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Groundwater Pollution at Beed, Maharashtra as an Effect of MSW Dumping

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ABSTRACT

Groundwater has been regarded as one of the important and safest sources of the drinking water. Recently various human activities are causing serious pollution of these groundwater sources. These sources are quite vulnerable to the pollution and the pollution is irreversible and reclamation of polluted groundwater sources is very difficult. The present investigation deals with the study of impact of Municipal solid waste dumping on groundwater quality at Beed, Maharashtra. The study has shown that MSW dumping has clearly deteriorated the quality of the groundwater samples. Select physicochemical characters were taken as an representation to the pollution profile of the water in the study which include pH, Dissolved Oxygen (DO), Alkalinity, Salinity, Chlorides, Nitrates, Calcium Hardness (CaH), Magnesium Hardness (MgH), Total Hardness (TH), Sulphates and Biological Oxygen Demand (BOD).

Keywords: *Groundwater pollution, MSW, Leachate, DO, Hardness, Sulphates, BOD.*

INTRODUCTION

The ground water is defined as water that is found underground in cracks and spaces in soil, sand and rocks. This source has two distinct functions; firstly, it is a significant source of both urban and rural population's water supply and secondly it sustains many wetland ecosystems [1]. The sources for ground water supply mostly depend upon the rainfall and the resulting percolation of the water in the earth, another important factor is the type and quality of the soil [2].

This resource is particularly favoured for domestic purpose, since it is of high quality and requires little treatment before use. This is due to the fact that, as the water percolates down through the soil and rocks, bacteria, fungi and other such biological pollutants are naturally filtered out or diluted [3]. The daily demand of drinking water of a man is normally 7% of his body weight. Thus, it is vital for the healthy growth of the persons. But the same water may become a hazard, a threat to the continuation of life, if it gets polluted with harmful or toxic substances and potentially pathogenic microorganisms able to cause the diseases [4,5].

Usually the groundwater is considered as less polluted as compared to the surface water, due to the reduced exposure to the external environment. But lack of sanitation, improper waste management, have a potential to spoil the purity of the ground water leading to increased pollution levels. Hence, it has been reported that about 40% or even more disease outbreaks are attributed to be water borne in nature [6]. According to UNESCO report, a majority of Indian population has no access to safe drinking water and that about 66 million people rely on un-safe ground water for consumption [7,8].

The importance of water for the life processes, its' easy availability and the nature of water, has caused uncontrolled human interventions in the natural water cycle, which has resulted in the degradation of water both qualitatively in the form of decrease in water level index and quantitatively in the form of heavy loads of pollution. These unbalanced exploitations, during the last few decades have created serious problems of water quality and quantity. It appears that if such exploitation is continued, the conditions may still worsen [9].

Water pollution is an alteration in physical, chemical and biological characteristics, which may lead to harmful effects on humans and aquatic biota [10]. The pollution loads contributed to the water bodies are physical, chemical and biological in nature

The ground water originates as infiltrations from precipitations, stream flows, lakes and reservoirs. The quality of water therefore depends on the type of materials on the passage routes, the dissolved salts and general human activities especially those bordering on waste disposal systems. Ray (1988) has reported that, where the water table is shallow and the soil is porous, dissolved gases, nitrates, sulfates, soluble organic compounds and dissolved salts might be introduced into the groundwater system [11]. Thus, if the solid waste disposal sites are not chosen wisely, high concentrations of chemical and gaseous compounds or decayed organic matter may leach through the soil and contaminate ground water.

Ground water pollution usually arises from four main origins, *viz.*, industrial, domestic, agricultural and over exploitation. Studies carried out in India revealed that one of the most important causes of ground water pollution is unplanned urban development without adequate attention to sewage and waste disposal from industries and other sources as well. The incidence of ground water pollution is highest in urban areas, where large volumes of wastes are generated and discharged into relatively small areas [12]. In India, majority of industries are located in and around cities. There are 142 major cities in India, of which 112 lie on river basins, 17 are coastal and 13 non-coastal. [13].

In recent days, the water pollution is mostly attributed to the human activities, occurring in more frequent and widespread manner. Therefore, access to safe and sufficient water is now recognized as basic human right and is given high priority in Millennium Development Goals (MDG) [14].

The usual and the most neglected cause of water pollution is uncontrolled dumping of Municipal Solid Waste (MSW). Infiltration of water by rainfall, water already present in the waste, or water generated by biodegradation, cause the leachate to leave the dumping ground laterally or vertically and find its way into the groundwater thereby causing contamination [14,15].

It is evident from the above discussions that the water is one of the essential most requisite for sustaining the life on the planet earth. Water need is to be fulfilled through the limited available sources only. The uncontrolled and unplanned exploitation has very much deteriorated the quality of the water and now, it has become a potential cause for many of the diseases in human and other living beings. Hence, it is necessary that one must wisely use the water in order to avoid any possible adverse consequences; there is an urgent need to take necessary steps to monitor the water quality and to avoid any deterioration being caused.

MATERIAL AND METHODS

For the present investigations eight (08) groundwater samples were assessed in the vicinity of the municipal garbage dumping area at Beed city. The samples included the bore wells and dug wells situated ion an radius of 2 Km from the dumping area in all directions. Each of the sampling stations were located at least 500 meters away from each other. The samples were assessed for the concentration of various physicochemical parameters like pH, Dissolved Oxygen (DO), Alkalinity, Salinity, Chlorides, Nitrates, Calcium Hardness (CaH), Magnesium Hardness (MgH), Total Hardness (TH), Sulphates and Biological Oxygen Demand (BOD).

The analysis was done using the methods as given in APHA manual.

RESULT AND DISCUSSION

The detailed observations for the Physico-chemical analysis of groundwater are given in the table 1.

pH: The pH of the groundwater samples ranged between 7.5 to 8.0, which is well within the permissible limits of WHO standards. The maximum pH (8.0) was recorded in the sample collected at sampling station N1 and minimum (7.5) was recorded at S2. All the samples have been found to have pH values well within the limits prescribed by WHO for drinking water.

Alkalinity: The alkalinity was reported to occur between 289 mg/l to 344 mg/l. The highest alkalinity values were reported at sampling station N1 and lowest was at W2. Almost all the samples were found have values exceeding the WHO permissible limits of 200mg/l.

Chlorides: The chlorides were estimated in the samples understudy, the maximum value was 290 mg/l at N1 and minimum recorded value was 239 mg/l at W1. Except for W1 all the groundwater samples were found to have chlorides in access of the permissible limit of 250 mg/l.

Salinity: The salinity was calculated based on the chloride concentration and it has shown a similar pattern, with maximum value at N1 (545.20 mg/l) and minimum at W1 (449.32 mg/l).

Sulphates: The sulphates in the assessed groundwater samples ranged between 252.90 mg/l to 280.80 mg/l. The highest sulphate concentration was found at W1 and lowest was at E2. At all the sampling stations sulphate concentration was found to be exceeding the permissible limits of WHO.
Nitrates: The groundwater samples assessed have been found to contain nitrates in a range of 39.20 mg/l to 46.90 mg/l. The highest nitrate concentration was recorded at E1 and lowest was found at W2. However all the groundwater samples assessed have shown nitrate concentrations exceeding the WHO prescribed limits of 10 mg/l.
Dissolved Oxygen (DO): The concentration of DO in the groundwater samples assessed varied between 2.10 mg/l to 4.90 mg/l. The highest was recorded at W1 and lowest at N1.
Biological Oxygen Demand (BOD): The BOD requirements of the assessed water samples ranged between 6.5 mg/l to 8.3 mg/l. The lowest BOD requirement was at W1 and highest was at S2.
Calcium Hardness (CaH): The CaH values ranged between 162 mg/l to 229 mg/l, with the highest being at N1 and lowest at W2. All the assessed groundwater samples were found to exhibit CaH vaues exceeding the WHO prescribed limit of 75 mg/l.
Magnesium Hardness (MgH): The MgH values ranged between 43.43 mg/l to 57.58 mg/l, with the highest being at W1 and lowest at N2. All the assessed groundwater samples were found to exhibit MgH vaues exceeding the WHO prescribed limit of 30 mg/l.
Total Hardness (TH): The TH values ranged between 412 mg/l to 376 mg/l, with the highest being at N1 and lowest at E2. All the assessed groundwater samples were found to exhibit TH vaues exceeding the WHO prescribed limit of 200 mg/l.

Table 1: Physico-chemical analysis of groundwater samples at Beed (mg/l)

Sample	pH	Alk.	Cl	Sal.	SO_4	NO_3	DO	BOD	CaH	MgH	TH
Standard	**6.5-8.5**	**200**	**250**		**150**	**10**			**75**	**30**	**200**
N1	8.00	344	290	545.20	270.10	41.20	2.10	8.10	229	44.65	412
N2	7.90	296	281	528.28	259.40	42.40	3.80	7.70	221	43.43	399
S1	7.60	298	271	509.48	258.90	40.80	3.60	7.90	199	48.56	398
S2	7.50	300	278	522.64	271.20	44.30	3.00	8.30	176	50.26	382
E1	7.90	312	277	520.76	262.10	46.60	4.10	7.20	196	50.51	403
E2	7.90	293	281	528.28	252.90	46.90	4.60	6.80	165	51.48	376
W1	7.70	295	239	449.32	280.80	41.70	4.90	6.50	191	53.19	409
W2	7.50	289	259	486.92	261.60	39.20	3.90	7.70	162	57.58	398
Avg.	**7.75**	**303.38**	**272**	**511.36**	**264.63**	**42.89**	**3.75**	**7.53**	**192.38**	**49.96**	**397.1**
SD	**0.20**	**17.74**	**16.06**	**30.20**	**8.85**	**2.79**	**0.89**	**0.63**	**24.38**	**4.54**	**12.40**
% CV	**2.58**	**5.85**	**5.91**	**5.91**	**3.34**	**6.50**	**23.6**	**8.43**	**12.67**	**9.08**	**3.12**
SE	**0.04**	**3.87**	**3.51**	**6.59**	**1.93**	**0.61**	**0.19**	**0.14**	**5.32**	**0.99**	**2.71**

From the above findings it was evident that almost all the eight (08) samples assessed during the course of this study are showing physicochemical properties in excess of WHO prescribed limits except of the pH. It was also noted that the samples collected from the vicinity of the dumping area contained higher concentrations of these pollutants as compared to the samples collected at the farther sampling stations. This clearly indicates that the continued dumping of the municipal solid waste is slowly decomposing the groundwater sources.
Although the level of theses contaminants is not very much deleterious to human health, but this investigation does indicates that there strong possibilities that other lethal pollutants like metal ions may have reached these water sources along with the pollutants studied.

Therefore, a serious analysis of the situation is necessary and dumping should be avoided or at least should be aided with a suitable method to prevent groundwater pollution.

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