ASSESSMENT OF POLLUTANT LEVEL ON GROUND WATER OF AN INDUSTRIAL – PORTTOWN

[1] Dr. K. Karthikeyan* [2] Dr. S. Sivaprakasam [3] Dr. N. Nagarajan
Assistant Professor Assistant Professor Assistant Professor
Department of Civil Engineering, Faculty of Engineering and Technology
Annamalai University, Annamalainagar

Abstract: The rapid industrial growth, population and development of human society has polluted the environmental ecosystem selfishness is the chief cause depletion as the resources. The poor availability of water in nature and increasing population, industrialization, deforestation and other activities have not only decreased the per capita availability of water but also deteriorate the quality of water. Because of urbanization, the quality of water has changed in its physical, chemical and biological characteristics. The chemical quality of water is an important factor which determines the usefulness of water both for drinking and Industrial purpose. Concentration of chemicals, beyond certain limits in water brings cause for the toxics impact on the environment. The high concentration of chemicals in water in the industrial towns is mainly due to the customs and practices. In this study, water samples, taken from various parts of Cuddalore block near Port-town were analyzed for their physical and chemical parameters such as **pH, EC, TDS, Na, K ,Ca, Mg, Cl, HCO_3, SO_4, F**. The Analyzed results were compared with BIS standards. Based on the BIS parameter, if the results of the water samples fall within the permissible limits, they are considered potable water, and if the results show above the permissible limits, they are not potable water. Hence a comprehensive study on water quality aspect on an industrially developed Cuddalore Old town has become on in evitable one.

Index Terms -**Physical, Chemical and Biological characteristics, Permissible limit, Water samples**.

I. INTRODUCTION

Water is a common chemical substance that is essential to all forms of life. Infact, water is refereed only to its liquid form, but the substance also has the solid and gaseous states, - Ice and water vapour. About 1,460 tera tonnes of water cover 71% of Earth's surface, 1.6% of water is found below ground in aquifers; and 0,001% is found as vapour, clouds, and precipitation. Saltwater oceans hold 97% of surface water, glaciers and polar ice hold 2.4%; of water and the other land surface water such as rivers and lakes 0.025%. At present nearly $1/5^{th}$ of water used in the world is obtained from the ground water resources. Agricultural sector being the major consumer of water and nearly 80% of all water is consumed by the sector. The present irrigated area, in India, comprises 60 million hectares. About 40% of water is used for agricultural purpose. In the recent years, there has been an increasing tendency towards drilling deep well as well as revitalization of the existing open dug well. Advancement in the field of ground water tapping has made it possible to lift ground water from the depth of 60 to 120 meter. The government, voluntary agencies, land development banks, state agro-industries corporation come forward to help the poor and marginal farmers by giving loans grants, technical advice and thus accelerates the face of ground water development and bring more land under extensive irrigations. About two-third of total land area, in India comprises consolidated formation of 75% which is made-up of crystalline and sediments and the remaining 25% forms the trap. The remaining one third of total land area comprises semi consolidated and unconsolidated formation like alluvial tracts. There is sufficient score for development of groundwater in these areas. Having the proposal of develop Cuddalore port, the Government of Tamilnadu aims at developing of Cuddalore port on public Private Participation. The port infrastructure such as, Cargo sheds, Breakwater, Cargo handling, etc., have been severely damaged by the 2004 Tsunami.

IMPACTS OF INDUSTRY ON GROUND WATER - SOURCES OF CONTAMINATION

Point Sources

- On-site septic systems
- Leaky tanks or pipelines containing petroleum products
- Leaks or spills of industrial chemical and manufacturing facilities
- Municipal landfills
- Livestock wastes
- Mill tailings in mining areas
- Wells for disposal of liquid wastes
- Asphalt production and equipment cleaning sites

Non-Point Source

- Fertilizers on agricultural land
- Pesticides on agricultural land and forests
- Contaminations in rain, snow, and dry atmospheric fallout

EFFECTS OF GROUNDWATER CONTAMINATION

- The contamination of groundwater causes the waterborne diseases; the pathogenic microorganisms are directly transmitted when contaminated drinking water is consumed.
- Contaminated drinking water, used in the preparation of food, can be the source of food borne disease.
- According to WHO, diarrheal disease accounts for an estimated 4.1% of the total daily global burden of disease and is responsible for the deaths of 1.8 million people every year.
- It was estimated that 88% of that burden is attributed to unsafe water supply, sanitation and hygiene and is mostly targeting the children in the developing countries.

II. STUDY AREA

The coastal region of Cuddalore Block which has been controlled for the grow water intrusion study. The selected area in the Cuddalore Block lies in the North latitude between 11º 35′ 00″ 11º 45′ 00″ and in the East longitude between 79º 41′ 40″ and 79º 46′ 40″ shown in Figure.1. Cuddalore Town is the Head Quarters of the Cuddalore Taluk and District. It is located at the estuaries of river Gadilam and Pennaiyar in the Bay of Bengal. The town is situated 200 km south of Chennai and 22 kms from Pondicherry. The town is well connected by Road and Rail with adjoining urban centres viz, Chidambaram, Virudhachalam Panruti, Nellikuppam and Villupuram and Cuddalore Town has been constituted as a Municipality during the year 1866 comprising a revenue village. The sample location and Formation details are shown in Table-1.

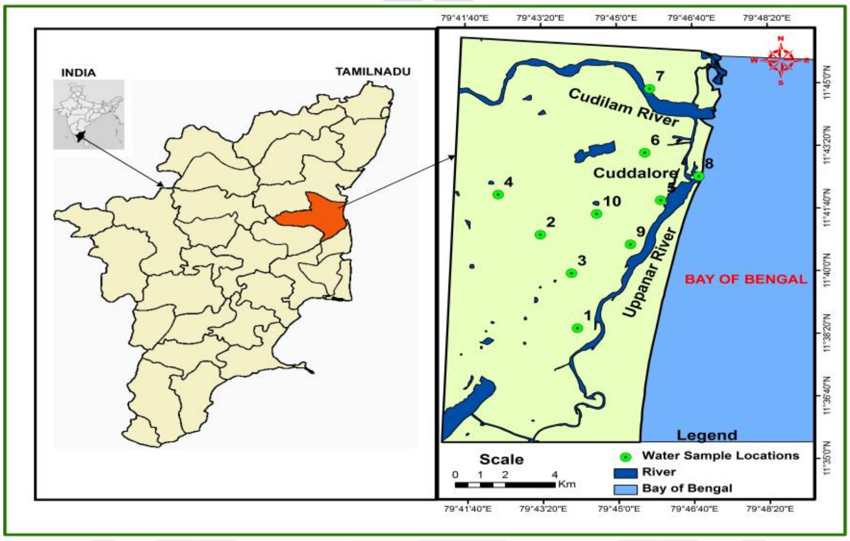


Fig. 1 Study area map

Table.1 Sample and Formation details

Sl.No.	Location	Sources	Depth	Formation
[1]	Semmankuppam	Bore well	< 50 meter	Rescent Aluvium, shales
[2]	Annaveli	Bore well	< 50 meter	Clay, Sandstone/latrite
[3]	Sedappalayam	Open well	> 50 meter	Sandstone/latrite
[4]	Ramapuram	Open well	> 50 meter	Sandstone/latrite
[5]	Pachayankuppam	Bore well	< 50 meter	Aluvial shales
[6]	Cuddalore OT	Bore well	< 50 meter	Aluvial shales
[7]	Cuddalore OT	Bore well	< 50 meter	Aluvial shales
[8]	Cuddaloreharbour	Open well	> 50 meter	Aluvial shales
[9]	Kudikadu	Bore well	< 50 meter	Sandstone/latrite
[10]	Karikadu	Bore well	< 50 meter	Sandstone/latrite

Objective of the study

The main objectives of the study are:

- To investigate the suitability of water quality for various purposes.
- To point out and demarcate the degradation of water pollutant levels.

III. METHODOLOGY

Sample Collection and Testing

Colleting sample of water is a difficult task as it requires at most care to analyze the results and interpret the results. A one litre sample should sufficient for the most physical and chemical analysis. It is recommended that the samples be collected and stored in bottles made of resistant borosilicate glass, hard rubber, polyethylene, or other inert material. Sample material shall be carefully cleaned before each wash. The following maximum limits are suggested as reasonable sample for the physical and chemical analysis.

- Unpolluted water - 72 hours, lightly polluted waters – 48 hours, polluted water – 12 hours.
- The record should be made on every sample collected and every bottle should be identified.

The records should include sufficient information to provide the identification of the samples at some later date, hour and exact location, the water temperature and any data which may be required in the future for correlations such as weather conditions, water level, etc. Samples from wells should be collected only after the wells have been poured for sufficient time; to ensure that the sample will represent the groundwater which feeds the well. Water samples were collected from selected 10 bore wells during the month of February and August 2017. The samples were collected in clean polythene bottles prescribed by (APHA1998).

The analysis has been carried out for various physicochemical parameters as follow.

Ca, Mg : EDTA titro-metric and atomic absorption spectrophotometer
Na, K : Atomic absorption spectrophotometer
HCO_3 : Acidimetric neutralization
C1 : Mohr titrametric and chloride metric
F : Spectrophotometric (Zirconium-Eriochrome Cyanine), Selective ion Electrode (combined) with fluoride meter
TDS : Gravimetric, total ionic counts
Sp. Cond. : Conductivity meter (digital) with selective electrode and sensor
PH : pH meter (digital) with selective electrode

The spatial map of water quality is generated with water quality ranges of water quality standards using the Arc GIS 9.3 software. The analyzed data are interpreted using WATCLAST software (Chidambaram et al. 2004). The spatial maps help the study to understand the simulation of the water quality behavior in addition to the groundwater. The spatial maps also depict the water quality pollutants spreading broadly up to the surface location extant. The ground- water sample analysis results are show in Table-2 (a, b).

Table 2 (a) Physicochemical Parameters of Pre- Monsoon Data

S. No	Location	pH	EC	TDS	TH	Ca	Mg	Na	K	HCO_3	SO_4	Cl
1	Semmankuppam	7.1	2990	2098	510	148	34	420	17	310.4	510	559
2	Annaveli	6.5	680	476	140	35	121	380	8	212.7	420	164
3	Sedappalayam	6.5	180	126	46	12	4	270	4	107.4	170	25
4	Ramapuram	6.5	490	343	128	32	12	680	5	114.2	79	76
5	Pachayankuppam	7.3	690	483	104	22	12	320	4	220.3	94	76
6	Cuddalore OT	6.7	1555	1089	850	84	34	425	2	127.1	310	32
7	Cuddalore OT	6.7	7480	5201	1700	360	192	310	3	117.2	98	167
8	Cuddalore Harbour	7.3	1985	1855	400	120	24	49	6	114.3	78	2332
9	Kudikadu	6.7	180	126	64	17	5	95	9	97.44	91	320
10	Karikadu	6.9	860	602	200	53	16	49	12	98.3	84	83

Table 2 (b) Physicochemical Parameters of Post- Monsoon Data

S. No	Location	pH	EC	TDS	TH	Ca	Mg	Na	K	HCO_3	SO_4	Cl
1	Semmankuppam	7.4	2220	2110	450	127	31	378	9	278.1	490	478
2	Annaveli	6.9	570	415	120	31	110	320	7	198.1	390	142
3	Sedappalayam	6.7	160	118	37	11	3	240	3	98.3	160	17
4	Ramapuram	6.9	380	312	110	27	9	520	3	107.1	72	59
5	Pachayankuppam	7.1	540	450	90	18	11	270	2	196.2	88	59
6	Cuddalore OT	6.9	1350	1010	650	78	31	390	1	110.2	299	27
7	Cuddalore OT	6.9	6900	4800	1430	310	168	216	1	98.4	90	152
8	Cuddalore Harbour	7.3	1700	1710	360	78	18	38	4	103.1	71	2012
9	Kudikadu	8.4	170	115	43	12	4	73	5	87.1	87	278
10	Karikadu	7.2	740	512	177	42	12	24	7	91.2	81	63

IV. RESULTS AND DISCUSSION

Potential hydrogen (pH)

The pH of water is an important indication of its quality as it provides the important pieces of information in many types of geochemical equilibrium or solubility calculations (Hem, 1985). In general, the pH of ground water sample is dependent on the relative quantities of calcium, carbonates and bicarbonates. The change is also governed by the amount of free CO_2 and HCO_3 and is directly related to the former complex which has direct bearing of the maximum and minimum of the pH. In the study area, the pH level for the pre monsoon varied from 6.5 to 7.3. Similarly, during the post monsoon period, it varies from 6.7 to 8.4. The spatial distribution of pH for the pre and post-monsoon is presented in the Figure-2 (a, b).The values for the both pre and post monsoon samples are within the limits as specified by 6.5 (10) to 8.5 (10) in WHO, (1993).

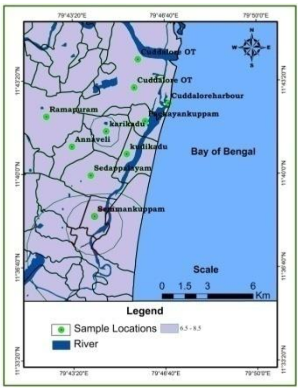
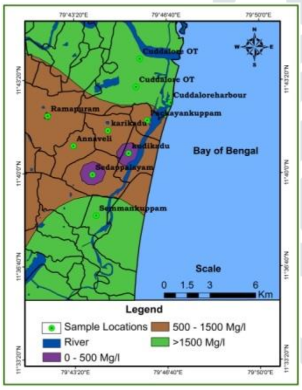


Figure-2(a) Spatial variation of pH Pre-monsoon **Figure-2(b)** Spatial variation of pH Post-monsoon

Electrical conductivity (EC)

Measurement of electrical conductivity provides indication of ionic concentration. It depends upon thermal concentration and types of ions present. Thus, as the concentration of dissolved salts increases, the conductivity also increases. Besides, it depends upon temperature, concentration and types of ions present (Hem, 1985). In the study area, the overall variation during the pre and post monsoon is from 180 to 7480 µsimens/cm. In the pre monsoon season it is found as 180 µsimens/cm as minimum at Sedappalayam and as 7480 µsimens/cm maximum at Cuddalore OT. In the post monsoon period, the minimum value of 160 was found at Sedappalayam and maximum value of 6900 µsimens/cm at Cuddalore OT. The high conduction was observed due to the high chloride concentrations in ground water (Davis and Dewiest,1966). The spatial distribution of EC, for the pre and post-monsoon is presented in the Figure-3 (a, b).The values for the both pre and post-monsoon samples are found within the limits as specified by 500 to 1500 in WHO, (1993). High concentration was observed in the North and the Southern part of the study area. The classification, proposed by (Wilcox 1955), is shown in Table 3.



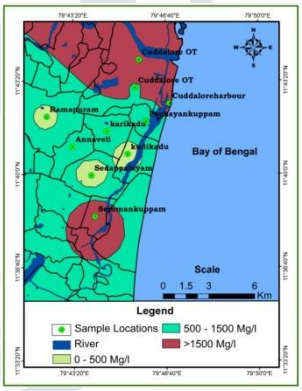


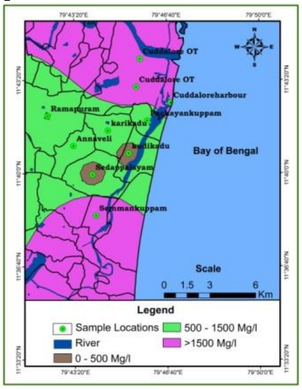
Figure-3(a) Spatial variation of EC Pre-monsoon **Figure-3(b)** Spatial variation of EC Post-monsoon

Table 3 EC classification of Pre and Post Monsoon

Classification	Value Range (ppm)	No. of Sample PRM	No. of Sample POM
Excellent	Less than 250	2	2
Good	250 – 750	3	4
Permissible	750 - 2250	3	3
Doubtful	2250 - 5000	1	0
Unsuitable	Greater than 5000	1	1

Total dissolved solids (TDS)

Total dissolved solids (TDS) are a measure of the total concentration of all the constituents in water and have a bearing in its taste. It does not include suspended sediments, colloids or dissolved gases (Walton, 1970). The TDS of the ground water varies from 160 mg/lto 5201 mg/land 126 mg/lto 4800 mg/lduring the pre and post-monsoon respectively. The principal ions contributing to TDS are bicarbonate, carbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium (EPA, 1976). However, the higher degree of salt concentration are due to groundwater movement and long residence time along the flow path (Norris et al, 1992). According to the classification of ICMR (1975), the TDS has been classified in to four categories namely category I as < 500 mg/lwhich is the highest desirable for drinking; category II as 500 to 1000 mg/lpermissible for drinking; category III as 1000 to 3000 mg/land it can be useful for irrigation and category IV as > 3000mg/lwhich is unfit for drinking and irrigation. The spatial distribution of TDS for the pre and post-monsoon is presented in the Figure-4(a b). It shows high concentration was noticed both pre-monsoon and post-monsoon in North and Southern part of the study area. The groundwater samples have been classified basis of on the concentration of TDS (USSL 1954) shown in Table 4.



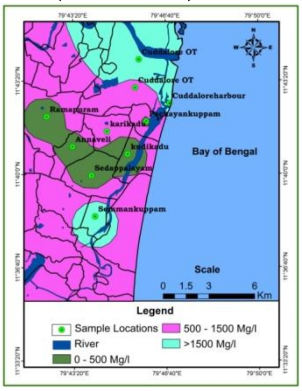


Figure-4(a) Spatial variation of TDS Pre-monsoon **Figure-4(b)** Spatial variation of TDS Post-monsoon

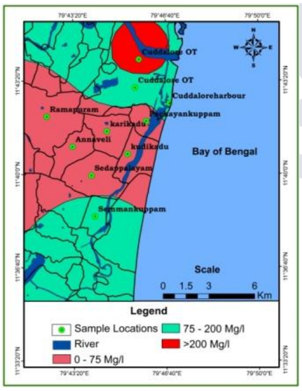
Table 4 TDS Classification of Pre and Post Monsoon

Classification	Value Range (ppm)	No. of Sample PRM	No. of Sample POM
Desirable	Less than 200	2	2
Permissible	200-500	3	3
Useful	500-1500	2	3
Unfit	1500-3000	3	2

Cations

Calcium (Ca)

The Ca ionic concentration found low as 12 mg/l in Sedappalayam, whereas it is observed high concentration of 360 mg/l in Cuddalore OT during the pre-monsoon. In Cuddalore OT, it is high as 310 mg/land in Sedappalayam low as 11 mg/l during the post-monsoon period. The limit of Ca for drinking water is specified as75 to 200 mg/l (WHO, 1993). The spatial distribution of Ca for the pre and post-monsoon is presented in the Figure-5 (a b). The concentration of Ca is due to interaction of minerals like feldspars minerals and weathering process.



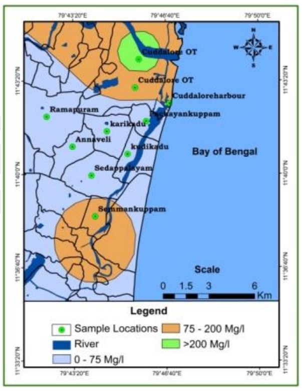
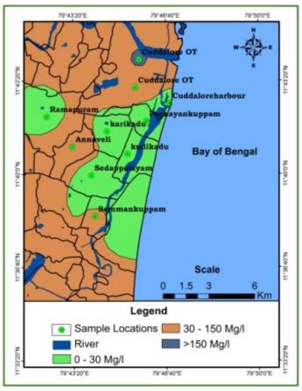


Figure-5(a) Spatial variation of Ca Pre-monsoon **Figure-5(b)** Spatial variation of Ca Post-monsoon

Magnesium (Mg)

The Magnesium concentration is varied from 4.00 mg/lto 192.00 mg/l in the premonsoon. During the post-monsoon period, higher concentration found at 168.00 mg/l Cuddalore OT, whereas the low, concentration was found at Sedappalayam as 3.0 mg/l. The limit of Mg for drinking water is 30 mg/l (WHO, 1993). In this study area, most of the samples are within the limit. The spatial distribution of Mg for the pre and post-monsoon is presented in the Figure-6 (a b).



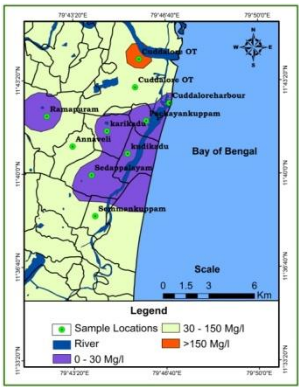
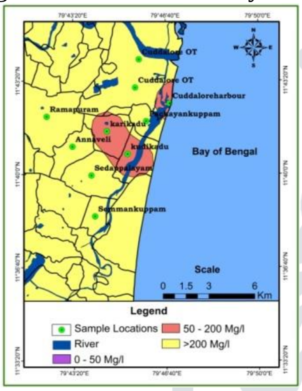


Figure-6(a) Spatial variation of Mg Pre-monsoon **Figure-6(b)** Spatial variation of Mg Post-monsoon

Sodium (Na)

The Sodium concentration varies from 49.00 to 680.00 mg/l during the pre-monsoon. The limit for drinking water is specified as 50.0 to 200.00 mg/l (WHO, 1993). During the post-monsoon periods the minimum concentration 24.0 mg/l to maximum concentration 520.0 mg/l. The spatial distribution of Na for the pre and post monsoon is presented in the Figure-7(a, b). The sodium concentration in the ground water is due to the chemical weathering of feldspar minerals in the country rocks. Also, the agricultural activities may have significant influence on the concentration of sodium in ground water.



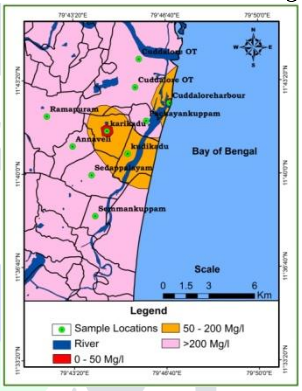
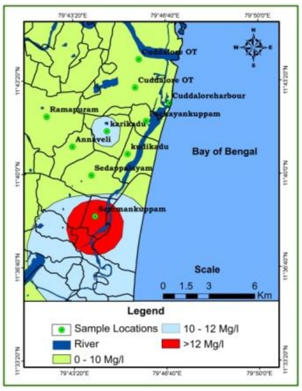


Figure-7(a) Spatial variation of Na Pre-monsoon **Figure-7(b)** Spatial variation of Na Post-monsoon

Potassium (K)

The Potassium concentration varies from 2.0 mg/l to 17.0 mg/l in the pre monsoon season. It was noticed that low concentration of 2.0 mg/l was observed at Cuddalore OT and high concentration of 17 mg/l was observed at Semmankuppam. The Potassium concentration varies from 1.0 mg/l to 9.0 mg/l in the post- monsoon season. The limit of Potassium for drinking water is specified as 25 mg/l (WHO, 1993). The spatial distribution of Potassium for the pre-monsoon and post- monsoon is presented in the Figure 8 (a, b). The Potassium concentration in water is low because of the high degree stability of Potassium bearing minerals.



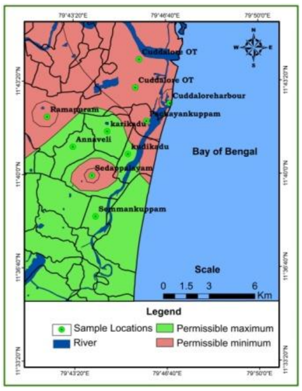
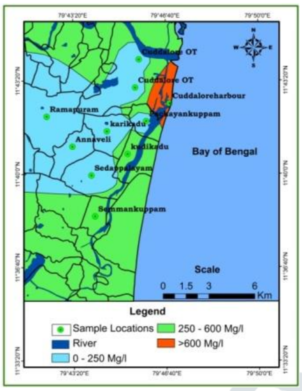


Figure-8(a) Spatial variation of K Pre-monsoon **Figure-8(b)** Spatial variation of K Post-monsoon

Anions

Chloride (Cl)

The Cl concentration varies from 25.0 mg/l to 2332 mg/l in the pre monsoon and 17.0 mg/l to 2012.0 mg/l in the post-monsoon periods. The low concentration was observed at Sedappalayam and high concentration was noticed at Cuddalore harbor during the pre monsoon period. Similarly high and low concentration were noticed at Cuddalore OT and Sedappalayam respectively during the post-monsoon period. The limit of chloride concentration for drinking water is specified as 600 mg/l (WHO, 1993). The spatial distribution of Cl for the pre-monsoon and post-monsoon is presented in the Figure 9 (a, b).



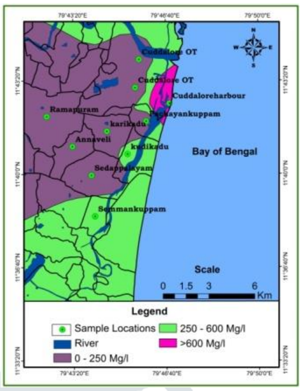
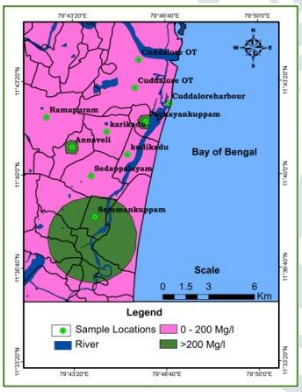


Figure-9(a) Spatial variation of Cl Pre-monsoon **Figure-9(b)** Spatial variation of Cl Post-monsoon

Bicarbonate (HCO_3)

The Bicarbonate concentration varied from 97.44 mg/l to 310.4 mg/l during the pre monsoon and from 87.1 mg/l to 278.1 mg/l were noticed during the post monsoon. The spatial distribution of HCO_3 for the pre-monsoon and post-monsoon is presented in the Figure 10 (a, b).



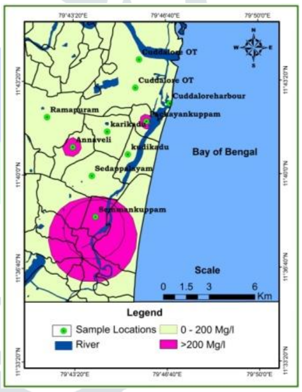
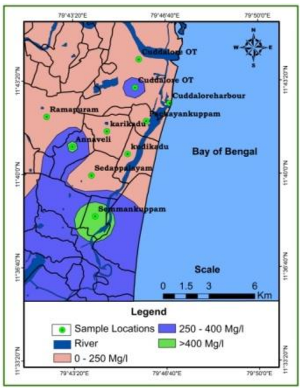


Figure-10(a) Spatial variation of HCO_3 Pre-monsoon **Figure-10(b)** Spatial variation of HCO_3 Post-monsoon

Sulphate (SO_4)

The Sulphate concentration varied from 78.0 mg/l to 510.0 mg/l during the pre monsoon period. During the post monsoon period, the higher concentration of 490.0 mg/l and low concentration of 71.0 mg/l. The limit for drinking water is specified as 250 mg/l (WHO, 1993). The spatial distribution of SO_4 for the pre monsoon and post monsoon is presented in the Figure 11 (a b). In general, the sulphates could be introduced through the application of Sulphatic soil conditioners (Karanth, 1987).



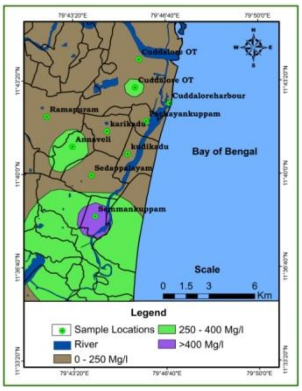
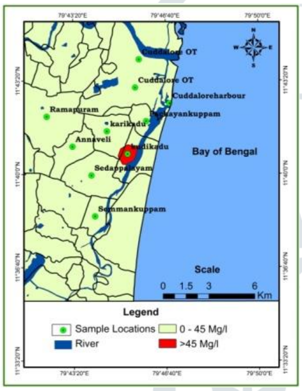


Figure-11(a) Spatial variation of SO_4 Pre-monsoon **Figure-11(b)** Spatial variation of SO_4 Post-monsoon

Nitrate

The Nitrate concentration varied from 9.0 mg/l to 52.0 mg/l during the pre monsoon period. During the post monsoon period, the higher concentration of 42.0 mg/l and low concentration of 4.0 mg/l. were observed. The limit for drinking water is specified as 45.0 mg/l (WHO, 1993). The sources of Open disposal of human and industrial waste from the Nitrate concentration. The spatial distribution of Nitrate for the pre- monsoon and post- monsoon is presented in the Figure 12 (a, b).



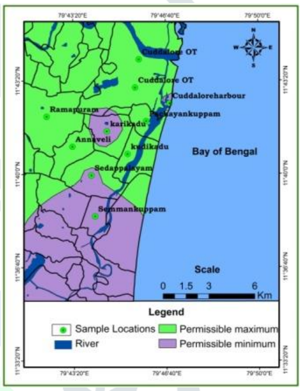


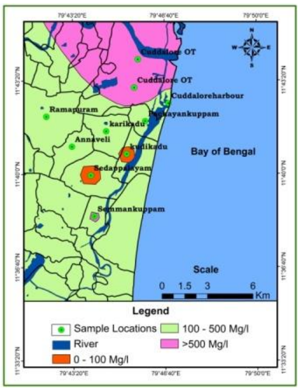
Figure-12(a) Spatial variation of Nitrate Pre-monsoon **Figure-12(b)** Spatial variation of Nitrate Post-monsoon

Total Hardness (TH)

Hardness is one of the properties of water considered important in evaluating the solubility of water for domestic, irrigation and industrial uses. Generally, water that has a hardness of less than 50 ppm is rated as soft water and it is suitable for many purposes without further softening. Water having 100 – 150 ppm hardness will deposit considerable scales in steam boilers and will, therefore, require softening before use. The tolerance of hardness of water for industrial uses varies from one industry to another. The classification of hardness for the pre- monsoon and post- monsoon is presented in the Table 5. The spatial distribution of Total Hardness for the pre- monsoon and post- monsoon is presented in the Figure 13 (a, b).

Table 5: Classification of Hardness

Class	Range of hardness mg/l($CaCO_3$)	No. of samples in pre monsoon	No. of samples in post monsoon	Remarks
Soft	0-55	1	2	Require little or no softening
Slightly hard	56-100	1	1	Require little or no softening
Moderately hard	101-200	4	3	Require softening
Very hard	201-500	4	4	Require softening



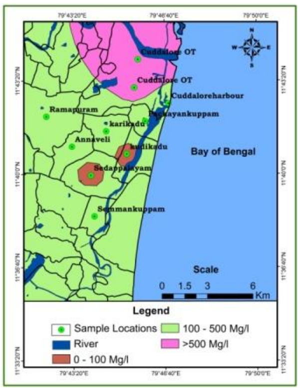
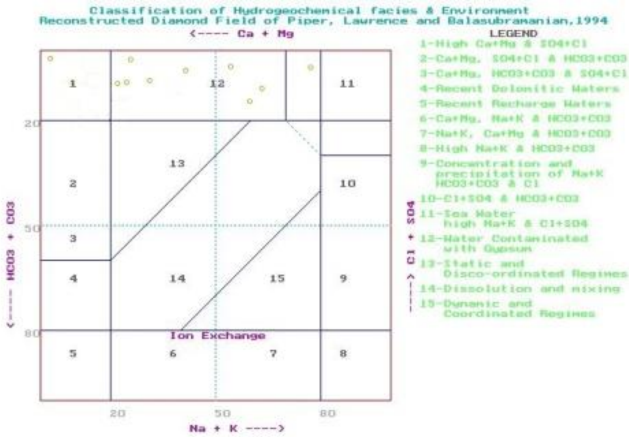


Figure-13(a) Spatial variation of TH Pre-monsoon

Figure-13(b) Spatial variation of TH Post-monsoon

Hydro geochemical Facies

The concept of hydrochemical facies to understand the chemical characteristics of groundwater. has been used and stressed by many workers including Back(1960), Seaber (1962), Morgan and Winner(1962), Hanshaw et al., (1965), Davis and Dewiest(1970), Walton(1970). In general, the hydrochemical facies at a place is influenced by the geology and distribution of facies by the hydrological controls. The hydrochemical facies classification was done using the trilinear diagram of Piper (1944). Nevertheless, the classification of hydrogeochemical facies and environment has been widely used by the reconstructed diamond field. The normal trilinear pattern has reconstructed into diamond field by Lawrence and Balasubramanian in 1986. The Piper trilinear diagrams are very useful to bring out the chemical relationships among ground waters in more definite terms (Walton 1970). Hence, the present study area ground water samples have been plotted with water that is contaminated with gypsum facies. The interpretation of the study area samples is shown in the Figure 14 (a, b).



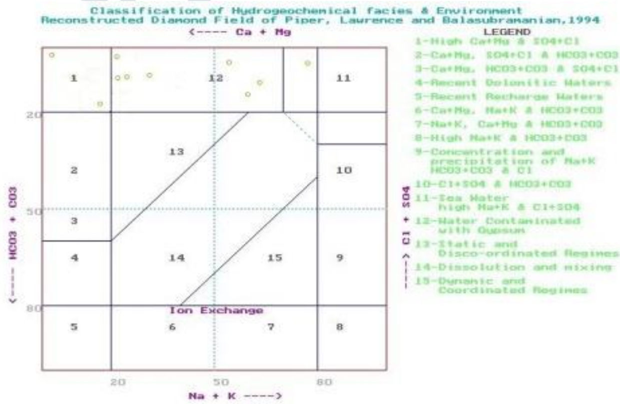


Figure-14(a) modern Piper trilinear diagram of Pre-monsoon

Figure-14(b) modern Piper trilinear diagram of Post-monsoon

USSL classification

The SAR is useful for judging the quality of water for the use of agricultural purposes (Todd, 1980). Richards (1954) classified the waters in relation to irrigation based on the ranges of SAR values. According to Richards's classification, all the samples of the study area have been classified as excellent. The USSL Diagram has been used to understand the alkali hazard of the groundwater samples for the study area, because this interpretation is very much useful for judging the quality of groundwater for the use of agricultural purpose (Todd 1980), where the sodium adsorption ratio is plotted against specific conductance. The sixteen classes in the diagram indicate the extent at which the waters can affect the soil in terms of salinity hazard as low (C1), Medium (C2), high (C3), and very high (C4) and similarly sodium hazard as low (S1), medium (S2), High (S3) and very high (S4). The analytical data plotted most of the sample medium salinity to very high sodium hazard shown in Figure 15 (a, b).

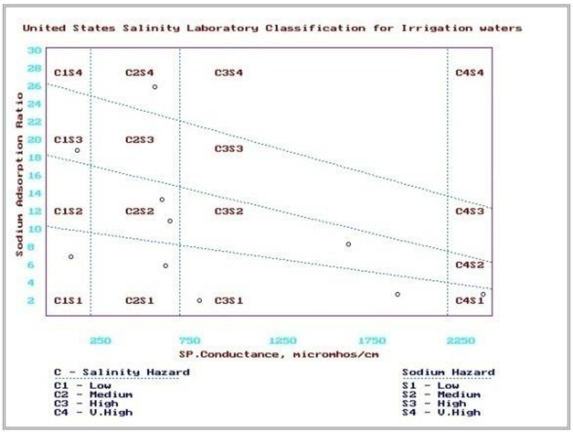


Figure-15(a) USSL classification of Pre-monsoon

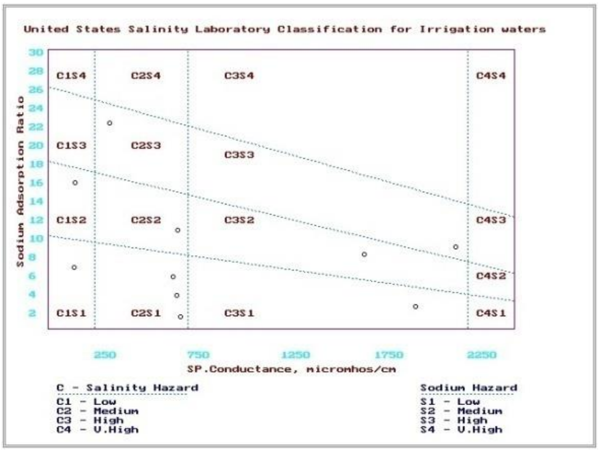


Figure-15(b) USSL classification of Post-monsoon

Gibb's Diagram

Convey (1942) and Gibbs (1970) has discussed some of the mechanisms that control the chemical composition of major dissolved salts of water. Hydrogeochemical studies relevant to water quality in a large area of total Karnataka State, India, have been enumerated by Viswanathiah et al., (1973). The mechanisms, responsible for the controls of surface water chemistry of the earth, have been identified using the Gibb's plots normally. The study area groundwater samples plots are shown in the Figure 16 (a, b). From these interpretations, it could be confirmed that the chief mechanism controlling the chemistry of groundwater of the study area are dominated by rock water interaction in both the pre monsoon and post- monsoon period.

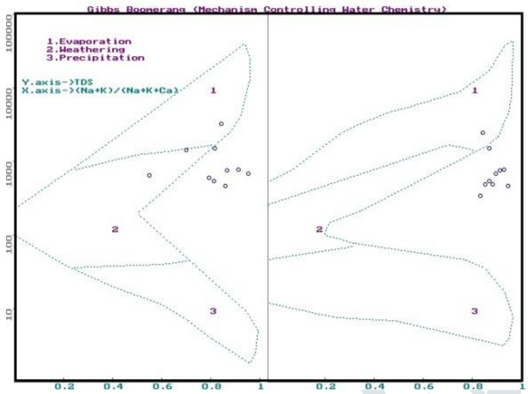


Figure-16(a) Gibb's diagram of Pre-monsoon

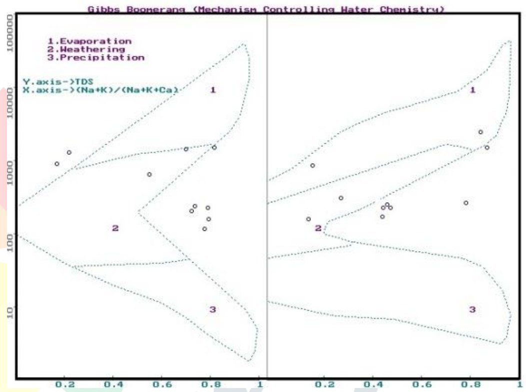


Figure-16(b) Gibb's diagram of Post-monsoon

V. Conclusion

- The results suggest that there is significant pollution of groundwater near coastal and uppanar river bank villages.
- It is evident from all the responses that the water pollution crisis is worsening year after year due to the growth of the industrial activity in Cuddalore old town. It is suggested that people should be provided with water tanks, boreholes and tap water so as to have access to clean water, since they believe the government has failed to manage and control the problem at source in the Cuddalore old town.
- Income generating projects are meant to supplement income to the people who have lost their occupation as a result of the polluted water. All respondents further complain of the huge costs incurred if they treat the water before use, plus escalating medical costs due to water polluted related sickness. Water pollution, therefore, should be recognized as one of the major factors that perpetuate poverty in the country. Due to over exploitation, water get contaminated and chemical concentration increases in water. Over exploitation of water happens due to the increase in population and industries.
- The increase the number of industries and population leads to high damage to the environment So proper steps should be taken by the government to manage this problem.
- The sources of pollution and the environment should be monitored. The government should conduct regular inspections and audits to ensure the waste control permit holder does the required filed work in containing the pollutants damaging the environment.

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