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Evaluation of Groundwater Quality and Its Suitability for Domestic and Irrigation Purpose in Cuddalore District

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Abstract

This study is focused on the quality of groundwater and its suitability for domestic and irrigation purposes at the Cuddalore district. The study area is chosen based on the vulnerability of seawater intrusion, and the location is identified for the collection of samples. The description represents the impacts of the groundwater and seawater intrusion in that area. The groundwater samples were collected from various sources such as bore well, hand pumps, dug well, irrigation water in and around the seashore region. This gives information about the salts, acids, etc.…present in water. Some of the samples were suitable for drinking purposes, and some samples for agricultural purposes. These samples were collected in polythene cans and been tested. Both the physical and chemical analyses were done properly within the time duration. The water samples are tested as per IS specifications, and the analysis is done for fluoride, chloride, total dissolved solids, total hardness, pH, calcium, etc. The quality of the groundwater and its suitability for irrigation purposes are varying. The water samples are tested in the laboratory and checked their salt content, and they are stabilized. The comparison of groundwater samples presents data to the 10 years old records of cuddalorethe chemical properties are increased due to industrialization and seawater intrusion. This paper presents the groundwater impacts, characteristics, and suitability.

I. INTRODUCTION

The extraction of groundwater can be executed by using one or more amounts of seawater. Water is the major component of all living things. It is the major constituent of streams, lakes and oceans, and fluids. Its chemical formula is H2O, meaning that each of its molecules contains one oxygen and two hydrogen atoms connected by covalent bonds. It forms precipitation in the form of rain and aerosols in the form of fog. Water covers 71% of the earth's surface, mostly in seas and oceans; small portions of water occur as groundwater (1.7%) in the glaciers and Antarctica and Greenland (1.7%) in the air as vapor, clouds, and precipitation. Groundwater is the water present beneath the earth's surface in soil pore spaces and the Fractures of rock formations. Groundwater is from eventually flows to the surface naturally. Groundwater is often withdrawn for agricultural, municipal, and industrial use by seawater extraction.

Saltwater intrusion is the movement of saline water into fresh water, which leads to contamination of drinking water sources. It occurs naturally and explains the hydraulic connection between groundwater and seawater. Saline water has higher mineral content than freshwater; it is denser and has higher water pressure. It contains more salts in the water, and it is not used for drinking and irrigation purposes. It is used only for domestic purposes. Thus it is checked in this project properly. This project vividly explains the seawater intrusion and its characteristics. This study is based on the hydrochemistry of groundwater in the different parts of the Cuddalore district. It explains the quality of groundwater for determining its suitability for drinking and agricultural purposes. The water samples were collected in the polythene can; its characters were noted down. The time, place, uses, depth, and distance were noted properly. The physical and chemical characteristics of water samples are tested properly. The tests conducted are fluoride, chloride, total dissolved solids, hardness, pH, calcium, magnesium, etc., in the water samples. The comparison of domestic use and irrigation use of water samples. The results are given properly by the comparison of the water samples.

II. METHODOLOGY

A. Selection of Location

Tamil Nadu, the southernmost state of the Indian peninsula, spread over 1,30,058 km2, lies between 80 0 0 0 Tamil Nadu has 32 districts, of which 13 districts are located along the coast. Cuddalore district (figure 2.1) is situated about 160 km south of Chennai, the state capital. The area of the district is 3706 km2. The Cuddalore district's headquarters is Cuddalore (11044' 45" N and 79045'56" E), a large industrial town that has experienced coastal development rapidly. Cuddalore district is bounded on the north by the Villupuram district and the union territory of Puducherry, on the west by the Perambalur and Ariyalur districts, on the

south by the Nagapattinam, Thiruvarur, and Thanjavur district, and on the east by the Bay of Bengal. The area's plan on the cuddalore site should be a master plan, or blueprint of a printed are established headlines, illustrates and also gives the site's overall appearance clearly described. In nearby should be covered on the industrial place, commercial place, opposite roads with connecting national highway, and a residential house. The port is situated at the confluence of rivers uppanar and paravanar, along with Bengal, roughly 200km south of Chennai, and is a prominent port. The Parvanar river flows parallel to the north directions for about 1km and empties into the Bay of Bengal. The corresponding latitude and longitude of the port are 11.42" N, 79.46" E, respectively.

B. Sample Collection

The groundwater samples are collected in 10 places for testing the physical and chemical characteristics as the samples are collected from the seashore at the distance of 3 km and randomly taken samples in the distance of 3 km from the seashore. The area covered at Cuddalore district for the project survey is 20 km of the surrounding area. The samples collected in the polythene can have the details of where it was taken and when it was taken. The polythene can contain a capacity of 2 liters. These can may contain saltwater, so it is not used for drinking; it is used only for washing, cleaning, bathing, etc.… These samples are taken around the seashore and contain more salt in it. These samples are tested in the laboratory.

The water samples are collected properly and without any impurities because the impurities cause errors while testing.

The 10 water samples are collected in a polythene cane with a 2-liter capacity and tested properly.

C. Testing of water samples

The tests done in water samples are fluoride, chloride, total dissolved solids,

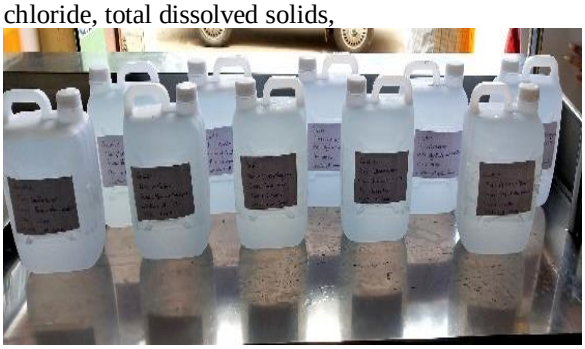

Fig 1 Water Samples

total hardness, sulfate, pH, ammonia, electrical conductivity, phosphate, nitrate, calcium, magnesium, color, odor, turbidity. The characteristics of water are tested in the laboratory. The physical and chemical characteristics of water are identified properly by the tests.

III. RESULTS AND DISCUSSION

The physical and chemical characteristics of the groundwater samples are tested, and the results are below:

Table 1: Comparison of groundwater in sample 1 (Devanampattinam) with the old cuddalore district records.

S.NO	PHYSICAL EXAMINATION	VALUES	PERMISSIBLE LIMIT	COMPARISON OF OLD RECORDS
1	Appearance	Clear	-	Clear
2	Odour	Agreeable	-	Agreeable
3	Turbidity NT units	0.7	5	0.5
4	Total dissolved Solids mg / L	780	2000	585
5	Electrical Conductivity Micro mho/cm	1114	-	1725
	CHEMICAL EXAMINATION			
6	Ph at 25*C	7.55	6.5 – 8.5	6.8
7	Ph.alkalinity as Caco3 mg/L	0		
8	Total alkalinity Caco3 mg/L	264	600	250
9	Total hardness as Caco3 mg/L	288	600	274
10	Calcium as Ca mg/L	75	200	81
11	Magnesium as Mg mg/L	24	100	35
12	Iron as Fe mg/L	0.37	1.0	0.45
13	Manganese as Mn mg/L	0	0.3	0
14	Free ammonia as NH3 mg/L	2.02	0.5	-
15	Nitrite as NO2 mg/L	0.18	-	0.13
16	Nitrate as NO3 mg/L	16	45	19
17	Chloride as Cl mg/L	124	1000	173
18	Fluoride as F mg /l	0.8	1.5	0.5
19	Sulphate as SO4 mg /L	68	400	82
20	Phosphate as PO4 mg/l	0	-	-

Table 2: Comparison of groundwater in sample 2 (Puthupalayam) with old records in Cuddalore district.

S.NO	PHYSICAL EXAMINATION	VALUES	PERMISSIBLE LIMIT	COMPARISON OF OLD RECORDS
1	Appearance	Clear	-	Clear
2	Odour	Agreeable	-	Agreeable
3	Turbidity NT Units	0.4	5	0.5
4	Total dissolved solids Mg/L	948	2000	585
5	Electrical conductivity Micro mho/cm	1354	-	1725
	CHEMICAL EXAMINATION			
6	Ph at 25*c	7.35	6.5-8.5	6.8
7	Ph alkalinity as CaCO3 mg/L	0	-	-
8	Total alkalinity as CaCO3 mg/L	312	600	250
9	Total hardness as CaCO3 mg/L	340	600	274
10	Calcium as Ca mg/L	80	200	81
11	Magnesium as Mg mg/L	34	100	35
12	Iron as Fe mg/L	0.2	1.0	0.45
13	Manganese as Mn mg/L	0	0.3	0
14	Free ammonia as NH3 mg/L	0	0.5	-
15	Nitrite as NO2 mg/L	0.2	-	0.13
16	Nitrate as NO3 mg/L	12	45	19
17	Chloride as cl mg/L	188	1000	173
18	Fluoride as F mg/L	1.0	1.5	0.5
19	Sulphate as SO4 mg/L	54	400	82
20	Phosphate as PO4 mg/L	0.44	-	-

Table 3: Comparison of groundwater in sample 3 (Old Town) with the old records in Cuddalore district.

S.NO	PHYSICAL EXAMINATION	VALUES	PERMISSIBLE LIMIT	COMPARISON OF OLD RECORDS
1	Appearance	Clear	-	Clear
2	Odour	Agreeable	-	Agreeable
3	Turbidity NT Units	0.7	5	0.5
4	Total dissolved solids mg/L	960	2000	585
5	Electrical conductivity Micro mho/cm	1371	-	1725
	CHEMICAL EXAMINATION			
6	Ph at 25*c	8.00	6.5-8.5	6.8
7	Ph. Alkalinity as CaCO3 mg/L	0		
8	Total alkalinity as CaCO3 mg/L	288	600	250
9	Total hardness as CaCO3 mg/L	284	600	274
10	Calcium as Ca mg/L	74	200	81
11	Magnesium as Mg mg/L	24	100	35
12	Iron as Fe mg/L	0	1.0	4.5
13	Manganese as Mn mg/L	0	0.3	0
14	Free ammonia as NH3 mg/L	0.5	0.5	-
15	Nitrite as NO2 mg/L	0.2	-	0.13
16	Nitrate as NO3 mg/L	12	45	19
17	Chloride as CL mg/L	240	1000	173
18	Fluoride as F mg/L	1.0	1.5	0.5
19	Sulfate as SO4	64	400	82
20	Phosphate as PO4 mg/L	0	-	-

The results of physical and chemical analyses are presented in the above tabulation. The samples differ in their results, color, characters, values, uses, etc.… the value of physical and chemical properties is sometimes decreased and increased according to their features. Their appearances are clear in all the samples, and their odours are agreeable. In sample 1and sample 3, the turbidity, total dissolved solids, pH, total alkalinity, nitrite, fluoride, and total hardness of their values are greater than the old records. The electrical conductivity, calcium, magnesium, iron, nitrate, chloride, sulfate are lesser than the old records. In sample 2, the total dissolved solids, pH, total alkalinity, nitrite, chloride, fluoride, and total hardness are greater than the old records. The electrical conductivity, calcium, magnesium, iron, nitrate, chloride, sulfate are lesser than the old records.

IV. CONCLUSION

The data and the limits of the water samples from old records to present data are compared properly. If the data are increased, it is only because of industrialization, seawater intrusion. On rainy days, surface water should be used, and on summer days, groundwater should be used. We should treat the surface water and make use of it. The awareness of groundwater should be made. Save the groundwater by following these instructions like managing chemical and household wastes, reusing whenever possible, avoiding and reducing pesticide usage, maintaining septic tanks properly, and conserve rainwater.

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