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ANALYSIS OF PHYSICO-CHEMICAL CHARACTERISTICS OF GROUNDWATER IN KANCHIPURAM MUNICIPALITY, TAMIL NADU, INDIA

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ABSTRACT
A research study on groundwater quality was conducted in the Kanchipuram municipality during July 2015. Samples of ground water were collected from 17 different locations in the study area which is nearby in the municipal solid waste dump yard. Both physical and chemical parameters have been analysed to find the water quality and to understand the influence of solid waste dump yard. Physico-Chemical parameters such as Total Dissolved Solids (TDS), Electrical Conductivity (EC), pH, Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Free Ammonia (NH_3), Nitrate (NO_3), Chloride (Cl), Fluoride (F), Sulphate (SO_4) and Phosphate (PO_4) were tested. Global Positioning System (GPS) was used to identify the location. By using Geographical Information System (GIS) spatial map of the study area with sample locations was prepared. Water Quality Index (WQI) was calculated for the study area to know the quality of groundwater.
Keywords: Groundwater, Physico-Chemical, GPS, WQI

INTROUDCTION

The quality of groundwater is essential for the drinking purpose of living organisms. Apart from the drinking purpose groundwater is used in many activities like agriculture, industry, domestic purpose, etc. Solid waste landfill is one of the common practices of waste disposal in developing countries. Possibilities of groundwater contamination are more nearby to the landfill area. Due to dumping of municipal waste quality of groundwater may get affected[1]. Groundwater is one of the valuable renewable natural resource not only for living purposes and also for economic development. The migration of leachate causes groundwater pollution in the dump yard surroundings. The increase in population reflects in solid waste generation, it results in the expansion of the landfill area. The uncontrolled landfill leads to serious groundwater pollution threat. The pollutant may reach the environment through different ways, such as seepage from landfill, runoff of animal waste, sewer lines etc[2-3]. Provision of groundwater for drinking purpose under desirable limit suggested by standards is mandatory. GPS techniques are used to identify the location of the earth surface features. GIS is used to incorporate the GPS location information and to do further analysis. The water quality index of a particular area is essential to understand the quality of water in that area.

Study Area

The study is conducted in the Kanchipuram municipality dump yard surrounding wards groundwater. Kanchipuram is one of the famous city of temples in South India. It is located 72 kms from the Tamil Nadu state capital Chennai. The geographic location lies between 12º46'30'' - 12º52'00'' North Latitude and 79º 39'00'' - 79º46'20'' East longitude. The sample location latitude and longitude coordinates are

shown in Table-3. The population of Kanchipuram municipality is 164384 (Census 2011). According to municipality data the solid waste generated is 450 grams per capita per day. The Kanchipuram municipality, location is shown in Fig-1 and Fig-2 shows the study area location in Kanchipuram municipality.

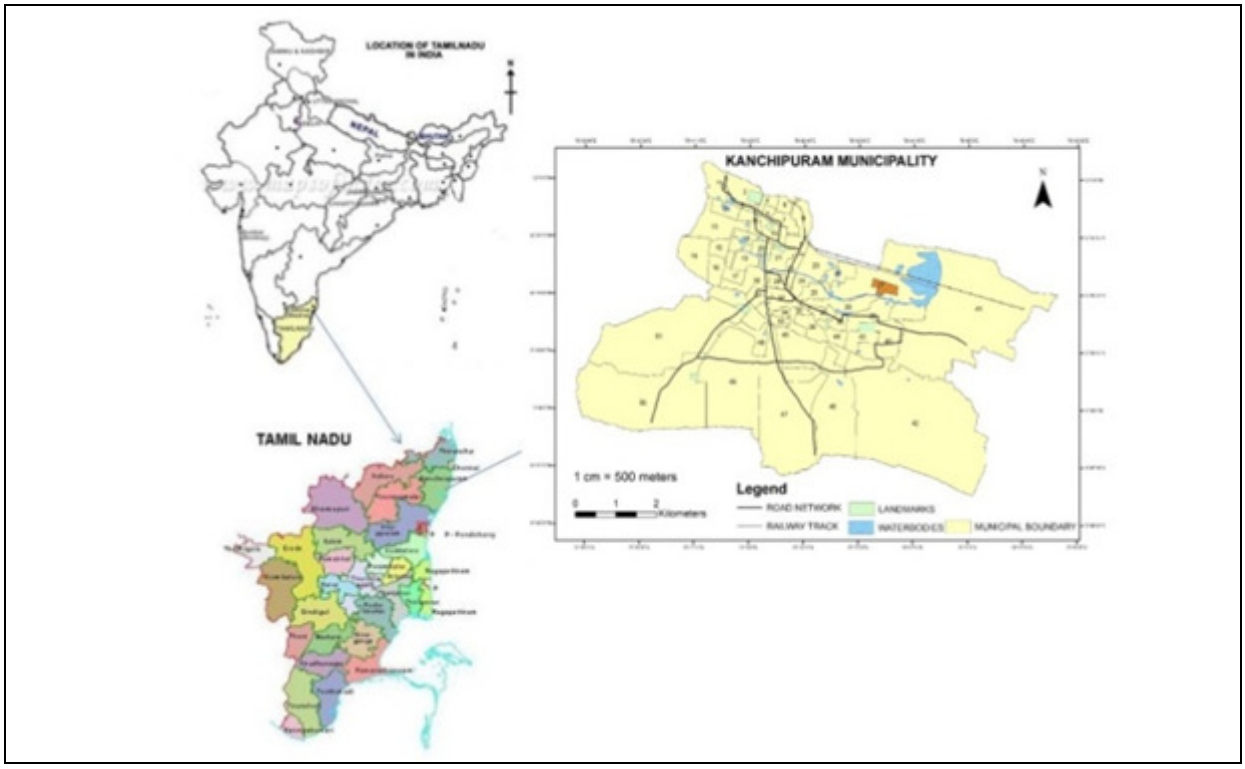

Fig-1: Kanchipuram Municipality

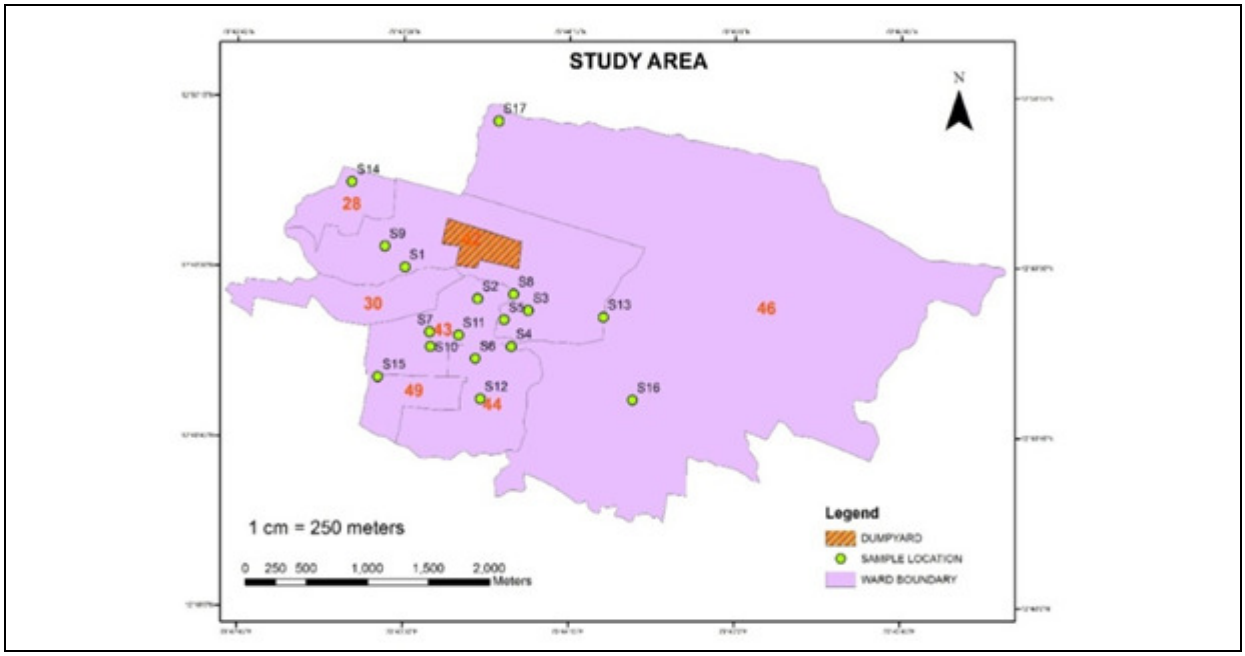

Fig-2: Study Area Location

EXPERIMENTAL

In this study 17 samples are collected from different locations bore well after pumping the water for 10 minutes. For water sample collection continuous pumping for 10 minutes were adopted[4]. The standard groundwater sample collection procedure was adopted to collect the water sample. Collection of water samples has been done by using previously washed and dried polythene bottle[5-6]. Collected samples are tested in laboratory within 12 hours from the time of sample collection. All the physical and chemical parameters are tested as per BIS 10500-2012. In this study 15 parameters are analysed to understand the groundwater quality in the study area.

RESULTS AND DISCUSSIONS

The laboratory result of the collected water samples has been shown in Table-1. The test result was compared with the standards (WHO/BIS) for drinking water. It is mandatory to monitor the drinking water for healthy life[7]. It has been identified in some parameter values are exceeded the desirable value suggested by WHO and BIS standards.

Table-1: Physico-Chemical parameters of the water samples (All parameters, units are in mg/L except EC and pH)

Parameter	TDS	EC	PH	TA	TH	Ca	Mg	Fe	Mn	NH_3	NO_3	Cl	F	SO_4	PO_4
Sample1	1514	2321	7.1	411	621	145	59	0.6	0	0	35	431	0.5	241	0.18
Sample2	1315	1621	7.5	332	641	162	75	0.3	0	0.3	23	228	0.9	141	0.4
Sample3	1412	1932	7.9	331	612	163	89	0.2	0.1	0.1	29	341	0.3	231	0.4
Sample4	2814	3841	7.4	475	799	211	76	0	0	0	42	774	0.8	264	0
Sample5	1300	1793	7.5	356	519	111	61	0.2	0	0.2	27	319	0.2	179	0.1
Sample6	1180	1813	7.5	201	278	64	37	0	0	0	34	329	0.4	179	0
Sample7	1168	1751	7.5	209	319	65	33	0	0	0	35	345	0.5	175	0
Sample8	1471	2040	7.4	311	589	139	79	0.3	0	0.3	25	386	0.7	209	0.1
Sample9	1041	1525	7.4	199	235	69	31	0.2	0	0.2	24	232	0.7	171	0.19
Sample10	829	1155	7.4	189	345	78	43	0	0	0	19	186	0.4	107	0
Sample11	1771	2532	7.2	409	589	135	68	0	0	0	21	415	0.25	278	0
Sample12	1210	1759	7.2	224	308	68	41	0	0	0	33	355	0.7	199	0
Sample13	845	1195	7.6	302	351	75	49	0	0	0	23	175	0.4	112	0
Sample14	1125	1599	7.45	153	339	80	41	0	0	0	34	349	0.4	191	0
Sample 15	1145	1641	7.5	245	271	59	30	0	0	0	29	342	0.7	151	0
Sample 16	779	1121	7.1	289	372	73	46	0	0	0	15	171	0.5	83	0
Sample17	395	559	7	195	172	37	24	0	0	0	14	59	0.5	30	0

Total Dissolved Solids, Electrical Conductivity and pH

The laboratory results show the TDS of water samples were varied from 395 mg/L to 2814 mg/L. Sample number 17 only has less TDS value as per the desired limit suggested by WHO. The EC values range from 559 to 3814 Micro mho/cm. The desirable value is 1000 as per standards, except sample number 17 all samples are having greater value. The pH results were varied from 7.00 to 7.90. The higher value of pH may cause difficulties in the chlorination process for disinfection of drinking water[8]. All the collected samples are below the desirable level of pH, i.e., 6.5-8.5 as per standards.

Total Alkalinity, Total Hardness and Calcium

The total alkalinity desired value is 200 mg/L as per BIS. The value of total alkalinity ranges from 153 mg/L to 475 mg/L. Five sample locations are under desirable value (Sample 1, Sample 9, Sample 10, Sample 14 and Sample 17). Sour taste and salinity may happen due to the high alkalinity presence in water[9].The value of total hardness is varied from 172 mg/L to 799 mg/L. The desirable value is 300 mg/L as per WHO standards. There is a possibility of kidney stone and heart diseases due to continuous use for drinking purpose[10]. Four samples (Sample 6, Sample 9, Sample 15 and Sample 17) are in desirable value as per standards. In calcium the laboratory results varied from 37 mg/L to 211 mg/L. The desirable value is 75 mg/L as per WHO standard. Seven samples (Sample 6, Sample 7, Sample 9, Sample 12, Sample 15, Sample 16, and Sample 17) are under desirable value as per WHO.

Table-2: Water quality Standards and Relative Weight for each parameter.

Parameters	Standards	Recommended Agency	Weight (w_i)	Relative Weight (W_i)
TDS	500	WHO/BIS	5	0.13
EC	1000	BIS	1	0.03
PH	6.5-8.5	WHO/BIS	1	0.03
TA	200	BIS	4	0.10
TH	300	BIS	4	0.10
Ca	75	WHO/BIS	2	0.05
Mg	50	WHO	2	0.05
Fe	0.3	WHO/BIS	5	0.13
Mn	0.1	WHO/BIS	1	0.03
NH_3	0.5	BIS	3	0.08
NO_3	50	WHO	2	0.05
Cl	250	WHO/BIS	2	0.05
F	1.5	WHO	2	0.05
So_4	200	BIS	3	0.08
PO_4	1	WHO/BIS	3	0.08
		Total	40	1.00

Magnesium, Iron and Manganese

Magnesium values vary from 24 mg/L to 89 mg/L. The desirable level is 50 mg/L as per WHO standards. In Collected samples ten samples are in desirable level (Sample 6, Sample 7, Sample 9, Sample 10, Sample 12, Sample 13, Sample 14, Sample 15, Sample 16 and Sample 17). Iron desirable value is 0.3 mg/L, sample 1 only having high value i.e. 0.6 mg/L. Iron value ranges from 0.0 mg/L to 0.6 mg/L. WHO and BIS standards were used to compare the laboratory test results in the study area[11]. Manganese the desirable value is 0.1 mg/L. The values vary from 0.0 mg/L to 0.1 mg/L.

Free Ammonia, Nitrate and Chloride

The free ammonia value ranges from 0.0 mg/L to 0.3 mg/L, the desirable level is 0.5 mg/L. Nitrate value is between 14 mg/L to 42 mg/L. As per WHO standard nitrate desirable level is 50 mg/L. Presence of high chloride leads to harms in metallic pipes and also in agricultural crops[12]. The chloride desirable level is 250 mg/L as per standard, the value ranges between 59 mg/L to 774 mg/L in the study area. Six

samples (Sample 2, Sample 9, Sample 10, Sample 13, Sample 16 and Sample 17) are in desirable level. For both animals and plants, excess amount of chloride is harmful[13].

Fluoride, Sulphate and Phosphate

Fluoride range is in between 0.20 mg/L to 0.90 mg/L, the desirable level is 1.5 mg/L as per WHO. Sulphate value varies from 30 mg/L to 278 mg/L, as per BIS the desirable level is 200 mg/L. Except five samples (Sample 1, Sample 3, Sample 4, Sample 8 and Sample 11) all other samples are in desirable level. A Toxic level is increasing in groundwater due to pollutant[14]. Phosphate value varies from 0.0 mg/L to 0.40 mg/L, the desirable level is 1.0 mg/L. Both fluoride and phosphate are under desirable level for all the 17 samples.

Water Quality Index

This technique is used to identify the influence of individual water quality parameters based on rating it. Mathematical approach can be made to identify the groundwater quality[15].The water quality index results are used to determine the suitability of water for drinking purposes. The water quality standard weight is assumed to be inversely proportional to the standards recommended value. Water quality identification is important to full fill the requirement of drinking water in towns[16]. Table-2 shows the standards with the weight and relative weight. Table-3 shows the result of water quality index of seventeen collected groundwater samples in the study area. Water quality is classified based on WQI value, less than 50 is excellent water, 50-100 is good water, 100-200 is poor water, 200-300 is very poor water and greater than 300 is unfit for use.

Table-3: Sample GPS location and Water quality.

Sample	Latitude	Longitude	WQI	Water Quality
Sample1	12.825	79.725	169.45	Poor Water
Sample2	12.823	79.731	141.31	Poor Water
Sample3	12.822	79.734	148.67	Poor Water
Sample4	12.819	79.733	215.48	Very Poor Water
Sample5	12.821	79.733	129.57	Good Water
Sample6	12.818	79.730	94.39	Good Water
Sample7	12.820	79.727	96.40	Good Water
Sample8	12.823	79.733	150.42	Poor Water
Sample9	12.826	79.724	96.30	Good Water
Sample10	12.819	79.727	74.89	Good Water
Sample11	12.820	79.729	146.87	Poor Water
Sample12	12.815	79.731	100.72	Poor Water
Sample13	12.821	79.740	81.80	Good Water
Sample14	12.835	79.719	94.88	Good Water
Sample 15	12.817	79.723	93.93	Good Water
Sample 16	12.815	79.742	77.48	Good Water
Sample 17	12.836	79.732	41.98	Excellent

CONCLUSION

The laboratory analysis results show the physical and chemical properties of the collected groundwater samples are affected by pollution. Few samples have exceeded the desirable limit of drinking water based on the comparison of test results with the recommended desirable values suggested by WHO and BIS. Water quality index values range from 41.98 to 215.48, it has been classified into very poor, poor, good and excellent categories. This study indicates the influence of solid waste dump yard because the sample locations which are nearby in the dump yard affected more. It is recommended to treat the water before consuming it for drinking purposes.

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REFERENCES

1. J.Abdul Bari, G.Vennila and T.M.Shanmugaraja, *Rasayan Journal of Chemistry*, **8(2)**, 198(2015).
2. M .Wu, D.Atchley, L.Greer, S.Janssen, D.Rosenberg and J.Sass, Natural Resources Defense Council White Paper, 60(2009).
3. Chanti Babu Patneedi and K. Durga Prasadu, *Rasayan Journal of Chemistry*, **8(1)**, 67(2015).
4. R.Shyam and G.S. Kalwania, *Journal of Natura Conscientia*, **1(3)**, 233(2010).
5. Durga Karthik, K.Vijayarekha and M. Sugany, *Rasayan Journal of Chemistry*, **8(4)**, 487(2015).
6. R. K. Trivedy and P .K. Goel, Chemical and Biological Methods for Water Pollution Studies, Environmental Publication, Karad, pp. 45-150 (1986).
7. Chanti Babu Patneedi and K. Durga Prasadu, *Rasayan Journal of Chemistry*, **8(1)**, 67(2015).
8. Prasad B. Guru, *Environ and Poll. Technol.*, **2(3)**, 273(2003).
9. P. Thamilarasu and R. Sharmila, *Rasayan Journal of Chemistry*, **8(1)**, 92(2015).
10. S. Lalitha, *Ind. J. Environ.l Protect.,* **24(12)**, 925(2004).
11. D. Virkar Dattatray, *Rasayan Journal of Chemistry*, **8(3)**, 355(2015).
12. C. Suresh, B.D. Tripathi and B.P. Mishra, *Com. Physico. Eco.,* **17(3)**,92(1992).
13. S. Mitharwal, R. D. Yadav and R. C. Angasaria, *Rasayan Journal of Chemistry*, **2**, 920, (2009).
14. K. Sneka Lata, A. Jesu and M.S. Dheenadayalan, *Rasayan Journal of Chemistry*, **8(3)**, 380(2015).
15. Durga Karthik, K.Vijayarekha and M. Sugany, *Rasayan Journal of Chemistry*, **8(4)**, 487(2015).
16. K.M. Sharma, Rolli Pandey, Md. Umar Farooq and Mridul, Jain, *Rasayan Journal of Chemistry*, **8(1)**, 42(2015).

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