RJC

RASĀYAN *J. Chem.*
Vol. 9 | No. 3 |319 - 324 | July - September | 2016
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

STUDY ONLEACHATE CONTAMINATION IN AND AROUND ARIYAMANGALAM DUMPING SITE TRICHY DISTRICT, TAMILNADU INDIA

D. Justus Reymond[1], J.S. Sudarsan[1*], K. Prasanna[1] and Helen Sheebha[1]
Department of Civil Engineering, SRM University, Kattankulathur-603203, (T.N.) India
*E-mail: sudarsanjss@yahoo.com

ABSTRACT

The inadequacy of good quality of ground water supplies in urban center is a major problem that leads to increased use of packaged drinking water from various sources like bubble top cans and bottled water in the households and at work places. This study was conducted in and around Ariyamangalam, Trichy city to assess the quality of ground water in several key locations of site selected and to ascertain reasons for increase in the purchase of packaged water consumption in the study area. A total of thirty two subsurface sample locations identified around the municipal solid waste dumping yard. From each location, samples were collected and physical, chemical and bacteriological analysis were made. The results obtained were compared with BIS: 10500 to ascertain the quality of water. The Water Quality Index (WQI) was done using Arithmetic Weighing method and statistical analysis was carried out using SPSS16.0.Theresultssuggested that the need of enhancing better solid waste management techniques leads to reduction in the leachate contamination of groundwater in addition to continuous monitoring of ground water quality and leachate percolation.

Keywords: Subsurface Water, Physiochemical parameters, Biological parameters, Water Quality Index, Leachate and Water quality standards.

INTRODUCTION

Adequate supply of fresh and safe drinking water is a basic need for all human beings on the earth. Communities in urban areas suffer from acute drinking water shortage. Water borne diseases such as diarrhoea, typhoid fever, cholera and bacillary dysentery has been traced to the consumption of unsafe water and unhygienic drinking water[1, 2]. Water Quality Index (WQI) is regarded as one of the most effective way to communicate water quality[3] .Water quality is assessed on the basis of calculated water quality indices[4,5] .The data obtained through quantitative analysis and BIS water quality standards were used for calculating water quality indices. The purpose of calculating WQI and comparing it with standards is to assess drinking water contamination and variation of drinking water quality in different locations of ground water on basis of calculated value of water quality indices[6, 7]. Leachate can consist of different organic and inorganic compounds either suspended or dissolved. Percolation of leachate shall contaminate the ground water quality[11].The contamination from an unplanned solid waste disposal system becomes a threat to the environment[6].The Ariyamangalam garbage ground near Trichy is an open dumpsite. Open dumpsites have low operating costs and lack expertise and equipment's for leachate collection. They are unhygienic and generally smelly. They attract scavenging animals, rats, insects, pigs and other pests. Surface water percolating through the trash can dissolve out or leach harmful chemicals, which are carried away from the dumpsites in surface or subsurface runoff. Among these chemicals heavy metals are particularly insidious and lead to the phenomenon of bioaccumulation and bio magnifications[8, 9, 10].

Study Area

Trichy city has a population of 27 lakhs (approx.) and the density is 602 inhabitants per square kilometer. The minimum and the maximum temperature experienced in this chosen study area is 18.90 and 37.70

respectively. The location of the dump yard is 10048'0'' N and 78043'0''E and has an elevation of 75.87 m above MSL. The study area is situated 12 km away from the city on the Trichy- Tanjore highway. The soil type of the study area mainly consists of alluvial soil. (Data source: Public Works Department, Tamil Nadu). The location map of the study area is given is Figure-1.

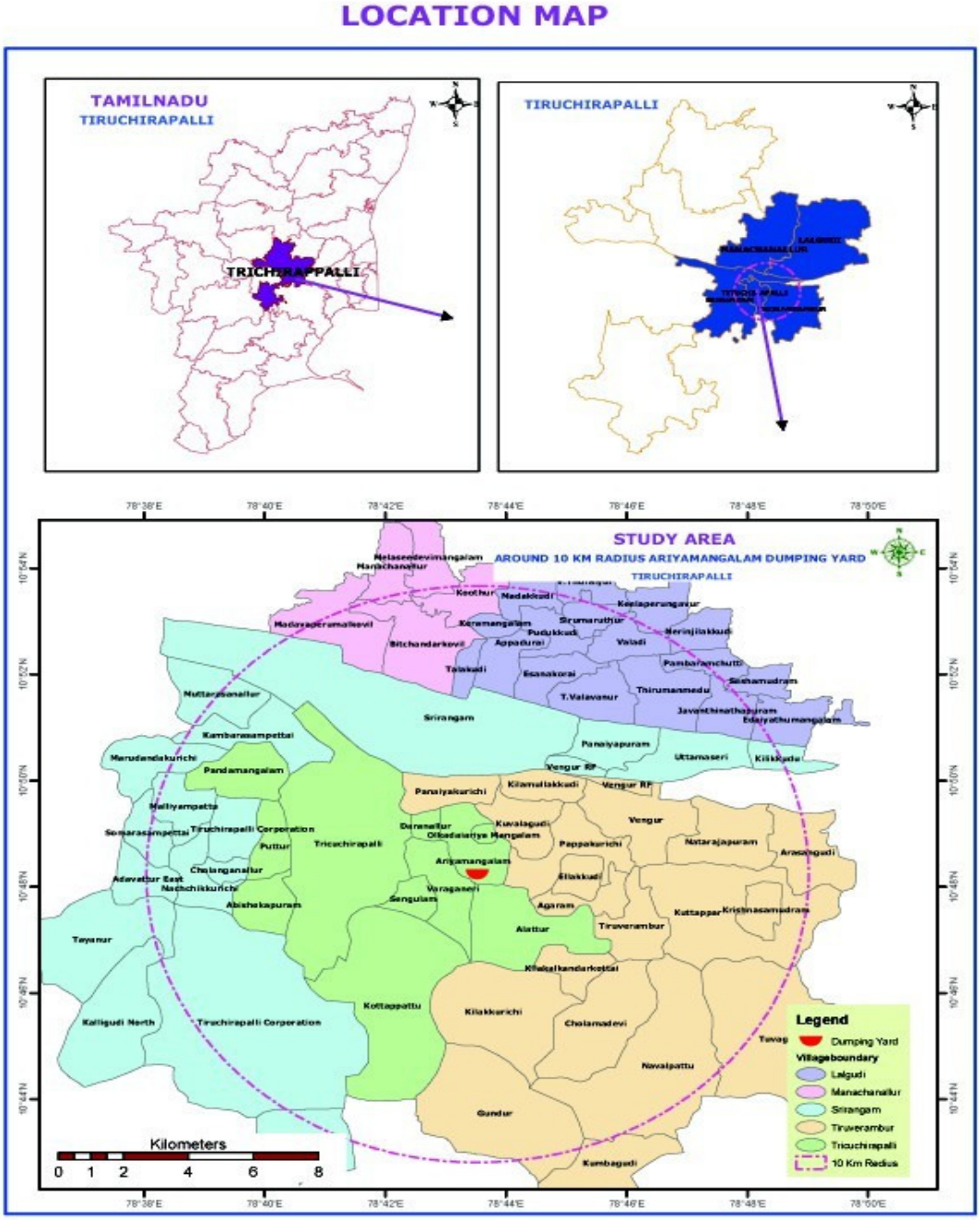

Fig.-1: Study Area

Waste Generation

The yearly variation of Municipal Solid Waste (MSW) (disposed quantity) in Trichy city was observed that the MSW generation rate for the Ariyamangalam dumping site varies between 115,845 and 149,100

tons/year for the year 2000–2010. This is largely because of rapid population growth, economic development in the country and increased consumption of packaged foods and other items. An average of470 tons of domestic waste per day has been disposed on the active open dumpsite from the surroundings. The total surface area of the dump yard is 47.7 acres and has been operated since 1967. Out of the total area, 42 acres of land has been filled with garbage with an average height of filling as 16 feet. There are many small scale industries, boiler manufacturing units and a vegetable market (Gandhi market), which contributes to the various characters of waste in the dump yard.

EXPERIMENTAL

A specific methodology is adopted in order to carry out this work. Various Standards and relevant literatures have been referred to arrive at an appropriate methodology. Sampling techniques and methods of testing are based on APHA guidelines in vogue[1]. A step by step procedure is followed in executing the work. Then the sampling procedures are studied from IS3025:2009.Sampling was done and tested for various physicochemical parameters and heavy metals.

Sampling and laboratory analysis

Random sampling of ground water has been done from32 locations and was labeled as S1 to S32.The locations were noted using the hand GPS-GARMIN *Etrex30*.18hotspot samples were collected and tested to know the level of leachate contamination of groundwater[10]. And the control samples were tested based on APHA guidelines in vogue and the same was compared with BIS 10500 to ascertain the quality of water to find contamination as the distance from the dumpyard[13].

Water Quality Index (WQI)

Weighted Arithmetic method has been adopted to find the water quality index of the contaminated ground water samples from32 locations. The method of calculation is given below.

$$wQI = \frac{\sum_{i=1}^{n} Q_i w_i}{\sum_{i=1}^{n} w_i} \qquad (1)$$

Mi=Laboratory estimated values of the i^{th}parameter
Ii= Ideal value of the i^{th} parameter
Si= Standard value of the i^{th} parameter

$$Q_i = \frac{(M_i - I_i)}{(S_i - I_i)}$$

Total hardness, Chloride, Total Dissolved Solids (TDS), pH, Alkalinity, Magnesium, Calcium and Fluoride are considered as primary indicators of water quality. Figure-2 shows the geographical location of the study area along with the 32 sampling stations. The boundary has been plotted for an area of 10 km. sampling locations have been randomly chosen on the basis of sources.

Table-1: Classification of water quality based on WQI

Value of WQI	Water Quality
0-24	Excellent
25-49	Good
50-74	Poor
74-100	Very Poor
>100	Unfit for drinking

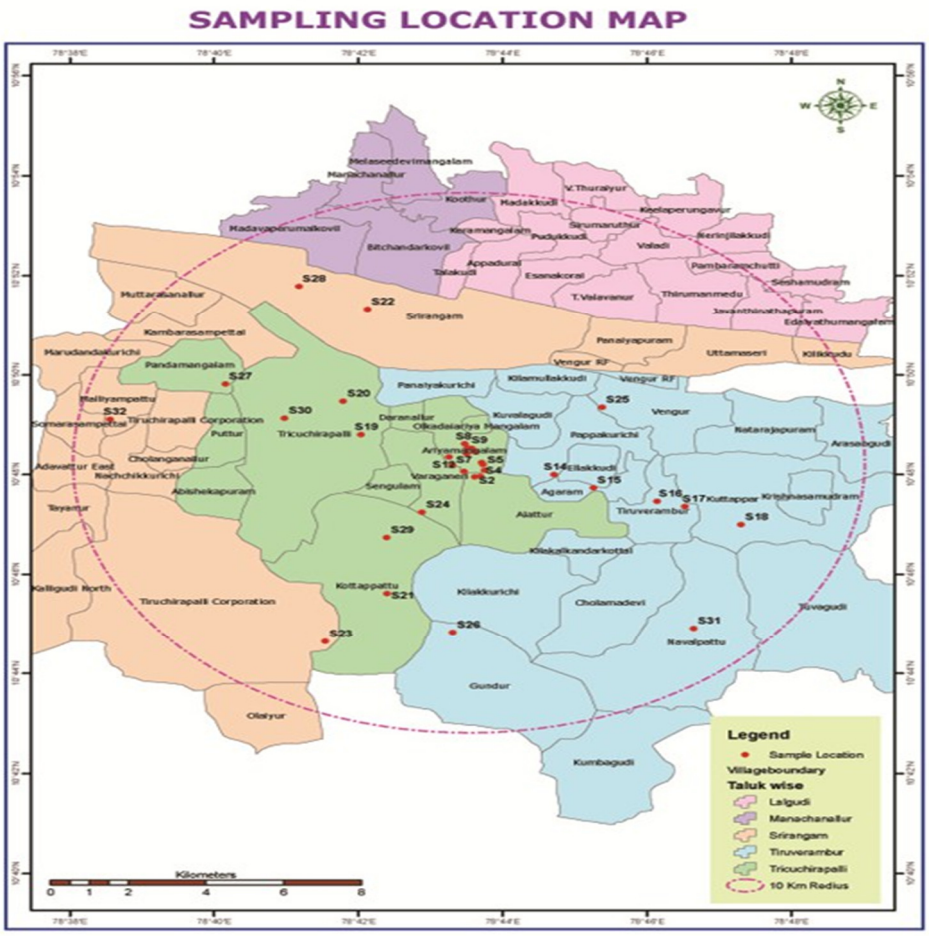

Fig.-2: Location of sampling

Table-1 shows the classification of quality of water based on water quality index values. Based on the water quality index calculated, the values are compared with the above mentioned classification table and the quality of the particular location was arrived.

RESULTS AND DISCUSSION

Thewaterqualityindexofthe32groundwatersampleswere calculated using Arithmetic Weighing method as shown in Table-2.

Table -2: Water Quality Index data

Sample No.	WQI	Sample no	WQI	Sample no	WQI
1	25.4	11	18.9	21	56.2
2	66.49	12	49.9	22	63.27
3	64.43	13	82.6	23	64.81
4	102.15	14	101.2	24	89.8
5	76.52	15	23.35	25	56.95
6	94.14	16	72.16	26	54.81
7	98.2	17	42.2	27	88.08

8	86.7	18	54.03	28	107.4
9	89.49	19	99.75	29	45.88
10	65.19	20	98.4	30	61.21
31	77.05	32	87.25		

It was found that34.37 % of the samples were of poor quality.37.5% of samples were very poor in quality.12.5% of the samples were good in quality and 6.25 % were of excellent quality.9.37 % of samples were unfit for drinking. The chart showing the percentage of various quality of water based on the quality index as calculated using arithmetic weighing method. The computed WQI values ranges from 16 to 89 and therefore it can be categorized in to four types, excellent water to poor water. Percentage of water samples that falls under different quality is shown in Table-3.

Table-3: Quality classification based on index values

Classification	No of samples under the classification	% of samples under classification
Excellent	2	6.25
Good	4	12.5
Poor	11	34.37
Very poor	12	12.5
Unfit for drinking	3	9.37

Table-3 shows the calculated water quality index which has been classified for quality based on the index chart. More than 50% of the samples were of poor quality out of which 12.5% were very poor and 9.37% were found to be unfit for drinking.

CONCLUSIONS

The samples were tested in physical, chemical and biological analysis and the results were interpreted in terms of Water Quality Index (WQI). It is evident that the water quality of ground water has been adversely affected due to the leachate from the Ariyamangalam dump yard. It is high time to take measures to reduce the further contamination of groundwater. Increase in population and the changing lifestyle of people will eventually lead to more generation of waste in the years to come. Sources segregation which is the main attribute in solid waste management should be done at the earliest stages of waste generation. Construction of an engineered landfill with gas collection and leachate collection facilities can be done as a best remedy for the existing problem. Geosynthetic clay liners (GCL) can also be adopted to decrease the rate of seepage of leachate into the soil to reach the water table. This can protect the groundwater from the contaminants. If immediate remediation is not taken, it shall completely degrade the ground water sources around the location of Ariyamangalam and its surroundings.

ACKNOWLEDGEMENTS

The authors are thankful to the officials and Management of SRM University, Kattankulathur.

REFERENCES

1. APHA (American Public Health Association), Standard method for examination of water and wastewater, NW, DC, 236(1994).
2. R.Kavitha and K.Elangovan, *International Journal of Environmental Science*, **2**, 145 (2010).
3. C.R.Ramakrishnaiah, C.Sadashiviah and G.Raganna,, *E –Journal of Chemistry,***6**, 523 (2009).

4. WHO (World Health Organization) Guidelines for Drinking-water Quality, Addendum. Surveillance and Control of Community Supplies. 2nd edition. World Health Organization, Geneva, **3**, 188 (1998).
5. O.Adeyemi, O.B.Oloyede, and A.T.Oladiji, *Asian J. Biochem*, ***2***,343(2008).
6. C.O.Akinbile, and M.S.Yusoff, *International Journal of Environmental Science and Development*, ***2***, 81(2011).
7. B.Jhamnani and S.K Singh, Intnl.J.of Environmental Science and Engineering, **1**, 121(2009).
8. S.Kanmani,and R.Gandhimathi, *Applied Water Science*, ***3***, 387(2013)
9. S.Kanmani, and R.Gandhimathi, *Applied Water Science*, ***3***, 193(2013).
10. S.Krishnaraj, S.Kumar, and K.P Elango, *IOSR Journals*.**9**, 6(2015).
11. D.Virkar and Dattatray, *Rasayan.J.Chem*. **8,** 355(2015).
12. K. Sneka Lata1, A. Jesu and M.S. Dheenadayalan, *Rasayan.J.Chem,***6**, 385(2015).
13. K. Prasanna and R.Annadurai, *RasayanJ.Chem.,***9**, 290(2016).

[RJC-1424/2016]