

## **Study on groundwater quality in and around sipcot industrial complex, area cuddalore district,tamilnadu.**

**Inbanila.T, Arutchelvan.V**

*Department of civil Engineering, Annamalai university,Chidambaram, India.*

### **ABSTRACT**

*STATE INDUSTRIES PROMOTION CORPORATION OF TAMIL NADU(SIPCOT) cuddalore phase 1 has established in 1984 at an extent of 518.79 acres. currently between 26 and 29 functional units are lie within phase1 of the industrial estates.At least 10 villages lie within or in the vicinity of the industrial complex. Till date no sites has been developed for secure storage of hazardous wastes generated by the industries in the estate. In absence of such facilities factories have dumped these wastes on neighbouring lands and in open pits. By the industries own admission,out of the 20 million litres of fresh water required by the companies, 18 million litres (90%) of the water is released back to their environment as toxic effluents.These poisons have leached into the ground water and contaminated the water resources of communities living around the factory. This study was carried out to asses the Quality of ground water in and around SIPCOT industrial complex in cuddalore district. The Quality was assessed in terms of physico chemical parameters.Ground water samples were collected from 30 locations in and around the study area and analyzed (APHA,1998) to know the present status of the Ground water Quality. The results were compared with standards prescribed by ISI 10500-91.It was found that the ground water was contaminated at few sampling locations.The remaining locations shows that the parameters are within the desirable limits and fit for drinking purpose.*

**Keywords:** *Ground water, water Quality,SIPCOT.*

### **I. INTRODUCTION**

Ground water is water that found underground in voids and fractures,cracks and space in soil. Ground water forms a major source of drinking water foe the urban and rural population of India.Besides being the primary source of water supply for domestic use,it is almost the most source of irrigation. It has become evident that the ground water has been a major contribution to meet the ever increasing depend of water .Ground water is a gift of nature, is about 210 billion m<sup>3</sup> includes recharge through infiltration, seepage and evaporation. The salinity intrusion and industrial pollution of ground water are to key reasons for deterioration of water quality. The objective of this study is to analyze the quality of ground water due to the discharge of waste from SIPOT industries.

### **II. STUDY AREA**

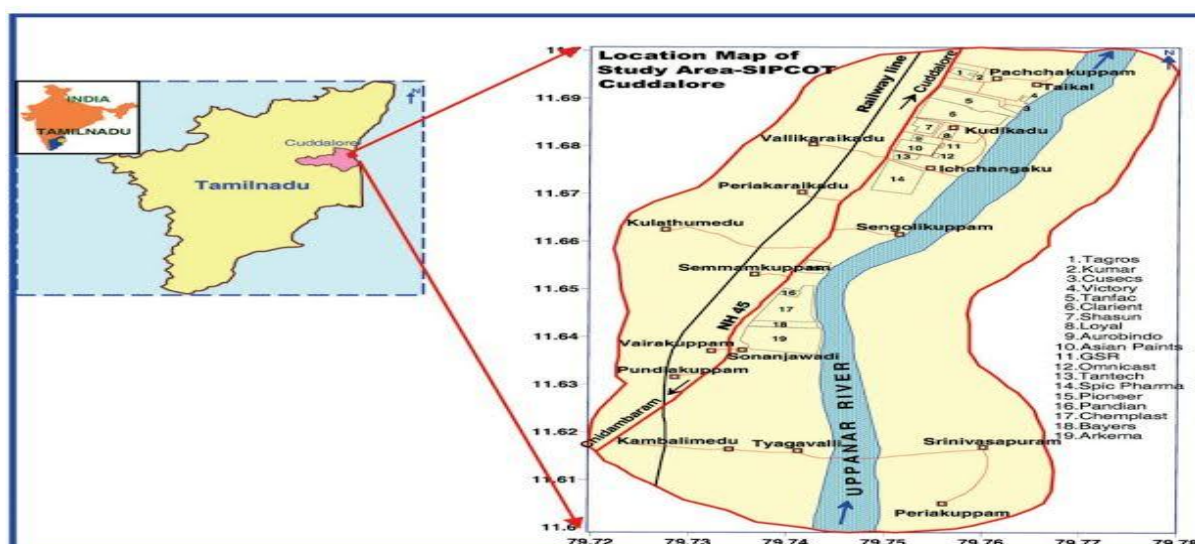
Cuddalore is the heartland of Tamilnadu,located 200km south of chennai and lessthan 25km south of Pondichery is a developing industrial city,lying between latitude 11 43 north and longitude 79 49 east. It is the port town from ancient times with historical trades lies to the occident and the orient.The 27 sq.km district comprises 6 taluks and136 panchayat villages. Bore well water is using for drinking and irrigation purpose in this district.SIPCOT has established in 1984 at an extent of 518.79 acres.

It is located 8 km from Cuddalore to Chidambaram road,stretching from Pachaiyankuppam in the north to semmankuppam in the south.Phase II will cover 88 hectares(200 acres).curently between 26 and 29 functional units are lieing within phase I of the industrial estate on the western bank of the river uppanar.these companies manufacture pesticides and pharmaceuticals and intermediates,chemicals,plastics and plastics additives,dyes and intermediates and textiles.

At least 10 villages lie within the vicinity of the industrial complex. At least 2000 peoples are estimated to be lying in the potential impact of SIPCOT taken taken from SIPCOT area community environmental monitors.

The village pachaiyankuppam is located at the north of the SIPCOT complex behind tagro's chemicals. Kudikadu lies on the eastern side of vanavil dyes and shasun chemicals uppanar towards band of uppanar behind asian paints. Echaukadu is located between pharma to the south and tanfac agro chemicals in the north. Sangolikuppam lies near the north of pioneer chemical. Semmakuppam lies immediate south of pioneer miyagi chemicals and sonnanchavadi is located on the southern end of sipcot, south of Aerokema peroxides and bayer. Groundwater was earlier available at 30 feet or less is now difficult to find even at 800 feet according to sipcot residents .

The study area receives about an annual rainfall of 1,162mm. Ground water in the area is overexploited for agriculture and industrial purposes are predominant land use , which includes sailing in the coastal aquifers.



### III. MATERIALS AND METHODS

To assess ground water Quality in and around SIPCOT area, 30 sampling locations are selected in around the study area. Water samples were collected during pre-monsoon season during (20.8.2012). Samples were analyzed for different physico-chemical parameters such as pH, Electrical conductivity(EC), Total Dissolved solids(TDS), Turbidity, Total Alkalinity(TA), Total Hardness(TH), Calcium (Ca), Magnesium ( $Mg^{2+}$ ), Sodium(Na), Potassium (K), Chlorides(Cl), Nitrate( $NO_3$ ), Sulphate( $SO_4$ ), etc as per the standard procedure APHA (1995).

### IV. RESULT AND DISCUSSION

Table:1 The analytical results are given in Waterquality Standards for drinking water

S.NO	PARAMETER	ISI 10500-91
1.	PH	6.5-8.5
2.	POTASSIUM	=
3.	TDS	500
4.	TURBIDITY	10
5.	TOTAL ALKALINITY	200
6.	TOTAL HARDNESS	300
7.	CALCIUM	75
8.	MAGENESIUM	30
9.	SODIUM	200
10.	IRON	0.3
11.	MANGANESE	0.1
12.	CHLORIDE	250
13.	FLUORIDE	1.5
14.	SULPHATE	200
15.	NITRATE	45

All the parameters are in mg/l, except pH and turbidity in NTU.

The values are compared with BIS standard for drinking water IS: 10050:1991  
The findings are discussed below.

Table-2  
Physico-chemical characteristics of groundwater of in and around sipcot area, cuddalore

S.N O	HABITATION	SEASON	TUR B	EC	TDS	PH	T.AL K	T.H	CA	MG	NA	K	FE	M N	N O 3	CL	F	SO4
1	THIRUCHIOPURAM	PRE-MONSOON	1.0	515	361	7.1	95	160	43.2	12	28	9	0.0	0	7	77	0.4	29
2	THIYAGAVALLI	PRE-MONSOON	1	1090	763	6.8	172	288	65.6	30	76	27	0.0	0	3	220	0.3	25
3	LENNINAGAR	PRE-MONSOON	0.6	290	203	6.7	65	100	25.6	9	12	5	0.00	0	6	40	0.1	4
4	AMBETHKARNAGAR	PRE-MONSOON	0.8	205	144	6.6	69	70	16	7	31	9	0.16	0	2	19	0	3
5	PERIYARNAGAR	PRE-MONSOON	0.9	440	308	6.5	82	152	36.2	15	18	6	0.0	0	2	90	0.1	25
6	NADUTHITTU	PRE-MONSOON	1	320	224	7.1	65	120	41.6	4	9	3	0.0	0	3	54	0.0	6
7	NOCHIKADU	PRE-MONSOON	2.6	445	312	7.0	129	176	36.8	20	11	4	0.40	0	2	36	0.0	26
8	CHITHIRAI PETTAI	PRE-MONSOON	1.5	535	375	7.3	168	200	48	19	52	13	0.13	0	3	65	0.1	31
9	POONDIYANKUPPAM	PRE-MONSOON	2.6	180	126	6.6	17	56	96	8	10	3	0.40	0	9	34	0.1	12
10	MANDAPAM	PRE-MONSOON	1	2600	182	6.6	22	80	19.2	8	14	6	0.0	0	3	65	0.1	13
11	SEMMANKUPPAM	PRE-MONSOON	1.3	530	371	6.7	108	210	48	22	70	25	0.13	0	7	537	0.4	31
12	SEMMANKUPPAM COLONY	PRE-MONSOON	1.5	550	385	6.6	206	160	40	14	51	14	0.13	0	3	28	0.1	11
13	SONANCHAVADI	PRE-MONSOON	1.6	815	571	7.1	215	248	44.8	33	47	12	0.27	0	3	108	0.1	7
14	SONANCHAVADI METTUTHERU	PRE-MONSOON	1	605	424	6.6	65	152	40	12	48	12	0.0	0	8	107	0.1	56
15	VAIRANKUPPAM	PRE-MONSOON	3.4	1815	1271	6.9	172	580	118	68	88	35	0.8	0	4	444	0.5	103
16	VAIRANKUPPAM COLONY	PRE-MONSOON	26	560	392	6.7	151	152	38.4	13	38	13	2.67	0	3	64	0.4	20
17	THACHAN COLONY	PRE-MONSOON	1	1510	1057	6.6	125	460	136	29	82	30	0.13	0	1	262	0.6	194
18	SANGOLIKUPPAM	PRE-MONSOON	1.0	935	655	6.9	267	236	64	18	71	22	0.13	0	3	92	0.1	26
19	SANGOLIKUPPAM COLONY	PRE-MONSOON	1.0	935	655	6.9	267	236	64	18	71	22	0.13	0	3	92	0.1	26
20	ECHANKADU	PRE-MONSOON	1.5	580	460	6.9	159	200	56	14	140	52	0.13	0	5	28.5	0	20
21	SEDAPALAYAM	PRE-MONSOON	10.8	330390	231273	6.66.6	4369	104110	2828	810	1624	710	0.00.0	00	43	5056	0.20.2	3024
22	CHINNAKARAIKADU	PRE-MONSOON	0.8	330	231	6.9	108	110	28	10	65	35	0.13	0	3	23	0.1	11
23	KARAIKADU	PRE-MONSOON	0.8	940	658	6.8	172	288	80	21	50	19	0.1	0	3	133	0.2	68
24	KARAIKADU COLONY	PRE-MONSOON	1.2	1225	858	6.7	237	360	95	27	80	23	0.0	0	6	70	0	20
25	KUDIKADU	PRE-MONSOON	1.0	1375	965	7.2	172	400	131	17	87	24	0.13	0	7	272	0.5	32
26	KUDIKADU (ROYAL FABRICS)	PRE-MONSOON	1	920	644	6.8	159	268	60.8	28	58	14	0.13	0	3	142	0.2	32
27	PERIYAKARAIKADU	PRE-MONSOON	1	865	606	7.0	43	260	57.6	24	100	32	0.13	0	2	266	0.2	32
28	PERIYAKARAIKADU COLONY	PRE-MONSOON	1.2	550	371	7.7	86	164	40	15	28	10	0.13	0	1	65	0.6	44
29	THAIKAL	PRE-MONSOON	1	730	511	6.7	155	260	48	19	25	11	0.0	0	5	92	0.1	41
30	PACHAYANKUPPAM	PRE-MONSOON	0.7	650	455	6.8	172	140	40	10	50	19	0.0	0	3	65	0.1	21

All the parameters are in mg/l, except pH and turbidity. is expressed in NTU, EC in micromhos/cm

**PH:**

The low PH value may cause corrosion in containers and pipe lines, while the high may produce sediments, deposits and difficult in chlorination for disinfection of water (sudhakar gummadi et al 2013). In the collected samples the values are within the permissible limit. There is no abnormal change in the ground water samples.

**Turbidity:**

Turbidity was in the range of 0.6-26 mg/l.

Out of 30 sampling locations, turbidity exceeded the desirable limit of 5mg/l in one location.

**Total Dissolved Solids:**

The Total solids in water are due to the presence of sodium, potassium, calcium, magnesium, manganese, carbonates, chlorides, organic matter, other particles. (Bhattacharya T., et al (2012)). TDS was found in the range of 126-127 mg/l. From the 31 sampling locations, 15 locations exceeded the desirable limits of 550 mg/l. The highest value was recorded in Vairankuppam (BW).

**Electrical Conductivity (EC):**

Signifies the amount of total dissolved solids. EC values were in the range of 180-1530 micromhos/cm. High EC value was observed in Echankadu (HP) indicating the high amount of dissolved inorganic substance in ionized form. pH varies from 6.5-7.7 and were found within the limit prescribed by ISI.

**Total alkalinity:**

Total alkalinity of water is due primarily to the salts of weak acids. Bicarbonate represents the major of alkalinity. Total alkalinity was in the range of 17-280 mg/l. The highest value 270 mg/l was found in Chinnakaraikadu, whereas the desirable limit is 200 mg/l. Out of 30 samples, 4 samples (Sonachavadi, Sangolikuppam (colony), Echankudi & Chinnakaraikadu) are exceeding the limit.

**Total Hardness**

Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. Hardness may also be caused by ferrous and manganese (Kavitha Kirubavathi A, 2010). Total Hardness in the study area was in the range of 56 mg/l - 580 mg/l. The highest value is found in Vairankuppam, whereas the desirable limit is 300 mg/l.

**Calcium (ca)** : Calcium may dissolve readily from carbonate rocks and lime stones or be leached from soils. But calcium is an essential nutritional element for human being and aids in the maintaining the structure of plant cells and soils (Chadrik Route et al 2011). Calcium was found to be in the range of 9.6-136 mg/l. Vairakuppam, Thachan colony, sangolikuppam and Chinnakaraikadu were above the desirable limit of 75 mg/l.

**Magnesium:**

Magnesium generally occurs in lesser concentration than calcium because of dissolution of magnesium rich minerals is slow process and calcium is more abundant in earth crust (Varatharathajan N et al., 2013). Magnesium was detected in the range of 4-68 mg/l, whereas the desirable limit is 30 mg/l. From the study area 4 samples such as Sonachavadi, Vairankuppam, Echankadu, Thaikal were above the desirable limits.

**Chlorides:**

Excess chloride (>250 mg/l) imparts a salty taste to water. Excessive chlorides in potable water is particularly not harmful but the criteria set for chloride value is based on its potentially high corrosiveness. Desirable limit of chloride in drinking water is 250 mg/l. In the study the chloride concentration was found to be in the range of 34 mg/l-444 mg/l. From this analysis, samples at Vairankuppam, Thachan colony, Echankadu, Kudaikadu and Periyakaraikadu exceeds the desirable limits.

**Sodium:**

Sodium and potassium elements are directly added into the ground water from industrial and domestic waste and contribute salinity of water (Mohamed Hanifa M, et al., 2013). Sodium concentrations were found in the range of 9 mg/l-140 mg/l. The values of sodium concentrations of all the samples are within the desirable limits.

**Potassium:**

Sodium and Potassium are most important minerals occurring naturally. High amount of potassium in the ground water is due to presence of Silicate minerals from igneous and metamorphic rocks (Zahir Hussain A, et al., 2011). Potassium content in this study was in the range of 3 mg/l-52 mg/l.

**Nitrate:**

The presence of nitrate in ground water may be due to leaching of nitrate with a percolating water. The contamination of ground water may be due to sewage and other waste rich in nitrate (Venkateshwara Rao B, et al., 2011). Toxicity of nitrates in infants causes methaemoglobinemia (Basic information in nitrates in drinking water, US EPA-2012). Nitrate was measured in the range of 1-9 mg/l. All the samples are within the desirable limit of 45 mg/l.

**Fluoride:**

High concentration of fluoride in ground water may be due to break down of rocks and soil or infiltration of chemical fertilizers from agricultural land. Skeletal fluorosis is an important disease due to presence of high fluoride content in ground water (Mohamed M Hanifa, et al., 2013). Fluoride concentration in the study was in the range of 0.1-0.8 mg/l. All the values are within the desirable limit.

**Sulphate:**

High concentration of sulphate may cause gastro intestinal irritation at particularly when magnesium and sodium ions are also present in drinking water resources ( Indirani Gupta et.al.,2011). The sulphate concentration varied between 4 mg/l-194mg/l .Desirable limit of sulphate in drinking water is 200 mg/l. All samples are within the desirable limit

**V. CONCLUSION**

The above studies shows that the ground water in and around SIPCOT in Cuddalore district is not affected with respect to turbidity, TDS ,Total alkalinity ,Total hardness, calcium, Magnesium, Chlorides are exceeding the limits in the. Villages such as Kudikadu, Sonnanchavadi ,Echankadu ,Vairankuppam, Thachan colony, Periyakaraikadu are lie in a virtual gas chamber surrounded on three sides by chemical industries .Ground water from these villages got polluted due to the industrial discharges,industrial activities and of from illegal dumpings of toxic wastes

**REFERENCES:**

- [1] R.Rajamanickam and S.Nagar,Studies on physio-chemical characteristics ground water in Amaravathy river basin of Karur district,Tamil nadu.2020,29(1):153
- [2] Kavitha Kirubaathy.A,Ground water quality of orathupalayam village,Erode district,Tamil nadu,Environ.Monit 2010 20(4):389-392
- [3] APHA Standards Methods for the examination of water and wastewater,American public health association,Washington DC.1998,18th Ed.
- [4] Sudhir Dahiya and Amarjeet kaur,physio chemical characteristics of underground water in rural areas of tosham subdivision,Bhiwani district,Haryana,J.Environ poll,1999,6(4)281
- [5] "R.Rajamanickam and S.Nagar" Impact of Textile Dying Industries on ground water quality in Karur Amaravathi river basin,Tamil nadu-A field study,J.Environ,Science & Engg. Vol.52,2010,No.4,P.315-320
- [6] Mohamed Hanifa M. and Zahir Hussain A. Study of ground water quality at Dindigul Town.Tamilnadu,India, International Research Journal of Environment Sciences Vol,2(1), 68-73, January (2013)
- [7] Bhattacharya T., Chakraborty S. and Tuck Neha., Physico chemical Characterization of ground water of Anand district, Gujarat, India, I. Res. J. Environment Sci., 1(1), 28-33 (2012)
- [8] Zahir Hussain A. and Abdul Jameel. M., Monitoring the quality of groundwater on the bank of Uyyakondan channel of river Cauvery at Tiruchirappalli, Tamilnadu, India, Environmental Monitoring and Assessment, 10.10007/s 10661, 011, 1910-14 (2011)
- [9] Chari K.V.R. and Lavanya M.G., Groundwater contamination in Cuddapah urban area, Andhra Pradesh, In Proceedings on regional Workshop of Environmental aspects of groundwater development. KU, Kurukshetra Oct. 17-19, Kurukshetra, India, 130-134 (1994)
- [10] Chadrik Rout and Arabinda Sharma., Assessment of drinking water quality, a case study of Ambala cantonment area, Hariyana, India, International Journal of Environmental Sciences, 2(2), 933-945 (2011)
- [11] Varadarajan N., Purandara B.K. and Bhism Kumar, Assessment of groundwater quality in Ghataprabha Command area, Karnataka, India, J. Environ. Science and Engg. 53(3), 341-348 (2011)
- [12] Venkateswara Rao B., Physico-chemical analysis of selected groundwater samples of Vijayawada rural and urban in Krishna district, Andhra Pradesh, India, International Journal Environmental Sciences, 2(2), 710-714 (2011)
- [13] Basic Information in Nitrates in Drinking Water, Basic information about Regulated Drinking Water Contaminants, US-EPA-Environment Protection Agency(2012)