 200 mg/l. in all the samples of ground and surface water but was less than the maximum permissible limit.

TDS: - Total dissolved solid (TDS) is a measure of the combined concentration of all inorganic and organic substances contained in water. The permissible limit of TDS in drinking water is 500 mg/l (WHO, 2004). The observation show that TDS found in range from 1020-5470 mg/l. Result of TDS is above than permissible limit.

Total Hardness: The maximum permissible level prescribed by WHO for drinking water is 300-600 mg/l as set. According to classifications, water having hardness up to 75 mg/l is classified as soft, 76-150 mg/l is moderately soft, 151-300 mg/l as hard (Dufor & Backer, 1964) and more than 300 mg/l very hard. Total hardness was found in the sample water ranges from 150 – 1140 mg/l, which shows that water is unsafe for drinking purpose.

COD: The Chemical Oxygen Demand (COD) was observed between the range of 10-44 mg/L, which is more than the permissible limit as prescribed by BIS. It shows the presence of high concentration of carbonaceous and suspended particles in water samples which are suspected to come from solid waste sources.

Chloride: According to BIS (IS: 10500: 1991) the desirable and permissible limit for chloride contains in water sample is 250-1000 mg/L. All observations from water samples are within the limit.

4. Conclusion

All observed result show that the ground water, tap water (supplied by Municipal Supply systems) & surface water (ponds) are Contaminated. Specially the concentration of Total dissolve solid, Total alkalinity, COD and conductivity parameter are above the standard acceptable levels. Water of almost all point is hard and contaminated because of solid waste dumping area. Raipur for the immediate health problems such as skin diseases, stomach diseases, gastric trouble etc.^{13,14} Therefore proper solid waste dumping and caring at this area is recommended to surface & ground water. On comparing the water quality of the ground water sources in the surroundings of MSW dumps with the water quality standards mentioned in Table 4, several parameters like- alkalinity, turbidity, Hardness and COD were found to be critical. The values of water quality parameters shown in Table 3 and Table 4 depicts that the effect of solid waste on water quality parameters of the water sources in surrounding of MSW dump is remarkable.

Table 5: Health effect of chemical parameter^{15, 16, 17}

Parameter	BIS Guideline Value	Health Effect
Temperature	-----	-----
pH	6.5-8.5	Affects mucous membrane; bitter taste; corrosion
Total Alkalinity	600 mg/L	Boiled rice turns yellowish
Total Hardness	300-600 mg/L	Poor lathering with soap;deterioration of the quality of clothes; scale forming
COD	2-4 mg/L	High COD level is toxic for aquatic living organisms
TDS	200 mg/L	Undesirable taste; gastro-intestinal irritation; corrosion or incrustation
Chloride	250-100 mg/L	Taste affected; corrosion

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