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Comparative study on analysis of ground water quality in and around Kollidam and Chidambaram area for irrigation purposes

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ABSTRACT

Water is referred to as universal solvent, since among all the importance needs of human beings and animals and universally known as air, water food, shelter etc. water plays a very important role and it is the highest role because it is essential to sustain life since the protoplasm of many living cells contain 30% of water and any substantial reduction will cause disaster. The main objective of the study is to determine the ground water quality in and around Kollidam and Chidambaram area. The study reveals that the characteristics of ground water in and around Kollidam area and Chidambaram are not having wide variation with Indian standards with except few locations in Chidambaram and Kollidam.

Keywords: Kollidam, Water, Ground water, etc.

1. Introduction

1.1 General

Water is referred to as universal solvent, since among all the importance needs of human beings and animals and universally known as air, water food, shelter etc, water plays a very important role and it is the highest role because it is essential to sustain life since the protoplasm of many living cells contain 30% of water and any substantial reduction will cause disaster. Water is required for satisfactory performance of physiological organisms, as the circulatory fluid, as a carrier of nourishing food and for the removal of products of water. It is noted and found that two third of the human body consists of water. Water is used by man for variety of purpose such as drinking, bathing, washing, laundry, cleaning, heating, air conditioning, irrigation, gardening, industrial processing, power generation, fire fighting, water disposal, fishery, swimming, boating and other recreational purpose etc. When compared to all other minerals available on earth, the ground water serves to be precious distributed resources of the earth. At Present nearly one fifth of all the water used is obtained from ground water nearly 80% of the consumption of water is used for agricultural purpose. Not only for agriculture, when considering the all animals, fisheries, need abundant quantity of water. About 40% of ground water is used for irrigational purposes. The ground water available in most of the inhabited areas is of potable quality and free from pollutants and evaporation losses. The aim of this study is to access any variation in physical and chemical constituents of underground water available by all means of comparing the test results of twenty number of bore wells obtained with the standards.

1.2 Importance of Ground Water

Ground water IS commonly understood to mean water occupying all voids within the geological stratum and the water that occurs below the earth. This saturated zone is to be different from an unsaturated or zone of aeration where voids are filled with water and air is a saturated zone, and is important for engineering works, geological studies and water supply developments. Unsaturated zones are usually found above saturated zones and extend upwards to the ground surface because water includes soil moisture within the root zones it is of major concern of agriculture, botany and soil science, No rigid demarcation of water between the zones is possible for the posses and inter dependant boundary and water can move from one zone to other zone in either direction. Ground water plays an important role in petroleum engineering, two fluid system involving oil and water, three fluid system involving gas, oil, water, occur

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frequently in development of petroleum industries. Several of earth science including geology, hydrology, meteorology, oceanography concerned with ground water.

1.3 Formation of Ground Water

Ground water occurs in permeable geological formation known as aquifers. Those portions of rock are soil, which is not occupied by

mineral matter, may be occupied by ground water. These spaces are known as voids. Interstices, pores are pore spaces. Ground water is the water formed from absorbed precipitated water in the upper most aquifers occurring in subsoil or in deeper bed rocks above the upper most aquifers. Rock formation material which yields significant quantities of water has been defined as aquifers. It plays a very important part in the ground water.

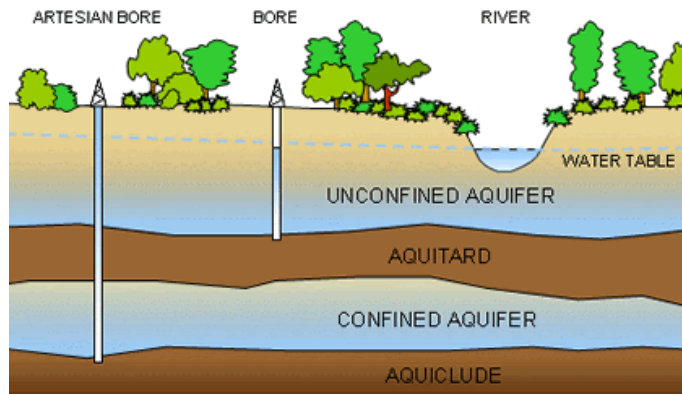


Fig 1: Formation of Ground Water

Figure1. Shows the typical cross section of the earth crust showing the occurrence of the ground water in a confined and an unconfined aquifers. Formation which contains ground water on the same line

which all sufficient permeable to transmit and yield water in usable quantities is called aquifers.

2. Study area in Kollidam

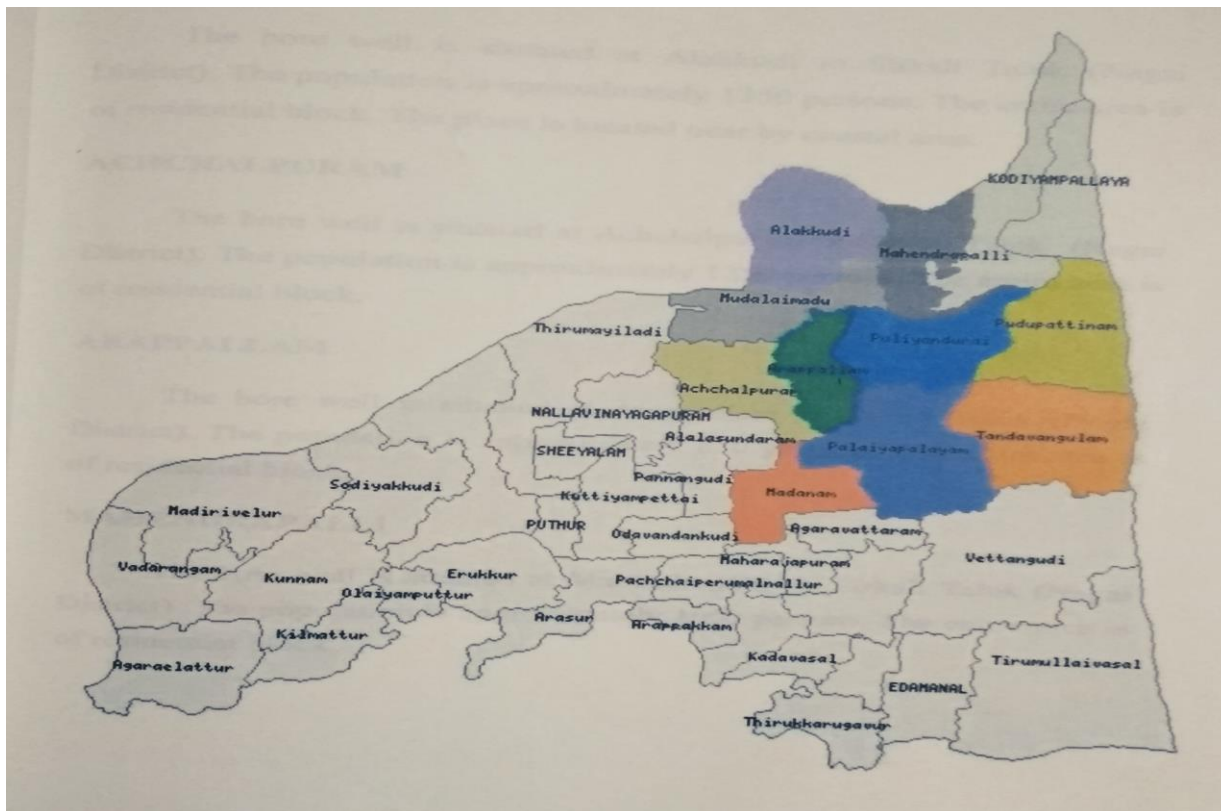


Fig 2: Study area map

Mudalaimadu

The bore well is situated at Mudalaimadu in Sirkali Taluk (Nagai District. the population is approximately 950 persons. The entire

area is of residential block. The place is located near by coastal area.

Alakkudi

The bore well is situated at Alakkudi in Sirkali Taluk (Nagai district)- the Population is approximately 1350 persons. The entire area is of residential block. The place is located near by coastal area.

Achchalpuram

The bore well is situated at Achchalpuram in Sirkali Taluk (Nagai District). The population is approximately 1250 persons. The entire area is of residential block.

Arappallam

The bore well is situated at Arappallam in Sirkali Taluk (Nagai District). The population is approximately 850 persons. The entire area is of residential block.

Mahendrapalli

The bore well is situated at Mahendrapalli in Sirkali Taluk (Nagai District), The population is approximately 1000 persons. The entire area is of residential block.

Puliyandurai

The bore Well IS Situated at Puliyandurai in Sirkali 'aluk (Nagai District. the population is approxImately 1350 persons. T he entire area is of residential block.

Pudupattinam

The bore well is situated at Pudupattinam in Sirkali 'aluk (Nagai District). The population is approximately 1200 persons. The entire area is of residential block.

Palaiyalayam

The bore well is situated at Palaiyalayam in Sirkali Taluk (Nagai District). The population is approximately 1050 persons. The entire area is of residential block.

Tandavangulam

The bore well is situated at Tandavangulam in Sirkali Taluk (Nagai District). The population is approximately 1000 persons. The entire area is of residential block.

Madanam

The bore well is situated at Madanam in Sirkali Taluk (Nagai District). The population is approximately 1150 persons. The entire area is of residential block.

Study area in Chidambaram

Chidambaram is located at southern part of Cuddalore district, Tamil Nadu State. The Study area Chidambaram which lies in between 11° 23' 32" latitude in the North 11° 21' 34" latitude in South. 79° 41' 30" longitude in the West. 79° 42' 55" longitude in

the liast. In this sub-urban area so many new residential layout's (Nagars) have developed in the recent years. More or less there are 50 nagars around in Chidambaram.

Areas of Water Sampling

The ground water samples have been collected randomly in the following sub-urban areas of Chidambaram Town.

1. Chidambaram Town - Three Samples
2. Annamalai Nagar - Three Samples
3. DTK Nagar - Three Sample
4. Kamaraj Nagar - Three Sample
5. Mariyappa Nagar - Three Sample
6. Min Nagar - Three Sample
7. MRV Nagar - Three sample
8. Muthaiyah Nagar -Three sample
9. Raja Nagar - Three Samples

3. Materials and Methods

The water samples were collected using sample collecting bottles. The sample bottles were rinsed with the distilled water to avoid contamination. While collecting water sample in shallow depth, the mouth of the bottle was tightly covered with the cap and submerge the bottle to the desired depth and remove cap to allow of water to enter the bottle. Squeeze the bottle or tap the sides to dislodge any air bubbles clinging insides of the bottle. Replace the cap while the bottle is till under water. After bringing the bottle to the surface, complete examine it to be certain that no air bubbles are present in the sample. No air should be introduced with the reagents are added by allowing the drops to fall into the test sample, because of the greater density of the reagents, they will quickly descend into the sample. After each addition of reagents the bottle is carefully capped for mixing, making sure that no air bubbles are formed. The sample for analysis of underground water from Twenty Number of deep bore wells around in kollidam areas. Before collecting the samples the instructions are followed as mentioned above. These samples are collected in the one liters bottles with air tight caps and sealed it. After taking samples, mentioned the date of sampling and location of bore well details etc. The collected samples were tested in environmental laboratory and advanced environmental laboratory, Department of Civil Engineering, Annamalai university. Water samples were collected from twenty number of bore wells in different localities and the physical and chemical analysis were carried out and tabulated.

4. Results & Discussion

Water samples collected from twenty number of bore wells in different locations in and around Kollidam area were tested. The results obtained as compared with the Indian Standards were established as follows. The table shows the permissible limits obtained values and remarks based on the comparison with standards.

Table 2: Quality of Ground water in and around Kollidam area

Location	Name of the Villages	pH	EC (micromohs/cm)	TDS (mg/lit)	Chlorides (mg/lit)	Sulphate (mg/lit)
1	Kuthavakarai Village	7.49	1805	1173	450	90
2	Achankadu Village	7.66	505	328	220	18
3	Mahendrapalli (Bus stand)	7.55	2758	580	833	3
4	Mahendrapalli	8.15	585	380	108	7
5	Puliyandurai	7.48	735	477	230	15
6	Puliyandurai Kovil medu	7.41	1022	624	250	19
7	Pullaiyar koil street	7.62	1677	1090	340	33

8	Pudhupattinam	7.71	1977	368	470	66
9	Thandavangulam	7.62	1258	802	430	12
10	Anna nagar Village	7.35	1370	880	365	32
11	Palaiyapalayam	7.41	1428	917	380	36
12	Palaiyapalayam (School)	7.18	1550	1007	328	57
13	Madanam	7.36	480	306	170	10
14	Serukudi Street Village	7.16	1684	1087	345	42
15	Mudalaimedu	7.10	1298	837	420	3
16	Thoppu street Village	7.0	2600	650	610	18
17	Achchalpuram	7.10	662	498	150	13
18	Sannathi Street Village	7.0	615	396	160	11
19	Arapallam	6.8	1272	768	450	24
20	West Street Village: Arapallam	7	2205	1277	580	26

Table 3: Quality of Ground water in and around Chidambaram area

Location	Name of the Villages	pH	EC (micromohs/cm)	TDS (mg/lit)	Chlorides (mg/lit)	Sulphate (mg/lit)
1.	Chidambaram	7.0	1470	955	300	25
2.	Annamalai Nagar	7.51	2300	1495	270	254
3.	DTK Nagar	7.12	5000	3250	4300	120
4.	Kamaraj Nagar	7.33	590	578.5	160	27
5.	Mariyappa Nagar	6.58	4300	2795	1840	51
6.	Min Nagar	6.93	2500	1625	615	132
7.	MRV Nagar	8.01	880	572	205	40
8.	Muthaiyah Nagar	6.85	7000	4550	440	123
9.	Raja Nagar	7.15	1180	767	300	18

The water quality standards for irrigation purposes is shown in Table-4.

Table 4: Indian Water Quality standards for Irrigation purposes

Characteristics	E
Dissolved Oxygen (DO)mg/l, min	-
Biochemical Oxygen demand (BOD)mg/l, max	-
Total coliform organisms MPN/100ml, max	-
pH value	6.0-8.5
Colour, Hazen units, max.	-
Odour	-
Taste	-
Total dissolved solids, mg/l, max.	2,100
Total hardness (as CaCO ₃), mg/l, max.	-
Calcium hardness (as CaCO ₃), mg/l, max.	-
Magnesium hardness (as CaCO ₃), mg/l, max.	-
Copper (as Cu), mg/l, max.	-
Iron (as Fe), mg/l, max.	-
Manganese (as Mn), mg/l, max.	-
Chlorides (as Cu), mg/l, max.	600
Sulphates (as SO ₄), mg/l, max.	1,000
Nitrates (as NO ₃), mg/l, max.	-
Fluorides (as F), mg/l, max.	-
Phenolic compounds (as C ₂ H ₅ OH), mg/l, max.	-
Mercury (as Hg), mg/l, max.	-
Cadmium (as Cd), mg/l, max.	-
Selenium (as Se), mg/l, max.	-
Arsenic (as As), mg/l, max.	-
Cyanide (as Pb), mg/l, max.	-
Lead (as Pb), mg/l, max.	-
Zinc (as Zn), mg/l, max.	-
Chromium (as Cr ⁶⁺), mg/l, max.	-
Anionic detergents (as MBAS), mg/l, max.	-
Barium (as Ba), mg/l, max.	-
Free Ammonia (as N), mg/l, max	-
Electrical conductivity, micromhos/cm, max	2,250
Sodium absorption ratio, max	26
Boron, mg/l, max	2

Table 5: Guidelines for Evaluation of Irrigation Water Quality

Water class	Sodium (Na) %	Electrical conductivity ($\mu\text{S}/\text{cm}$)	SAR	RSC meq/l
Excellent	< 20	< 250	< 10	< 1.25
Good	20 - 40	250 – 750	10 – 18	1.25 – 2.0
Medium	40 - 60	750 – 2,250	18 – 26	2.0 – 2.5
Bad	60 – 80	2,250 – 4,000	> 26	2.5 – 3.0
Very bad	> 80	> 4,000	> 26	> 3.0

Conclusion

The physical and chemical properties of underground water vary with time, due to factors like climate, geologic, hydrological, ecological and biogenetic factors. It also Vary due to artificial factors such as irrigation, reservoir etc. In this study, the underground water in 20 bore wells situated in and around Kollidam and 9 bore wells in Chidambaram were analysed. The results obtained from analysis shown that the Ground water quality in and around Chidambaram is deteriorated and exceeded the Indian water quality standards for irrigation purposes than Kollidam area.

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