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

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Abstract
Solid waste management is both a town and village problem. Every person is a Produced of waste and thus a grantor 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 Tamil Nadu. The quality of water bodies depends on their chemical and microbial characteristics. In most of the countries solid wastes are being discarded on land in open without adopting any prophylactic land filling practices. 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 assess 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 wastes are defined as those wastes from human and animal activities. Rapid population growth and urbanization in developing countries have led to the generations of enormous quantities of solid wastes.

Study of Area
Cuddalore district is the nerve center of the Cuddalore Taluk and the Cuddalore district. It is located at the water way of rivers Gadilam and Pennayar on Bay of Bengal. The township is at a distance of 200 Kms from south of Chennai, 24 Km south of Pondicherry and 44 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 flowing Population of about 20,000. The Cuddalore Township covers a total area of 27.69 km2 and is divided in to 8 prophylactic division and 45 political wards [2, 3]. The urbanization and industrialization has made rapid changes and enlarging residential areas. The lack of acceptable collection and treatment of MSW by Cuddalore Municipality Corporation has created greater challenges for waste management in the rapidly enlarging town.

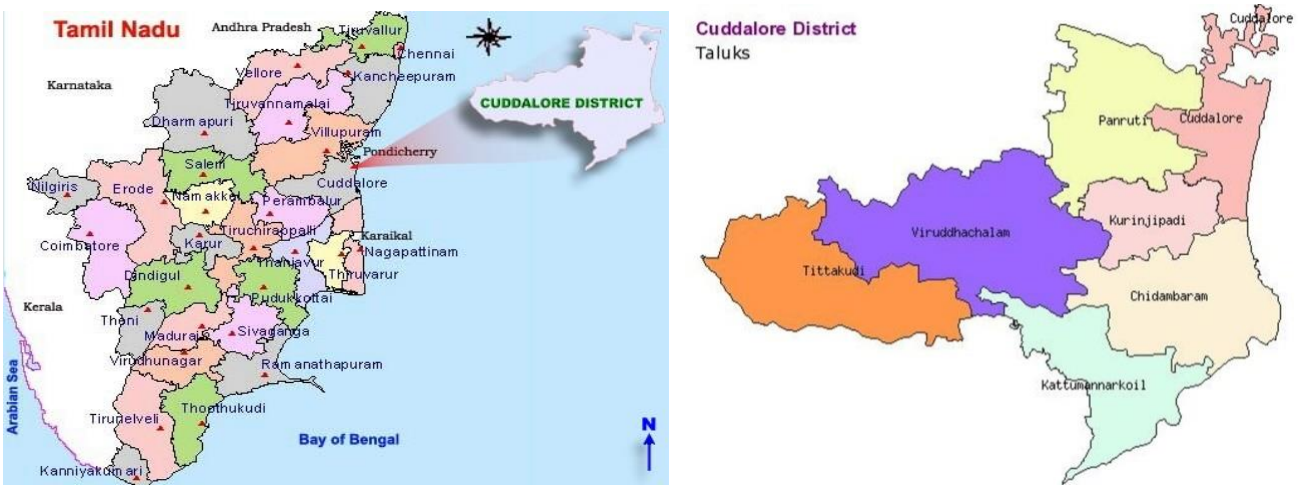

Fig 1: location of Cuddalore municipality

Climate

Cuddalore experiences a tropical wet and dry climate under the economic climate classification. In Tamil Nadu Cuddalore witnessing heavy rainfall in every northeast monsoon [2]. The highest 24 – hour rainfall registered 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 summary of ground water pollution caused by solid waste discarded. Three samples were collected from around the dumpsite in glass bottle. Water samples were analysis by using standard approach. Parameters analyzed were temp, pH, hardness, calcium, magnesium, total dissolved solids, total solids, total suspended solids, fluoride, chloride, sulphate, nitrate etc.,

Table 1: Average characteristic of water samples from different study locations in comparison with the permissible limits

S. N.	Parameters	Maximum Permissible limits IS 10500 : 1991	GW Sample 1	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.	Fluoride, 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 – spec IS 10500 : 1991.

Results and Discussion

1. P^H

The pH is used to considered the intensity of acidic or alkaline quality of solution. The pH controls the chemical state of many nutrients with 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).

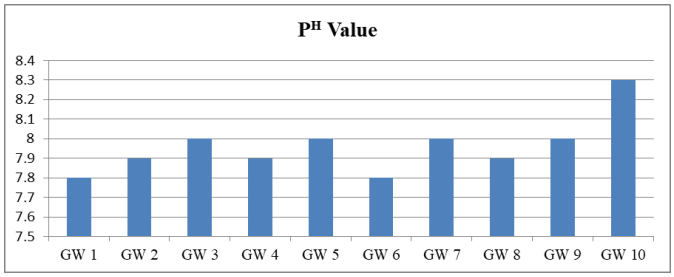

Fig 1: P^H Value

2. Hardness

Hardness is the resources of water which increases the blistering points of water. Hardness of water mainly confide in beginning with the amount of calcium or magnesium salts [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.

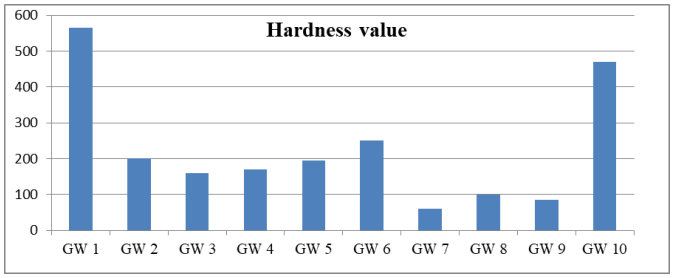

Fig 2: Hardness value

3. Calcium and Magnesium

The calcium and magnesium are precisely 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.

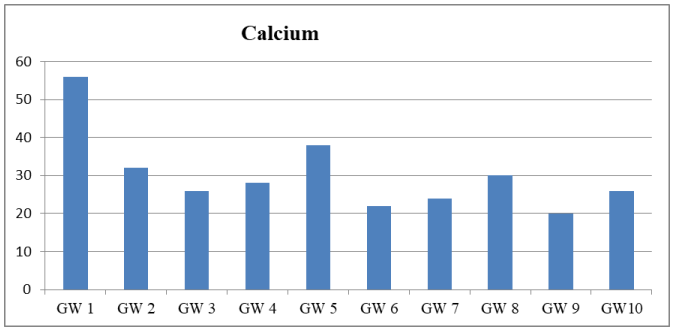

Fig 3: Calcium

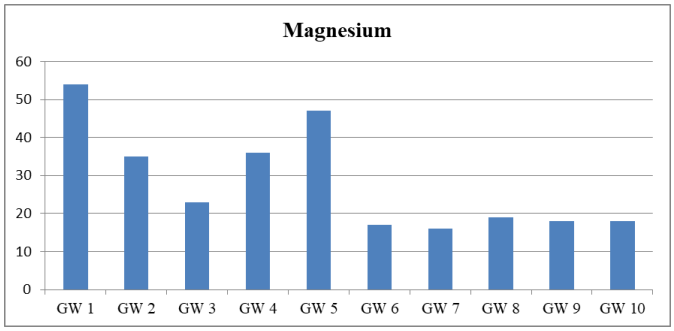

Fig 4: Magnesium

4. Total Dissolved Solids (TDS)

TDS is the presence of dissolved solids and it indicates the behavior of salinity in the groundwater. Water accommodate more than 500 mg/L of TDS is not considered fascinating 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.

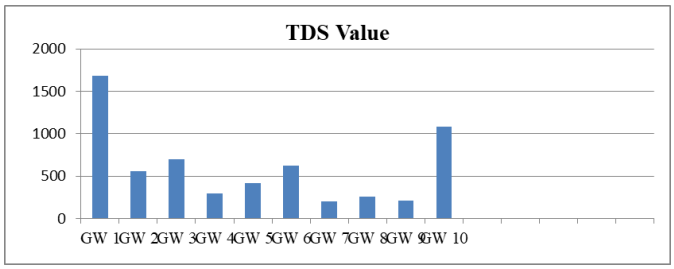

Fig 5: TDS Value

5. Chloride

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 destructive to human at low concentration, but could change the bitter 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.

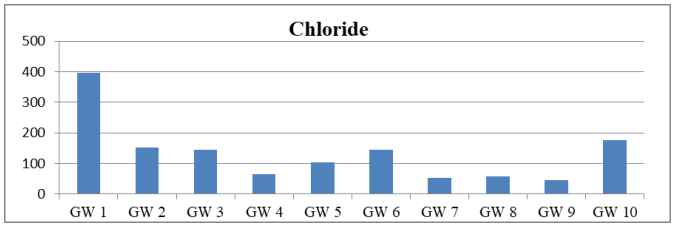

Fig 6: Chloride

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.

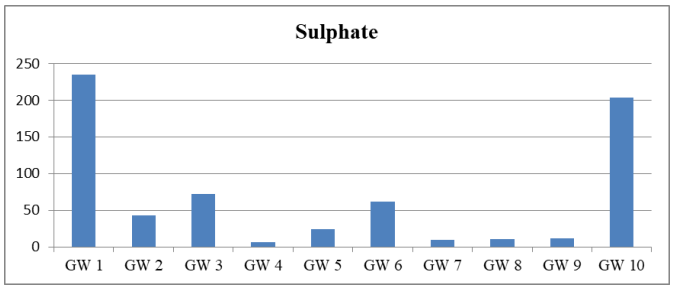

Fig 7: Sulphate

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.

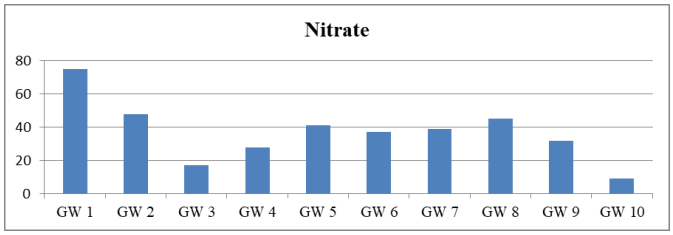

Fig 8: Nitrate

8. Fluoride

Fluoride content in over concentration in water creator 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.

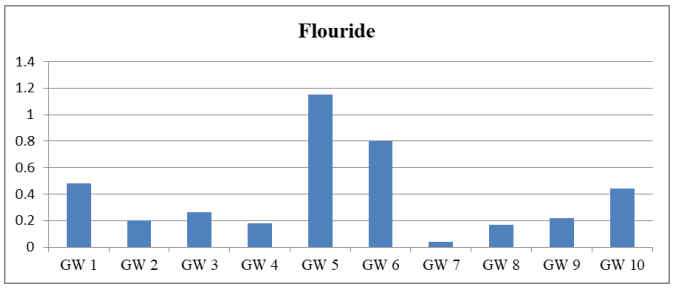

Fig 9: Fluoride

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 desirable reason for over concentration of these pollutants, it can be concluded that percolate has significant tremble on groundwater quality in the area near landfill location. The quality of the groundwater was begin to improve with the increase in extend and distance of the well from the landfill location. Although, the concentrations of few pollutants do not

exceed drinking water standard even then the groundwater quality represent a expressing threat to public health. Regular audit must be carried out over a large period, in order to verify the influence of seasonal variations on the pollutant 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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