Assessment of Groundwater Quality by Water Quality Index for Perungudi, Chennai

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Abstract: *Groundwater is the major source of drinking and for domestic uses. The usage has been reduced due to contamination and overexploitation of groundwater. Water quality index is an indicator used to determine the type of water. The study was carried out with the groundwater pollution caused by solid waste dumpsite in perungudi area located south of Chennai, Tamilnadu. From the study we have identified that the location nearby the dumpsite has been contaminated and suitable measures must be needed to safeguard the quality of ground water.*
Keywords: Water quality Index, Groundwater

I. INTRODUCTION

Groundwater is the major source of drinking and it can be used for domestic purposes. It should be free from impurities. Solid waste contamination is one of the major threats to groundwater which affects the quality of water. It is a duty of an individual to protect water for the future generation.

II. WATER QUALITY INDEX

Water Quality Index is one of the most effective tools to communicate information on the quality of water to the concerned citizens and policymakers. It is an important parameter for the assessment and management of ground water. The index of water quality has been divided into five categories: Excellent, good, poor, very poor and unsuitable for drinking.

III. SCOPE OF THE STUDY

The water quality of groundwater in this area has deteriorated mainly due to extensive solid waste dumpsite seriously affected due to the combined effect of industrialization and urbanizations there is no natural or other possible reason for high concentration of these pollutants, it can be concluded that landfill site has significant impact on groundwater quality in the area It is high time that the suffering of the people had to be relieved by taking proper policy action. Awareness should be done to reduce contamination.

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IV. OBJECTIVES OF THE STUDY

1. To collect water sample from the given location (Perungudi).

2. The water quality parameters such as pH, EC, TDS, Chlorides, Alkalinity, Turbidity, Calcium, Magnesium, Carbonate, Sulphate, Nitrate and Fluoride will be analysed to compute WQI by using weighted arithmetic mean method.

V. DESCRIPTION ABOUT STUDY AREA

Perungudi is a neighbourhood of Chennai in the state of Tamil Nadu. Perungudi houses one of the two major landfills in Chennai.
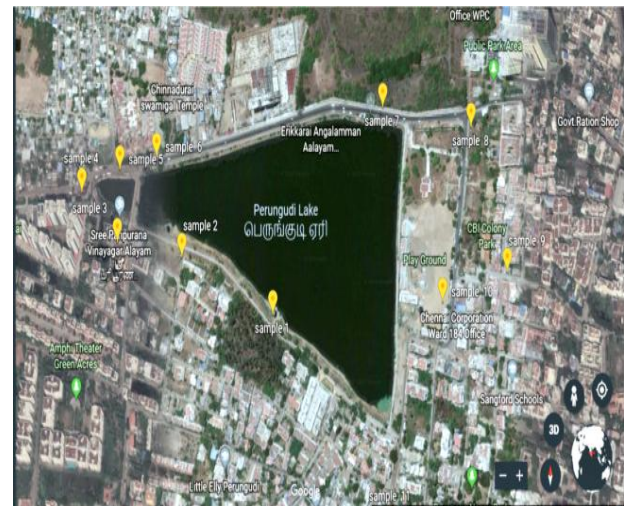

Fig 1. Sample location

VI. SAMPLE COLLECTION

The groundwater samples were collected from the 11 locations around the Perungudi Lake and analyzed for 15 physicochemical parameters. The parameters Electrical conductivity, pH, Calcium, Magnesium Sodium, Potassium, Bicarbonate, Carbonate, Sulfate, Chloride, Nitrate, Fluoride, Total dissolved solids, Total hardness, Total alkalinity were analyzed in the laboratory as per the standard procedure of APHA.

VII. METHODOLOGY

Water quality data sampling was carried out during January (pre–monsoon) by using GPS survey. A total of eleven water samples were collected from the selected locations throughout the study area. The latitude and longitude values of the selected sampling locations are given in Table 1.

Table I. Groundwater sampling locations

Sample No	Latitude	Longitude
1	12.965774	80.238801
2	12.966404	80.237088
3	12.966589	80.235872
4	12.967136	80.235181
5	12.967392	80.235914
6	12.967524	80.240879
7	12.968074	80.240879
8	12.96786	80.242547
9	12.966253	80.243245
10	12.965908	80.242028
11	12.963384	80.241039

VIII. WQI CALCULATION

First of all, each of the 11 parameters has been assigned a weight (wi) from 1 to 5 according to its relative importance in the overall quality of water for drinking purposes. The maximum weight has been assigned to the parameter with major importance in water quality assessment. The relative weight (Wi) is calculated from the following equation

$$W_i = w_i / \sum_{i=1}^{n} w_i \qquad (1)$$

Where, W_i is the relative weight, w_i is the weight of each parameter and n is the number of parameters.

C_i is the concentration of the parameter, by using C_i, a quality rating scale (q_i) for each parameter is arrived by dividing its concentration of the parameter in each water sample by its respective standard according to the guidelines given by WHO.

$$q_i = (C_i / S_i) \times 100 \qquad (2)$$

The sub index parameter SI is determined for each chemical parameter, which is then used to determine the WQI as per the following equation

$$SI_i = W_i \cdot q_i \qquad (3)$$
$$WQI = \sum SI_i \qquad (4)$$

SI_i is the sub index of i parameter; qi is the rating based on concentration of I Parameter and n is the number of parameters.

Table II. Physiochemical parameters of Post monsoon season

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	Average
Electrical conductivity	3170	1250	5000	2100	1820	2860	8170	4790	4620	4710	2020	3631.8
PH	6.8	7.1	6.5	6.7	6.9	6.8	7.2	8.5	7.4	7.4	7.2	7.1
Calcium	40	16	168	74	66	116	220	80	168	120	116	107.8
Magnesium	51	15	97	105	57	75	134	88	83	73	12	71.8
Sodium	580	239	773	200	235	382	603	771	766	807	304	516.3
Potassium	11	2	0	0	0	0	0	125	13	1	7	14.4
Bicarbonate	232	43	293	464	458	366	525	268	519	610	415	381.1
Carbonate	0	0	0	0	0	0	0	120	0	0	0	10.9
Sulfate	288	64	456	195	165	241	475	393	330	315	77	272.6
Chloride	723	347	1191	351	291	330	2233	993	1166	1049	425	821.7
Nitrate	19	1	40	16	43	14	4	41	48	20	71	34.2
Fluoride	0.27	0	0	0.11	0.4	0.6	0.43	0.73	0.42	0.63	0.16	0.3
Total dissolved solids	1828	706	2872	1173	1086	1341	4022	2796	2714	2691	1220	2040.8
Total hardness	310	100	820	615	406	600	1100	560	760	600	340	564
Total alkalinity	190	35	240	380	375	300	430	420	425	500	340	330.4

IX. WATER QUALITY INDEX

Water quality index was computed to identify the groundwater suitability for drinking purposes. The WQI of the water collected during post -monsoon season has been computed and given in the Table IV.

Table III. WQI range and its corresponding water type

Range	<50	50-100	100-200	200-300	>300
Type	Excellent	Good	Bad	Very bad	unsuitable

Table IV. WQI for post-monsoon

Sample No	WQI	Quality of water
1	77.5	Good
2	29.53	Excellent
3	124.2	Poor
4	44.8	Excellent
5	50.4	Good
6	66.1	Good
7	182.2	Poor
8	118.7	Poor
9	119.1	Poor
10	116	Poor
11	51.7	Good

X. CONCLUSION

Groundwater samples were collected from bore wells (BW), open wells (OW), and Hand Pumps (HP), in different locations and was analyzed for their physicochemical characteristics around Perungudi Chennai District, Tamil Nadu. The ground water samples were studied during pre-monsoon (January - March 2018) seasons from 11 different places.

The present study was undertaken to characterize the physicochemical parameters such as pH, Electrical Conductivity (EC), Hardness (H), Total Hardness (TH), Chloride (Cl), Total Dissolved Solids (TDS). Each parameter was compared with its standard permissible limit as prescribed by World Health Organization© (WHO). The Water Quality Index (WQI) was calculated and it reflected that 19% of the samples were of excellent quality in post monsoon, 27% of samples were of good quality and 54% of samples were of poor quality.

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