Solid Waste Management in Some Municipalities of Tirunelveli District and Its Impact on Ground Water Quality in and Around Their Dumpsities

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Abstract— In this paper solid waste management of three municipalities in Tirunelveli district which have open dumpsites of age more than 20 years were studied. Physico chemical analysis was carried out on ground water samples in the area around the three selected dumpsites. The aim of the study was to know the solid waste management practices in these municipalities and determine the impact of the dumpsites of urban solid waste on the quality of ground water. Twelve water samples were collected from the wells with in immediate vicinity and further away from the dumpsites for analysis. The samples were analyzed for pH, acidity, alkalinity, conductivity, total dissolved solids, hardness, chlorides and sulphates. This study concluded that the leachate from dumpsite had intruded in ground water in particular direction making it not potable.

Index Terms—Solid waste management, municipalities, dump sites leachates, physico chemical analysis, and ground water quality

1 INTRODUCTION

THE urban solid waste management is one among the basic and essential services provided by municipality to keep urban areas clean. One of the most pressuring problems facing urban areas of not only India but also world today is the problems of disposal of solid wastes. Urban solid waste management is one of the most neglected areas of urban development in India. It is the one of the major environmental issues of Indian municipalities. Improper management of solid waste causes economic losses and health hazards to the Inhabitants. There has been a significant increase in the generation of municipal solid waste in India over the last few decades due to a result of rapid population growth urbanization, and changing consumption pattern among people living in the country The daily per capita generation of the municipal solid waste in India ranges from about 125g in small towns to 600g in large towns. The characteristics of municipal solid waste collected from any area depends on a number of factors such as food habits, cultural tradition of inhabitant, life styles, climate etc. At present most of the municipal solid waste in the country is disposal off unscientifically. More often in some urban areas the generated huge amount of solid waste of towns is just dumped in open land with no liner and prior process. This has adverse impact on not only the ecosystem but also on the human environment Unscientific disposal practices leave unattended at the disposal sites, which attract birds, rodents, flies etc., to the waste and create unhygienic conditions like odors, release of airborne pathogens, etc. The plastic content of the municipal waste is picked up by the rag Pickers for recycling either at primary collection centers or at dumpsites. Plastic are recycled mostly in factories, which do not have adequate technologies to process them in a safe manner. This exposes the workers to toxic fumes and hygienic conditions. Moreover, since the rag picking sector is not organized, not all the recyclables, particularly plastic bags, get picked up and are found littered everywhere, reaching the drains and water bodies ultimately and choking them (Esakku, 2007).

In order to improve the quality of life of urban population, water supply and environmental sanitation need to be improved. Both solid and liquid waste management comes under environmental sanitation. The objective of solid waste management in urban areas is to collect the waste at the source of generation, recovery of recyclable materials for recycling, Conversion of organic waste to compost and secured disposal of remaining waste. Inorganic recyclable solid wastes are to be collected separately from residential houses through sensitization and motivation. Recyclable items would be sold to generate fund. In our study areas open dumping is the most common economically opted method for solid waste disposal.

In our present study mainly confines the views on solid waste management of three municipalities which are semi-urban area of Tirunelveli district of Tamil Nadu in India and their impact on ground water. The one of the most important environmental consequences of the process of solid waste management of this area is to protect the ground water resources from leachate of uncontrolled open dumps without liner.

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2 SITE DESCRIPTIONS:

The study area is the selected three municipalities of Tirunelveli district namely Tenkasi, V.K.Puram and Shenkottai which have more than 20 yrs.' dumping the solid wastes at their open dumpsites, has per capita generation ranges 325-375gm. The dumpsites contained vegetable matters, domestic wastes, organic and inorganic matters, wood, paper, cloths, glass, plastic of various type and metal scraps. The dumpsites are being operated as open dumps. The details of solid waste management practices in these municipalities are given in table -1. The ground water table in V.K.Puram and Tenkasi are at a depth of 3 m and 2 m respectively.

TABLE 1-DETAILS OF IMPLEMENTATION OF SOLID WASTE MANAGEMENT

Parameter	Name of municipality		
	Shenkottai	V.K.Puram	Tenkasi
Year of up gradation as municipality	1961	2004	1965
Total area (sq. km)	2.6	38.65	26.15
Population (2011census)	26808	47163	70530
No of ward	24	21	33
Dump site (acres)	5.10	6.8	3.03 - Mathalamparai 8.25 - Boganallur
Period of dumping (years)	25	28	28
Total quantity of garbage (ton/day)	6.8	12	26
Per capita waste generation (kg)	0.244	0.250	0.279
Composition of solid waste (%)			
Bio degradable	42.29	48.83	54
Plastic	4	3	2
Metal , Glass&Rubber	1.10	1.67	2.5
paper	2.1	2.91	2.5
Inert	50.51	43.59	39
Transport vehicles detail (No's)			
Mini lorry	2	2	5
Dumper placer	1	1	1
Auto	8	6	5
Hand cart	10	0	30
Total no of sanitary worker	30	61	132
Disposal of municipal solid waste	Open dumping	Open dumping	Open dumping

3 MATERIALS AND METHODS

The water samples were collected from existing well in and around the dump sites in the month Feb-2015 to assess the possible scenario of ground water pollution caused by solid waste dumping. Twelve samples were collected from in and around the dumpsites in 5 litre plastic can. Water samples were analyzed by using standard method. Physico chemical parameter analyzed were pH, acidity, alkalinity, hardness, conductivity, TDS, chloride and sulphate etc..,
The results of physic-chemical characteristics of ground water are presented in table-2

4 RESULT AND DISCUSSIONS

pH

The pH is used to express the intensity of acidic or alkaline condition of samples. The pH controls the bio-chemical reactions in the environment. Mostly the water shows slight alkaline in nature. The pH of all the samples was found to be in the range 7-8.4. All the samples fall in the range prescribed by the IS for the pH (ie. 6.5 to 8.5)

ELECTRICAL CONDUCTIVITY (EC)

The electrical conductivity ranged from 426-4070 µs/cm. The maximum electrical conductivity was noted for the sample collected at the inside of Shenkottai dumpsite. The minimum electrical conductivity was observed for the sample collected from 445m away from dumpsite in northwest direction. The electrical conductivity for water samples collected close to Tenkasi dumpsite were higher (>1000µs/cm) than the WHO recommended maximum permissible safe level for portable water. The maximum electrical conductivity for V.K Puram dumpsite is 3130 µs/cm for sample 220m away from dumpsite in west direction

TOTAL DISSOLVED SOLIDS

The total dissolved solids range from 214-2300mg/l with maximum concentration of 3700 at the inside of Shenkottai dumpsite well. The IS recommended for TDS is 1000mg/l. The maximum concentration of TDS in V.K Puram is 2200mg/l in the west direction at a distance of 220m. In Tenkasi the maximum concentration of TDS observed in the wells of north and east direction were 2200 and 3400 mg/l respectively.

TOTAL HARDNESS

The values for the total hardness were observed in the range of 84-2300mg/l. The maximum hardness was noted for the sample collected in Shenkottai dumpsite itself. The IS recommendation for the total hardness is only 300mg/l as desirable value. In Tenkasi dumpsite all the samples (four samples) have the hardness greater than 300mg/l.

The maximum hardness 1560 mg/l of water sample for Tenkasi dumpsite is the north direction at a distance 15m from dumpsite. The water sample collected for testing in V.K.Puram dumpsite except one sample has hardness less than 300mg/l. Two locations in Tenkasi one location from Shenkottai have hardness values greater than 600mg/l (max. permissible concentration).

TABLE – 2 GROUND WATER QUALITY OF VARIOUS LOCATIONS IN AND AROUND THE SELECTED THREE MUNICIPALITIES DUMP SITES

LOCATION	SAMPLE	LATITUDE	LONGITUDE	DISTANCE FROM DUMPING SITE (m)	PARAMETERS*								
					pH	EC (µs/cm)	TDS	TH	ACIDITY	ALKALINITY	DO	CHLORIDE	SULPHATE
Shenkottai	S1	8º59′22″	77º15′50″	INSIDE	7.9	4070	3700	2300	58	606	6.1	1460	720
	S2 (W)	8º59′21″	77º15′36″	50	8.4	740	650	272	12	440	6.6	48	82
	S3(NW)	8º59′24″	77º15′43″	445	7.8	426	380	214	20	168	5.1	32	38
	S4(N)	8º59′33″	77º15′47″	375	7.8	585	500	286	22	262	5.7	53	75
V.K.Puram	V1 (SW)	8º43′17″	77º23′31″	200	7.2	989	650	236	56	30	6.8	97	230
	V2 (SW)	8º43′18″	77º23′31″	250	8	878	610	84	28	24	6.5	115	160
	V3 (W)	8º43′22″	77º27′31″	220	7.5	3130	2200	724	36	20	7.2	376	450
	V4 (S)	8º43′17″	77º27′37″	800	7	739	510	192	44	24	6.1	69	36
Tenkasi I	T1 (N)	8º56′24″	77º19′26″	50	8	2460	2200	1560	20	276	6.2	410	160
	T2 (E)	8º56′22″	77º19′30″	40	7.9	3970	3400	1440	56	764	6	1380	370
	T3 (S)	8º56′20″	77º19′26″	75	8.1	1137	920	420	18	294	6.3	650	BDL
	T4 (W)	8º56′21″	77º19′19″	90	7.9	957	790	520	30	246	6.1	140	120

Fig.1 Schematic diagram showing the sampling points at Shenkottai

Fig.2 Schematic diagram showing the sampling points at v.k.puram

Fig.3 Schematic diagram showing the sampling points at Mathalamparai (Tenkasi)

Fig.1 Schematic diagram showing the sampling points at Shenkottai

ALKALINITY

The concentration of total alkalinity as CaCo3 in well water ranges 20-764mg/l. The locations of Tenkasi and Shenkottai have alkalinity more than 250mg/l which is permissible limit for construction purpose.

CHLORIDES

The chloride concentration ranged from 32-1460mg/l. The standard recommendation for chlorides is 250mg/l as desirable value. Five location have chloride value greater than 250mg/l.1000mg/l is maximum permissible concentration of chloride and if chlorides exceed this, the sample source is unsuitable for domestic purpose. Two locations have chloride value greater than 1000mg/l.

SULPHATES

The sulphate concentration ranged from 36-720mg/l. Maximum sulphate concentration were note for sample collected at one location if Shenkottai, Tenkasi and V.K Puram were 720,370 and 450mg/l respectively. The standard recommendation for sulphates is 200mg/l as desirable value and 400mg/l as maximum permissible concentration.

DISSOLVED OXYGEN

Dissolved oxygen is the one of the most important measure of water quality. It is found in the ground water samples ranges from 5.1-7.2mg/l.

5 CONCLUSION

From the present study of the solid waste management and its impact on ground water in and around the three selected municipalities dumpsites, it is found that the parameters like electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), chloride(CH) and sulphates (S) concentration are above the limits of Indian standard for drinking(BIS-10500-1991). The higher concentration of these parameters shows the penetration of open dump leachate has occurred to ground water and pollutes the ground water aquifer. Hence, it is concluded that at present the impact of municipal solid waste in these three municipalities has significant impact on the ground water quality. The ground water of location of Tenkasi dumpsite is more affected. The emphasis should be given to improve waste management practices, design and construct properly landfill sites with liner to pre-vent the ground water pollution of the area.

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