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Study of Current Quality Status of Groundwater around Tirunelveli Corporate Dumpsite in Ramayanpatti

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***Abstract:** A common waste disposal method is dumping of solid waste on land and practiced almost all cities around the world. The nature of water quality depends on disposing of solid waste around the dump site. The present research is focused on monitoring ground water quality in the region of dumpsite leachate. Tirunelveli is one among the Indian cities facing acute problem in administering the solid waste. Sixteen locations were identified and samples were collected from the wells with in immediate vicinity and further away from the dumpsites for analysis. The samples were analyzed for pH, dissolved oxygen, chemical oxygen demand, acidity, alkalinity, electrical 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 suitable for domestic purpose.*

***Keywords:** solid waste, dump site, electrical conductivity, leachate, total dissolved solids*

I. INTRODUCTION

From the beginning of civilization, open land dumping of solid waste has been practiced worldwide. Developing countries like India still faces problem in administering municipal solid waste.

Dumping is being practiced rather than incineration and composting in open land as it is the easiest and cheapest.

Ground water is a resource of global importance as it is one of the fresh water sources which is applicable to areas where availability of surface water is limited. The aquifers play predominant role in collecting ground water from rivers, stream, and seas. Renewable and non renewable aquifers are root cause in retaining the quality of water. Ground water comprises about 95 of the world's supply of fresh water excluding fresh water in globe ice irrespective of the locality. The water extracted from far below the ground are considered to be partially filtered since it has been percolating the soil. The ground water extracted from beneath the ground surface is observed to be contaminated which is due to direct concoction of solid waste. Due to origination of leachate, the locality near municipal solid waste dump yard has higher possibility of pollution risk. Organic and inorganic contaminant from the leachate leads to serious health hazard for the public and nature.

II. DESCRIPTION OF THE ASSESSMENT REGION

Tirunelveli was incorporated as corporation in the year of 1994. It has got a population of about 4, 74,838. It covers an area of 108.65km^2. Ramayanpatti from Palayamkottai is one among the eleven taluks of Tirunelveli district of Tamilnadu state, India. It is located 3km away from centre of city facing north, 10km from Palayamkottai and 649km from state capital Chennai.

The dumping site spreads for about 118 acres of land having an elevation of 47m. Tirunelveli Corporation disposes nearly 180 tons of garbage every day in which the per capita waste is around 379g.The average rainfall is 1511.5mm. Due to improper maintenance of dumping site area the surrounding bore holes have been contaminated.

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Fig No. 1.Sample Collection Points At Ramayanpatti Dumpsite

III.MATERIALS AND METHODOLOGY

The analysis covered physico-chemical parameters of the samples. The qualitative analyses were experimented in chemical analysis laboratory as per standard methods.

TABLE I Physico-Chemical Parameters of the Samples

Parameters	Method of determination
pH	Microprocessor based pH meter (model
Acidity	Titration method
Alkaliity	Titration method
Chloride	Argentometry method
Total Hardness	Titration method
Sulphate	Muffle furnace method
COD	COD Digestor 2015 M (SC 093)
DO	DO- EU Tech instrument
TDS	TDS meter(TDS3TM)
EC	EU Tech instrument con 510 Conductivity/ TDS /°C/°Fmeter (s no. 288529)
Sodium	Fire flame photometer (ELICO, 19B, 01832)
Potassium	Fire flame photometer (ELICO, 19B, 01832)
Calcium	Fire flame photometer (ELICO, 19B, 01832)

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A. Tabulation- Ramayanpatti Dumpsite

The results obtained from testing various parameters for water samples around Ramayanpatti dumpsite are shown below

TABLE III. Results Obtained from Testing Various Parameters for Water Samples Around Ramayanpatti Dumpsite

Sample station	Direction	Distance from site(m)	Location	Latitude	Longitude	pH	Acidity mg/l	Alkalinity mg/l	Cl mg/l	TH mg/l	SO4 mg/l	COD mg/l	DO mg/l	TDS mg/l	EC µS/cm	Na mg/l	K mg/l	Ca mg/l
S1	SW	1400	AVN(BW)	8 º 45' 29" N	77 º 41' 9"E	7.83	60	320 `	188.59	500	59.91	8.7	4.53	918	194.2	13.8	0.3	15.7
S2	SW	1300	VT(BW)	8 º 45' 29"N	77 º 41' 1"E	7.94	30	310	165.76	310	101.61	16.8	1	867	185.7	16.8	0.2	14.5
S3	S	1200	AVN(BW)	8 º 45' 33"N	77 º 41' 6"E	8.09	34	320	397.04	540	144.24	9.32	4.02	1800	3890	27.3	0.7	40.9
S4	SW	1100	RC(BW)	8 º 45' 41"N	77 º 41' 8"E	8.05	36	320	191.59	335	110.63	23.31	7.03	1040	2260	27.6	0.6	44.1
S5	E	100	ST(BW)	8 º 45' 51"N	77 º 40' 35"E	8.02	12	212	64.52	220	79.67	27.3	1.48	517	1202	5.4	0.8	22.9
S6	SE	150	MT(OW)	8 º 45' 36"N	77 º 40' 45"E	8.26	28	340	155.83	310	25.36	25.3	6.48	874	1978	18.6	0.3	20.2
S7	NE	750	VC(BW)	8 º 45' 58"N	77 º 40' 57"E	8.15	36	252	684.89	320	194.03	27.97	5.21	2220	5660	27.8	0.7	94.9
S8	NE	850	SN(BW)	8 º 46' 6"N	77 º 40' 59"E	8.35	28	180	187.6	235	24.27	24.6	5.61	664	1468	9.1	0.3	27
S9	N	975	KN(HP)	8 º 46' 5"N	77 º 41' 4"E	8.2	32	208	212.41	260	4.2	18	3.02	873	2060	18.4	0.4	10.8
S10	NW	1060	APC(BW)	8 º 46' 1"N	77 º 41' 10"E	8.3	16	216	230.28	250	50.72	6	6.1	1230	2380	20.1	0.3	27.3
S11	NW	1110	APC(HP)	8 º 46' 0.15"N	77 º 41' 11"E	817	20	210	223.33	325	31.12	6	3.71	1010	2100	19.1	0.4	17.2
S12	NW	1250	TTBS(BW)	8 º 45' 57"N	77 º 41' 9"E	8.15	48	200	283.88	425	46.68	8	1.66	1300	2880	24.9	0.5	26.2
S13	N	1430	PSK(B	8 º 45'	77 º	8.0	36	210	564.	975	93.3	14.	1.8	252	597	25.	0.	87.

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	W		W)	52"N	41' 4"E	6			78		6	67	3	0	0	3	7	6
S14	NW	1520	APC(BW)	8 ° 45' 49"N	77 ° 41' 7"E	817	56	330	805.99	2910	77.8	4	2.09	3360	7870	36.6	0.7	65.6
S15	SW	1600	APC(HP)	8 ° 45' 47"N	77 ° 41' 8"E	8.16	50	446	726.58	1335	93.36	11.34	1.26	3180	7500	32.5	0.6	56.6
S16	SW	1700	BN(BW)	8 ° 45' 49"N	77 ° 41' 14"E	8.29	38	234	881.42	975	197.61	12.67	5.37	2940	6790	35.4	0.7	55.7

IV. RESULTS AND DISCUSSIONS

A. pH

The pH is used to find the intensity of Acidity or Alkalinity of the samples. The pH controls the bio-chemical reactions in the environment . This study indicates that the pH of different areas around dumping sites ranges from 7.83 to 8.35 which is the desirable limit of BIS. The pH was maximum at the sampling site S8 than at the sampling site S1.

B. Acidity

The acidity of water samples around Ramayanpatti dumping sites ranged from 12mg/l to 60mg/l. It was found that acidity was maximum at the sample at S1 than S5.

C. Alkalinity

The alkalinity of water samples around the dumpsites being ranged from 180mg/l to 446mg/l.The Alkalinity of water at the dumping site S15 was high than at the S8. This difference is mainly due to OH,CO_3,and HCO_3 ions. The noted values of alkalinity at different sites were within the permissible limit of BIS.

D. Chlorides

As per study, The chloride level in water samples is ranges s between 64.5mg/l to 881.43mg/l. Highest value of chloride was obtained in the location S16 while the minimum value was found S5.

The founded chloride value lies in the range limit(250mg/l to 1000mg/l) of BIS. If the observed value of chloride exceed 1000mg/l, the sample source is unsuitable for domestic purpose.

E. Total Hardness

Water hardness is usually fluctuating due to the presence of multivalent metal ions which comes from minerals that dissolved in water. During the experimentation study, total hardness was recorded as minimum (220mg/l) at S5 to maximum as (1335mg/l) at S15. It was recorded beyond the acceptable limit as 600mg/l at the S13,S14,S15, and S16 sampling sites.

F. Sulphates

Sulphate concentration of samples ranged from 4.2mg/l to 197.612mg/l and it was observed to be within the desirable limit(200mg/l to 400mg/l)of IS at all the sampling sites. Higher sulphate value (197.612mg/l) was identified in the site S16, while the lower value of sulphate(4.2mg/l) was analysed in the site S9.

G. Chemical Oxygen Demand

The COD analysis in general is used to estimate the amount of organic compounds present in water. COD is one of the important parameter in identifying the quality of ground water which identifies the amount of organic pollutants present. The COD of water samples around the dumpsites being ranged from 4mg/l to 33.96mg/l. Higher the COD (4mg/l) was found at the sampling site S14, while COD(33.96 mg/l) the lower value identified in the location S2.

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H. Dissolved Oxygen

Dissolved oxygen is the most predominant water quality parameter which is easy to measure. As per the study, the DO of water sample around the dumpsites being ranged from 1mg/l to 7.03mg/l. the highest value of DO(4mg/l) was identified in the location site S2, while the lowest value of DO (7.03mg/l) was identified in the location S4.

I. Total Dissolved Solids

The study, total dissolved solids analysis was recorded as minimum (517mg/l) at S5 to maximum as (3360mg/l) at S14. The IS recommended for TDS is 2000mg/l. In S7, S13, S14, S13, S14, S15,S16 the availability of organic content (TDS) was higher than the permissible limits.

J. Electrical Conductivity

The electrical conductivity ranged from 185.7µS/cm to 7870. The electrical conductivity for water samples collected at S3 to S16 were higher (>1000µs/cm) than the WHO recommended maximum permissible safe level for potable water sample collected at R14 (sivaji nagar- arasu pudhu colony). The minimum electrical conductivity was noted for the sample collected at S2 (vinayagar temple). The electrical conductivity for water samples collected at S3 to S16 were higher (>1000µs/cm) than the WHO recommended maximum permissible safe level for potable water.

K. Sodium

As per BIS, no clear cut norms for sodium have been prescribed, meanwhile WHO has recommended that high concentration of sodium will reduce comfort for irrigation. Sodium concentration of samplings around Ramayanpatti dumpsites ranged from 5.4mg/l to 36.6mg/l. The maximum sodium value was detected in the location S14,while the minimum sodium value was detected in the location S8. These observed values are within acceptable limit renounced by WHO.

L. Potassium

There is no clear cut norms registered for permissible potassium levels. As per study, potassium concentrations in samples around Ramayanpatti dumpsites are identified in the level of 0.2mg/l (S2) to 0.8mg/l (S5).

M. Calcium

Calcium concentration of samplings around Ramayanpatti dumpsites being ranged from 10.8mg/l to 87.6mg/l**.** The maximum value was detected in the location S13 which is located at a distance of 1430m from the dumping site in North West direction, while the lowest value was identified in the location S9 which is located at a distance of 975m from the dumping site in North direction. The values are acceptable as per BIS. Hence the ground water around Ramayanpatti dumping site has calcium concentration which is appropriate for human consumption.

V. CONCLUSIONS

From the current research on Municipal solid waste and its impact on ground water quality in the surrounding of Ramayanpatti dumpsites, it is found that the parameters like electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH) are above the limits of Indian standard for drinking. The higher obtained values of these parameters proves the percolation of open dump leachate in the ground water table which results in polluting the aquifer. Hence it is concluded that at present the disposing of municipal solid waste in this municipality has significant impact on the ground water quality. It is concluded that the underground water in Ramayanpatti dumpsite is observed to be highly contaminated. Emphasis should be given to enhance waste management practices, design and construct landfill sites with liner properly to prevent the ground water pollution of the area around the dumpsite.

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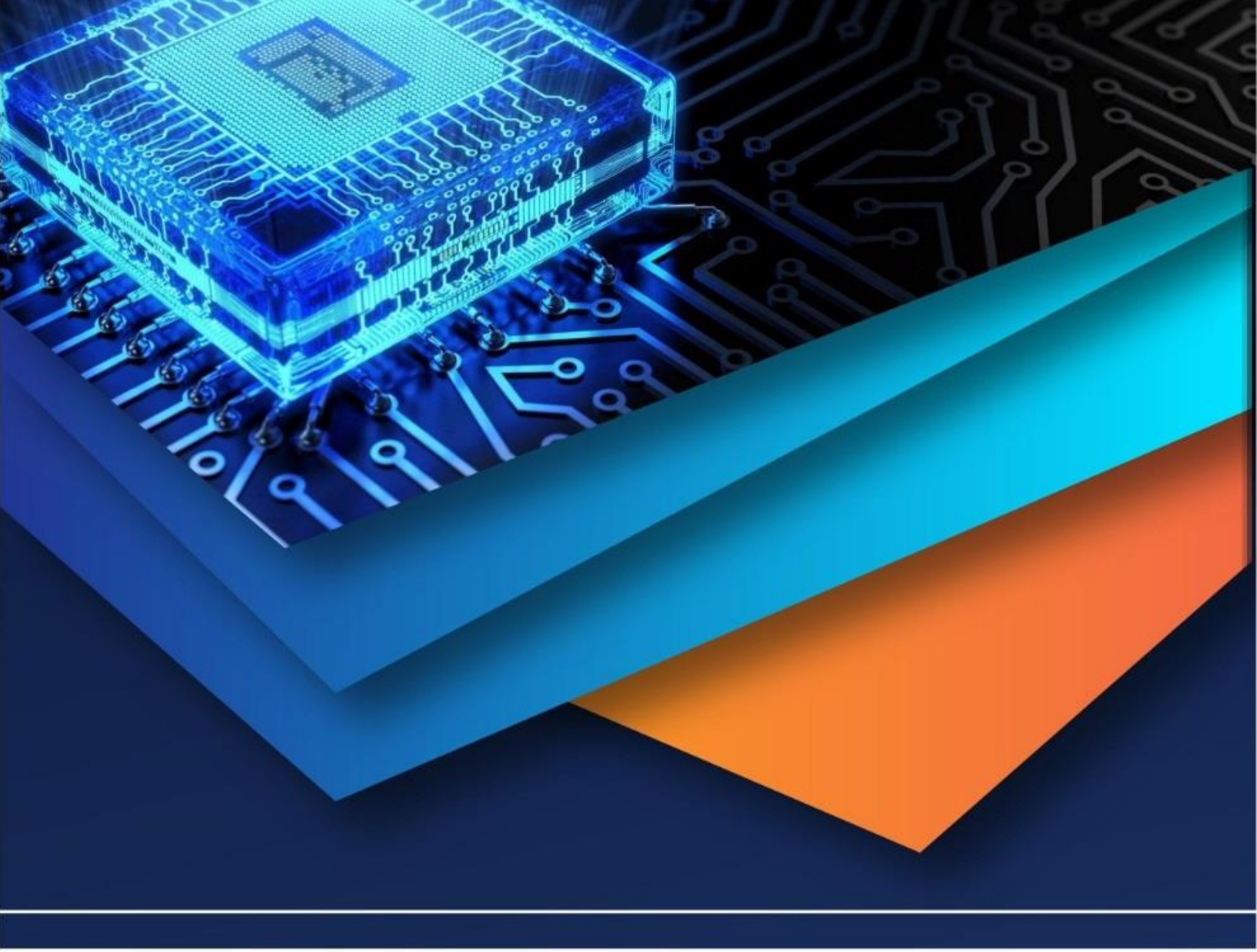
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