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PHYSICO CHEMICAL ANALYSIS OF GROUND WATER NEAR MUNICIPAL SOLID WASTE DUMPING SITES IN ARUMUGANERI, THOOTHUKUDI DISTRICT, TAMILNADU, INDIA

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Abstract

Ground water samples in and around from the dumpsite located in Arumuganeri were studied to assess the impact of Municipal solid waste on the ground water resources. Ground water samples were collected from the 5 different bore-wells in and around the dumpsites. The collected water samples were analyzed for parameters of Total Dissolved Solids (TDS), Total Alkalinity (TA), Total hardness, chloride and dissolved oxygen. The results were observed in each sample , compared with standards WHO, ICMR, ISI and thus an attempt was made to ascertain whether the quality of ground water is fit or not for drinking and other purposes.

Keywords: Ground water, MSW, Total hardness, Total Alkalinity, Water pollution.

INTRODUCTION

Due to its wide distribution and ease of access, Ground water is an important resource for water. The actions on the environment have been intensified by the human beings and so they have become a primary cause for the impact on the chemical characteristics of the groundwater in certain locations. The ground water levels have declined because it has been pumped for industrial use and agriculture. Moreover due to over fertilization in agriculture, the concentration of nitrogen is raised to a high level [1-2]. Solid municipal waste and industrially manufactured solid waste increased the organic, heavy metals and inorganic groundwater ions [3–4]. As population increased in India, it has resulted in a drastic increase in the generation of Municipal Solid Waste (MSW). It includes domestic as well as commercial waste that accounts for a relatively small part of the total solid waste stream in developed countries. Accumulation of a large amount of waste may create several problems to inhabiting populations. Collection, transportation and handling of the waste must also be properly dealt with, if not, the waste creates a number of problems, many of which are related to human health and environment [5-6].

The major part of MSW management was direct disposal and it was observed that in developing countries, the waste is dumped directly by unscientific and uncontrolled manners which can be detrimental to the urban environment. There are varieties of chemicals like inorganic chemicals, detergents and complex organic chemicals and metals in the MSW lechate [7]. During infiltration of water by rainfall, water already present in the waste cause the leachate to leave the dumping ground laterally or vertically and find its way into the ground water thereby causing contamination [8-9]. The impact of leachate on groundwater and other water resources has attracted a lot of attention because of its overwhelming environmental significance in recent times. The resources of ground water are in high risk due to leachate migration from landfills and release of pollutants from sediments and this should be managed [10]. Investigations in study area revealed that, rapid growth in population during the recent decades resulted in increasing quantity of urban solid wastes. The present study deals with the assessment of ground water quality near Municipal Solid Waste dumping sites in Arumuganeri, Thoothukudi District, Tamilnadu, India.

MATERIALS AND METHODS

Five ground water samples were collected from five bore wells namely Muthukrishnapuram (Loc.no.1), Kamarajapuram (Loc.no.2), South Thisaikaval Street (Loc.no.3), Nataraja nagar (Loc.no.4) and Maduthuvilai (Loc.no.5). Standard procedures were used for the determination of water quality parameters. All the chemicals used were AR grade. The pH of the samples was measured with digital pH meter. The Total Hardness and Alkalinity were determined using titration method. The method for the determination of dissolved Oxygen was based on the Winkler's method. The chloride was determined by titration method using standard silver nitrate solution. The total dissolved solids were measured by TDS meter.

Table I. Parameters of water quality characterization and standards

Parameters	WHO	ICMR	USPH	ISI
PH	6.5 – 9.2	7.0 – 8.5	6.0 – 8.5	6.5 – 8.5
Electrical Conductivity (mho/cm)	300	300	300	-

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TDS	500	500	500	500
Chloride	200 – 600	250	250	250
Alkalinity	120	120	-	200
Total Hardness	300	300	500	300
Dissolved O_2	4 – 6	4-6	4.6	3.0

WHO - World Health Organization

ICMR - Indian Council of Medical Research

USPH - United States public drinking water standard

ISI - Indian Standard Institution

RESULT AND DISCUSSION

The aim of the present study is to determine the extent of ground water contamination. For this study, physico-chemical analysis was done with the ground water samples collected from five locations around Aumuganeri. The results of both physico-chemical analysis of different ground water samples are presented in Table (2). These results were compared with values of prescribed standard quality parameters presented in Table (1).

Table 2: Parameters measured for the water samples

Location	Appearance	Odour	pH	EC (mho/cm)	TDS (ppm)	Cl^- (ppm)	Total Alkalinity (ppm)	Total Hardness (ppm)	Dissolved Oxygen (ppm)
L_1	Clear	None	7.44	1410	100	77.23	454.75	105.820	5.2078
L_2	Clear	None	7.65	5286	150	174.19	1417.75	312.169	4.1061
L_3	Clear	None	7.57	3875	180	332.44	722.25	253.968	5.2078
L_4	Clear	None	7.63	7118	180	339.66	1257.25	544.973	3.2048
L_5	Clear	None	7.8	6558	1270	365	1043	455	4.2344

The appearance of ground water sample is clear in all the locations except loc. No. 5 and all the observed samples didn't have any odour. The pH values of water samples varied between 7.4 to 7.8 and were found within the limit prescribed by WHO. The entire sample showed neutral values.

The electrical conductivity of all the water samples exceeded the domestic water standards of 300µmho/cm. These high values of electrical conductivity may be due to the high concentration of ionic constituents present in the water bodies. So these water samples cannot be used for drinking purposes.

TDS values varied from 100 to 1270ppm. TDS in all the water samples are within the range except L_5.The TDS concentration in L_5 found to be above the permissible limit may be due to the leaching of various pollutants into the ground water which can decrease the potability and may cause gastrointestinal irritation in human and may also have laxative effect. High level of TDS may aesthetically be unsatisfactory for bathing and washing. The accumulation of organic and inorganic solids also contributes to high total dissolved solids [11].

The chloride concentration serves as an indicator of pollution by sewage. In the present analysis, chloride concentration was found in the range of 77.23 to 365 ppm. Higher chloride concentration in samples from sites may be due to big discharge of sewage near the sampling sites. It imparts a salty taste to water and accelerates corrosion of metals. High concentration of chloride is considered to be an indicator of pollution by organic wastes from industrial and other origin [12].

The highest value of alkalinity was due to the accumulation of organic matters produced by decay and decomposition of vegetation from sewage and in turn, added carbonate and bicarbonate concentrations in the water content [13].

The hardness values are ranged from 105 to 544 ppm. The TH values of some samples are found higher than the prescribed limit and this may be mainly due to the contamination by the large quantities of sewage and detergents and the high total hardness would lead to heart disease and kidney stone formation.

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Dissolved oxygen is an important parameter in water quality assessment and biological processes prevailing in the water. The DO values indicate the degree of pollution in the water bodies. The presence of dissolved oxygen (DO) enhances the quality of water and also acceptability. Here dissolved oxygen of ground water ranges between 3.27 – 5.20 ppm.

CONCLUSION

The area chosen for study is significant for industries and dense population. So far, no major studies have been carried out on solid waste interaction with groundwater. In this study, it is observed that the groundwater regime is being highly polluted due to improper dumping of solid waste besides geological causes. The water quality in all the areas surveyed was found to be unfit for human consumption due to high values of Total hardness. The remedial measure must be taken immediately to safeguard and conserve the precious water resources from pollution for future generation .

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