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Assessment of ground water quality from near municipal solid waste dumping sites of Cuddalore –Tamil Nadu

K Arul Jothi[1], B Geetha[2]
[1] M.Phil Research Scholar, Department of Chemistry, PRIST University, Puducherry, Tamil Nadu, India
[2] Assistant Professor, Department of Chemistry, PRIST University, Puducherry, Tamil Nadu, India

Abstract
Solid waste Disposal and management is both an urban and rural problem. Every person is a potential generator of waste and thus a contributor to this problem. To generate waste is one thing, the type of waste generated is another and yet also the way the generated waste is managed or disposal of is quite a different issue. This study carried out in Cuddalore district in Tamilnadu. The quality of water bodies depends on their chemical and microbial characteristics. In most of the countries solid wastes are being dumped on land in open without adopting any sanitary land filling practices or treatments. The areas near land fill sites have a greater possibility of water sources contamination due to potential pollution. In present investigation the water samples (both ground and surface) were collected from near the landfill sites of Cuddalore and its adjacent area to study the impact of water quality. The attempts were made to focus on the impacts of solid waste dumping on the water quality at various locations. The water samples collected were analyzed using standard methods to asses the quality the parameters like p^H = 6.5 – 8.5, hardness 600mg/L etc., were found higher then prescribed Indian standard for drinking water specification IS 10500 : 1991. The results reveal that the both ground and surface water contamination is more frequent in the near landfill sites.

Keywords: groundwater, water pollution, water quality, solid waste

Introduction
Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effect of industrialization is the creation of solid waste [1]. If the solid waste sites are not managed properly may cause surface water and ground water pollution, air pollution, soil contamination, odor nuisance, disease causing vector nuisance etc. In rainy season the water gets mixed into the waste and most of the chemicals and materials dissolve in water and starts leaching. The leachate percolates in ground water sources located near the dumping sites and creates the problem of ground water pollution.

Study of Area
Cuddalore town is the headquarters of the Cuddalore taluk and the Cuddalore district. It is located at the estuary of rivers Gadilam and Pennayar on Bay of Bengal. The town is at a distance of 200 Kms from south of Chennai, 23 Km south of Puducherry and 45 Kms north of Chidambaram. The latitude and longitude are 11.75°N and 79.75°E respectively. As per 2011 censes the town had population of 173,361 and floating Population of about 20,000. The Cuddalore town covers a total area of 27.69 km2 and is divided in to 8 sanitary division and 45 political wards [2, 3]. The urbanization and industrialization has made rapid changes and expanding residential areas. The lack of adequate collection and treatment of MSW by Cuddalore Municipality Corporation (CMC) has created greater challenges for waste management in the rapidly expanding town

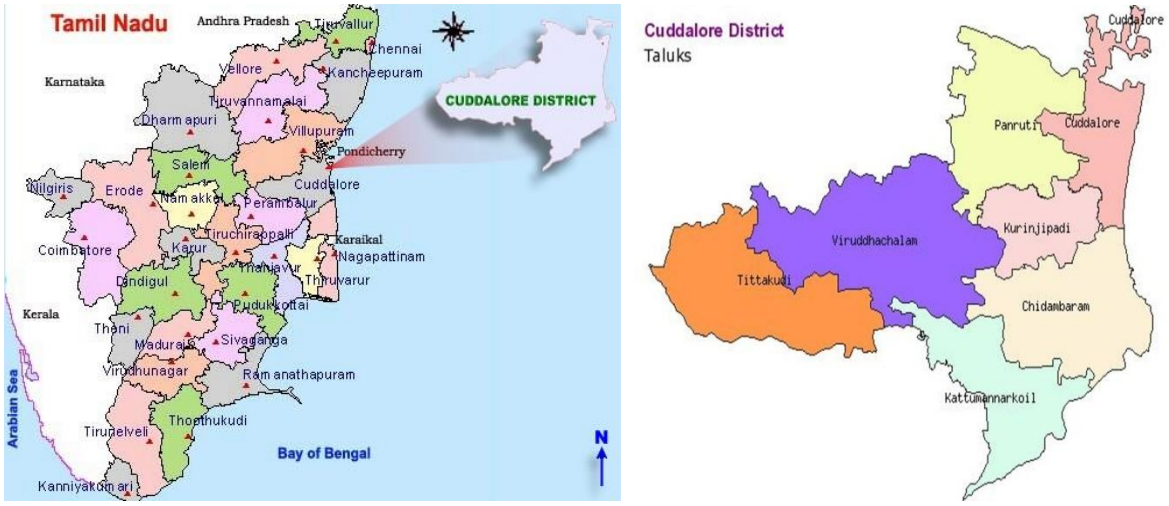

Fig 1: location of Cuddalore municipality

Climate

Cuddalore experiences a tropical wet and dry climate under the koppen climate classification. In Tamilnadu Cuddalore witnessing heavy rainfall in every northeast monsoon [2]. The highest 24 – hour rainfall recorded in Cuddalore was 570 mm on may 18, 1943.

Sampling and Analysis

The water samples were collected in month of may, 2018 to assess the possible scenario of ground water pollution caused by solid waste dumping. Three samples were collected from around the dumpsite in glass bottle. Water samples were analysed by using standard methods. Parameters analyzed were temp, pH, hardness, calcium, magnesium, total dissolved solids, total solids, total suspended solids, fluoride, chloride, sulphate, nitrate etc.,

Average characteristic of water samples from different study locations in comparison with the permissible limits

Table 1

S. No.	Parameters	Maximum Permissible limits IS 10500 : 1991	GW sample1	GW sample 2	GW sample 3	GW sample 4	GW sample 5	GW sample 6	GW sample 7	GW sample 8	GW sample 9	GW sample 10
1.	P^H	6.5 to 8.5	7.8	7.9	8.0	7.9	8.0	7.8	8.0	7.9	8.0	8.3
2.	Hardness	600 mg/L	565	200	160	170	195	250	60	100	85	470
3.	TDS, mg / L	2000 mg/L	1680	556	694	296	419	627	200	254	206	1083
4.	Calcium, mg /L	200 mg/L	56	32	26	28	38	22	24	30	20	26
5.	Magnesium, mg /L	100 mg/L	54	35	23	36	47	17	16	19	18	18
6.	Chloride, mg /L	600 mg/L	397	152	145	64	103	145	53	57	46	177
7.	Sulphate, mg /L	400 mg/L	235	43	72	6	24	62	9	10	12	204
8.	Nitrate, mg /L	50 mg/L	75	48	17	28	41	37	39	45	32	9
9.	Flouride, mg /L	1.5 mg/L	0.48	0.2	0.26	0.18	1.15	0.8	0.04	0.17	0.22	0.44

Indian standard for drinking Water – specification IS 10500: 1991.

Results and Discussion

1. P^H

The pH is used to express the intensity of acidic or alkaline condition of solution. The pH controls the chemical state of many nutrients including dissolved oxygen, phosphate, nitrate etc. most of the water shows slight basic nature [6, 7]. IS 10500 – 1991 has recommended maximum permissible limit of pH between 6.5 to 8.5. at all sample stations pH value were found near permissible limit(basic nature).

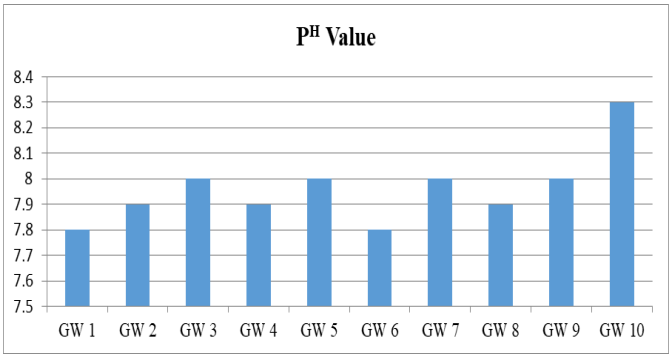

Fig 2

2. Hardness

Hardness is the property of water which increases the boiling points of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both [8]. The hardness values in present study were in range of 60 mg/L to 565 mg/L and found within the limit prescribed by IS 10500 – 1991.

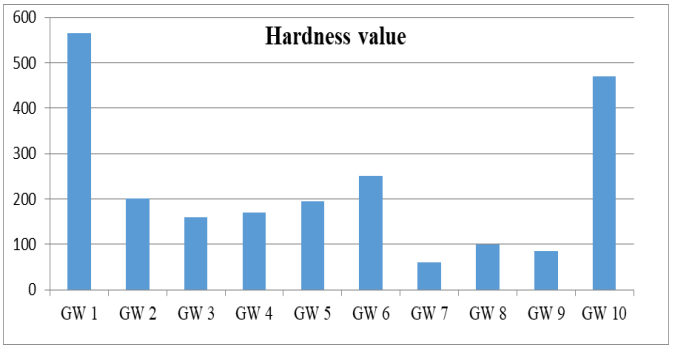

Fig 3

3. Calcium and Magnesium

The calcium and magnesium are directly related to hardness of water. Calcium concentration in the sample water was ranged between 26 mg/L to 56 mg/L and found below permissible limit of IS 10500 -1991. While magnesium content in the water samples was ranging between 16 mg /L to 54 mg /L. which were found within the prescribed limit.

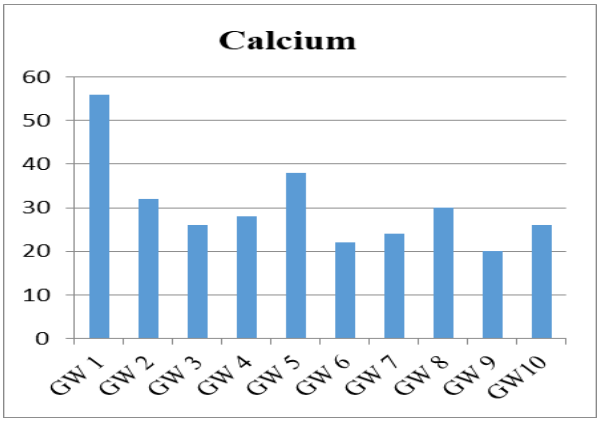

Fig 4

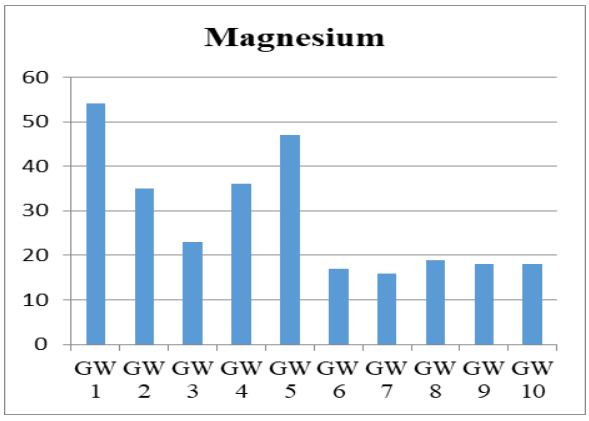

Fig 5

4. Total Dissolved Solids (TDS)

TDS is the presence of dissolved solids and it indicates the behavior of salinity in the groundwater. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies. But in unavoidable cases TDS level 1500 mg/L is also allowed [9]. TDS values in present investigation varied from 200 mg/L to 1680 mg/.L. GW 2, GW 3, GW 6 sample are slightly higher than desirable limit. GW 1 and GW 10 TDS values are near permissible limit.

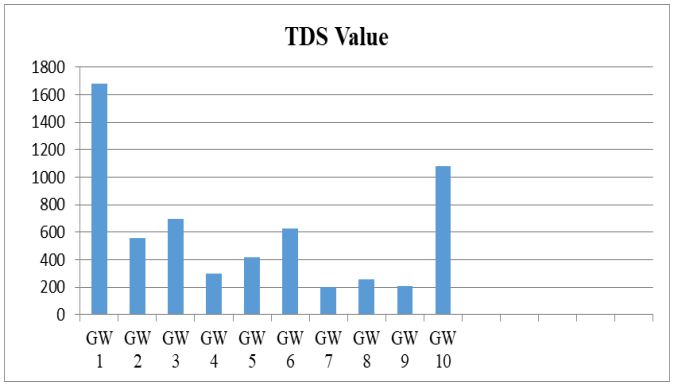

Fig 6

5. Chloride

The Department of National Health and Welfare, Canada (DNHW, Canada 1978) reported that the chloride in groundwater comes from natural and manmade sources like agricultural runoff, inorganic fertilizers, industrial and septic tank effluents, animal feed stocks. Chloride content ground water may result from both, natural and anthropogenic sources such as run – off containing salts, the use of inorganic fertilizers, landfill leachate, septic tank effluents, animal feeds, and seawater inversion in coastal areas [10]. Chloride is not harmful to human at low concentration, but could alter the taste of water at concentration above 250 mg/L. the values of chloride obtained in present investigation were in the ranges of 46mg/L to 397 mg/L. GW 1 sample was higher than desirable limit.

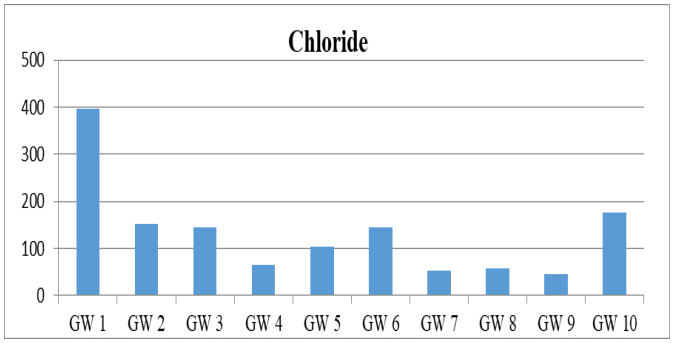

Fig 7

6. Sulphate

Sulphate is a nontoxic anion but ailment like catharsis, dehydration and gastrointestinal irritation have been linked with it's when concentration is high [11, 12]. concentration of Sulphate in water samples collected in present study ranged from 6 mg/L to 235 mg/L. GW 1 and GW 10 Sample values

are higher than desirable limit.

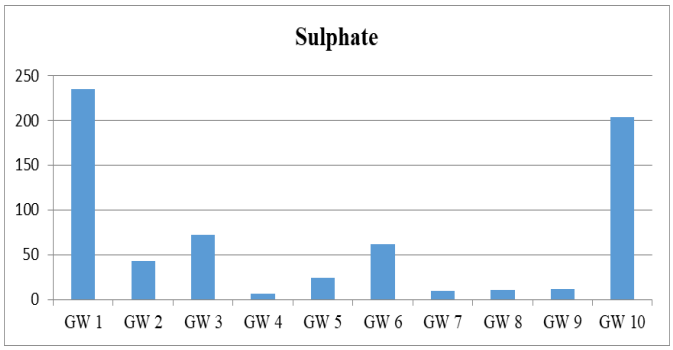

Fig 8

7. Nitrate

The nitrate content in all ground water samples are within permissible limits. The value ranges from 9 mg/L to 75 mg/L [13, 14]. But higher than desirable limits GW 1 and GW 2 Sample. Which indicate that the water quality in the study areas has no potential impact in terms of blue baby syndrome.

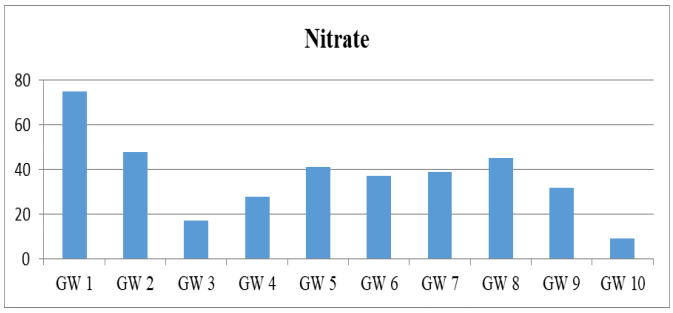

Fig 9

8. Fluoride

Fluoride content in higher concentration in water causes teeth mottling. The fluoride values in present study were in range of 0.2 mg/L to 1.15 mg/L [15] and found within the limit prescribed by IS 10500 – 1991. GW 5 sample has higher than prescribed limit.

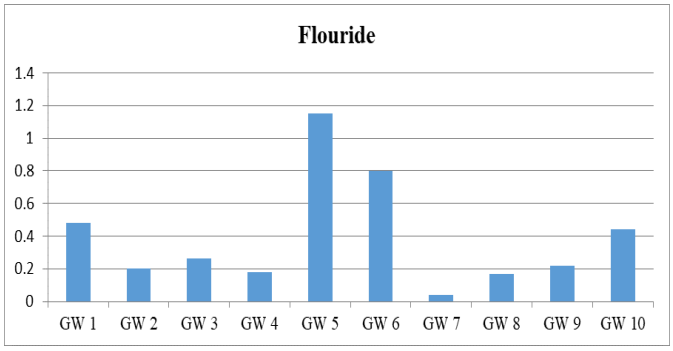

Fig 10

Conclusion

The moderately high concentrations of some ground water sample in P^H, TDS, Cl^-, SO_4^{2-}, NO_3^-, in groundwater were found near landfill which deteriorates its quality for drinking and other domestic purposes. As there is no natural or other possible reason for high concentration of these pollutants, it can be concluded that leachate has significant impact on groundwater quality in the area near landfill sites. The quality of the groundwater was found to improve with the increase in depth and distance of the well from the landfill site. Although, the concentrations of few contaminants do not exceed drinking water standard even then the groundwater quality represent a significant threat to public health. Regular monitoring must be carried out over a large period, in order to verify the influence of seasonal variations on the contaminant concentrations with time. Developing countries should strictly implement integrated waste management approach to handle large volume of wastes and protect environment. The study suggested to the cuddalore municipality create awareness among the people surround to the kammiyampet and other dump yard to consume groundwater after proper treatment to lead healthy lives.

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