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Physico-Chemical Analysis of Ground and Surface Water in Cuddalore District due to Effect of 2015 Monsoon

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ABSTRACT

The piece of investigation is carried out to study the ground water quality as well as surface water quality, nutrient status and physico–chemical characteristics in Cuddalore district. The present work has been conducted by monitoring two types of ground water i.e., open well water and bore well water as well as of ponds, viz. temple pond, small pond and large community pond in the town. Attempts were made to study and analyze the physico-chemical characteristics of the water. The work has been done by collecting samples from various villages of Cuddalore district and the chemical analysis is carried laboratory. A water quality standard is a rule or law comprised of the uses to be made of a water body or segment and the water quality criteria necessary to protect that uses, so a study has become necessary in the present days to determine suitability of these water for health.

Keywords: Appearance, Odour, Alkalinity, Calcium, Chlorides, Sulphates, Nitrate, Electrical conductivity, Total Hardness, Magnesium, pH, Turbidity, Total dissolved solids, Iron, Phosphate.

INTRODUCTION

Water is absolutely essential for the existence, development, preservation of all human life, making it essential commodity in the world. However, nearly one billion people in the world lack access to portable water, mainly those living in third world countries. A water crisis has gripped these regions, threatening the quality of life of those living in developing world. According to the United Nation Human Development Report, the water and sanitation crisis claims more lives through diseases than any war claims through weapons (Water Fact 2012). The world's water resources are getting polluted due to man's activities. Domestic, industrial and agricultural wastewater pollutes the environment. Ground water is replenish able source and is considered to be the least polluted as compared to other inland water sources.

Urban areas are thickly populated and the density of wells is high. The major problem encountered in urban areas is the deterioration of the quality of water resources due to sewage and leach pits and seawater intrusion in coastal areas. The ground water available becomes unsuitable for domestic purposes. Recent studies have shown that in rural areas also the ground water resources are polluted due to poor sanitation facilities.

The general lack of sufficient quantities of safe drinking water to the developing world continues to be a serious problem. Providing safe water can dramatically and immediately improve the health of communities and also lead to the elimination of serious illnesses. Very little information is available on the removal and inactivation of harmful microorganisms. Many communities either suffer from chronic shortage of fresh water or the readily accessible water resources available there are heavily polluted. Hence it is essential to develop an ecofriendly home treatment method for purifying drinking water that can be adopted by common man.

The present study is aimed at evaluating and studying the extent of pollution of ground and surface water in selected areas of CUDDALORE District. An attempt has been made to improve the water quality.

MATERIALS AND METHODS

Sampling Techniques

A. Study Area

Pollution is commonly regarded as the result of the industrial revolution. Environmental quality of the area deteriorates mainly as a result of the increasing industrial activity. In order to find out the current status of the pollution in the area, due to the increasing trend in the industrial activities, it is very much essential to identify the various sources of pollution. Water is essential for the survival of any form of life.

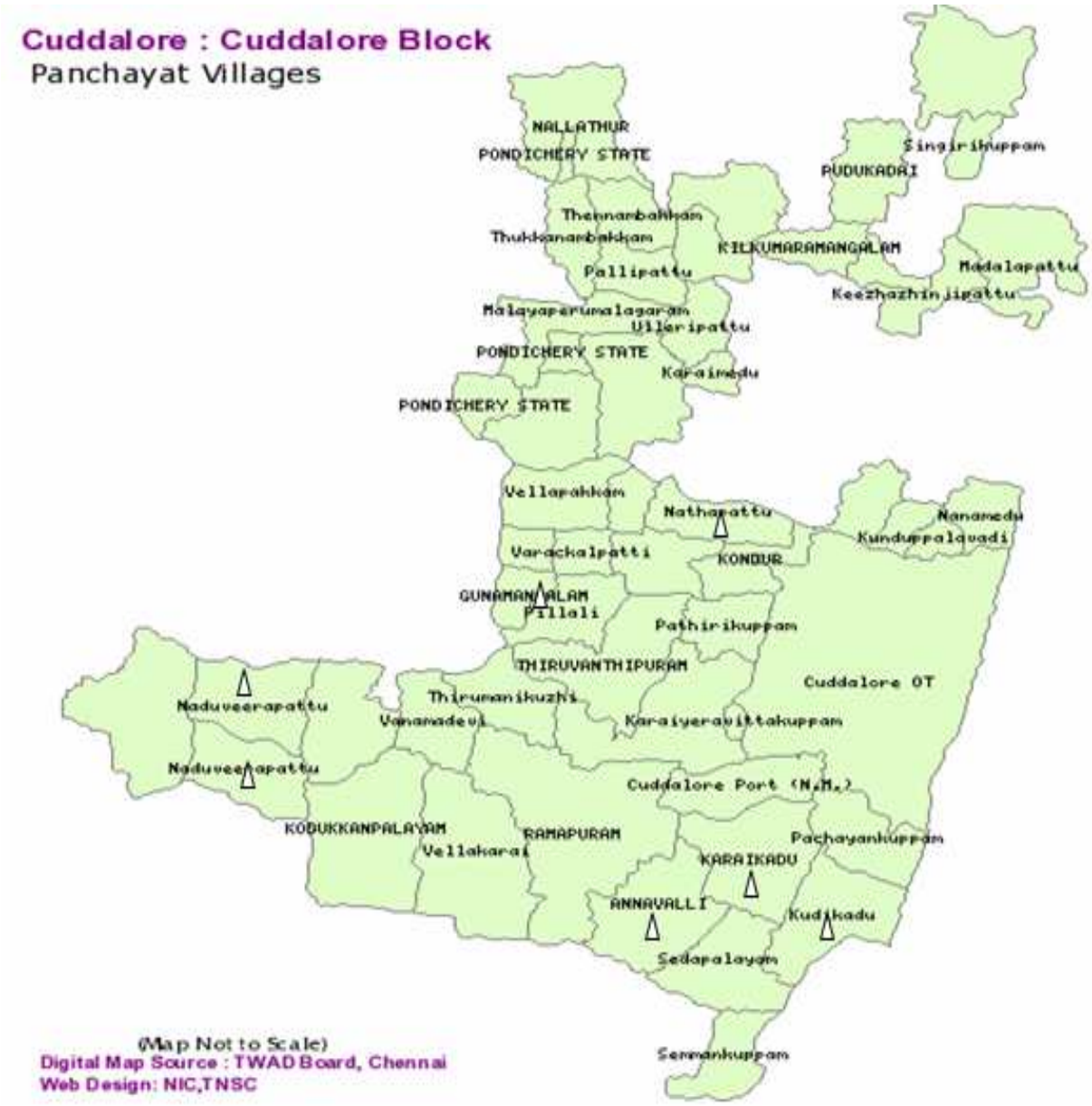

Fig.1 Digital Map of the study area

B. Sample collected areas

- Naduveerapattu
- Vilangalpattu
- Krishnankuppam
- Kullanchavadi
- Annavalli
- Keelakollai
- Vegakollai
- Karaikadu

C. Sampling Procedure

The samples were collected. They were normally collected in the afternoons in two plastic non-reacting bottles of 2litres capacity each. Immediately after sampling, preservatives were added to them and the bottles were recapped and sealed by the application of hot molten wax. These sealed bottles were put in a thermocol box and the box was put inside a deep fridge till it was carried to laboratory for carrying out the analysis. Sodium thiosulphate preservatives were used for sampling in tablet forms.

D. Sampling Collection Procedure

- If wearing the long sleeve shirt, roll sleeves of the shirt up, past elbow.
- Take a labeled sterile the 250ml sample bottle. Make sure that you keep the lid on the bottle.
- Hold sterile bottle in hand near its base and carefully remove and hold cap with the other hand. Don't touch the inside of the cap when sampling.
- Tip enough water from bottle to leave air space of about 1-2 cm from rim of the bottle.
- Carefully replace the cap immediately.

RESULTS AND DISCUSSION

A. Experimental Parameters

After the samples were preserved and brought to the laboratory, various experimental analyses were carried out on them in order to determine the water quality. The parameters for which tests were conducted include the following viz.

- Appearance
- Odour
- Turbidity
- Electrical Conductivity
- Total Dissolved Solids
- PH
- Alkalinity
- Total Hardness
- Calcium
- Magnesium
- Ammonia
- Iron
- Manganese
- Nitrite
- Nitrate
- Chlorides
- Fluoride
- Sulphates
- Phosphate
- Tidy's

B. Analysis

The basic purpose of conducting the analysis work is to compare the results for various parameters of the given water sample with the IS: 10500 drinking water standard and as well as the required steps can also be taken for disinfection and others purposes.

C. Experimental Results

The experiments were conducted to analyse the samples which are collected from various areas of the Cuddalore district and the results of different parameters were predicted and calculated. The results were formulated and compared with the previous data's.

TABLE.1 The result of analysis of sample before the effect of 2015 Monsoon

Sl. No	Lab No	Panchayat	Habitation	source	Appearance	Odour	Turbidity	Electrical Conductivity	Total Dissolved Solids	pH	Alkalinity	Total Hardness	Calcium	Magnesium	Ammonia	Iron	Manganese	Nitirte	Nitrate	Chloride	Fluoride	Sulphate	Phosphate	Tidy's
Acceptable limit							1	_	500	7.0-8.5	200	200	75	30	0.5	0.3	0.1	-	45	250	1.0	200	-	-
Cause for rejection when exceeds							5	_	2000	6.5-9.2	600	600	200	150	0.5	0.3	0.3	-	45	1000	1.5	400	-	-
1	47931	Naduveerapattu	Naduveerapattu	BW	Colourless & clear	None	3.0	720	650	4.7	148	87	45	0.0	0.0	0.0	0.0	0.0	13	214	0.0	39	0.0	0.3
2	47932	Naduveerapattu	Naduveerapattu	Open well	Colourless & clear	None	0	1150	690	4.9	232	67	32	0.0	0.0	0.0	0.0	0.0	13	356	0.1	43	0	0.3
3	47933	Vilangalpattu	Vilangalpattu	BW	Colourless & clear	None	0	420	376	5.2	116	63	14	0.0	0.0	0.0	0.0	0.0	4	123	0	21	0	0.2
4	47934	Vilangalpattu	Vilangalpattu	Open well	Colourless & clear	None	0	1560	1040	4.9	266	113	29	0.0	0.0	0.0	0.0	0.0	14	422	0	18	0	0.3
5	47935	Vilangalpattu	Vilangalpattu	Lake water	Slightly brownish	None	10	320	210	5.0	163	12	19	0	0.0	0.0	0.0	0.0	5	87	0	11	0	0.3
6	47936	Krishnankuppam	Krishnankuppam	BW	Colourless &Clear	None	0.0	178	276	5.4	185	53	14	0	0.0	0.0	0.0	0.0	8	62	0.4	13	0	0.2
7	47937	Krishnankuppam	Krishnankuppam	Open well	Colourless &Clear	None	0.5	516	420	5.5	185	88	21	0	0.0	0.0	0.0	0.0	7	126	0	34	0	0.2
8	47938	Krishnankuppam	Krishnankuppam	Lake water	Brownish	None	7	146	135	6.5	152	24	18	0.7	0.0	0.0	0.0	0.0	0	37	0	43	0	0.2
9	47939	Kullanchavadi	Kullanchavadi	BW	Colourless &Clear	None	0	253	215	5.5	0	120	19	13	0.0	0.0	0.0	0.0	0	59	0	21	0	0.3
10	47940	Kullanchavadi	Kullanchavadi	Open well	Colourless &Clear	None	0	427	346	5.0	220	48	31	0	0.0	0.0	0.0	0.0	15	101	0.1	53	0	0.3

TABLE.1 The result of analysis of sample before the effect of 2015 Monsoon

Sl. No	Lab No	Panchayat	Habitation	source	Appearance	Odour	Turbidity	Electrical Conductivity	Total Dissolved Solids	pH	Alkalinity	Total Hardness	Calcium	Magnesium	Ammonia	Iron	Manganese	Nitirte	Nitrate	Chloride	Fluoride	Sulphate	Phosphate	Tidy's
Acceptable limit							**1**	_	**500**	7.0-8.5	**200**	**200**	**75**	**30**	**0.5**	**0.3**	**0.1**	-	**45**	**250**	**1.0**	**200**	-	-
Cause for rejection when exceeds							**5**	_	**2000**	6.5-9.2	**600**	**600**	**200**	**150**	**0.5**	**0.3**	**0.3**	-	**45**	**1000**	**1.5**	**400**	-	-
11	47941	Kullanchavadi	Kullanchavadi	Lake water	Colourless &Clear	None	0	794	647	5.1	343	116	31	0.36	0.0	0.0	0.0	0.0	9	134	0.2	132	0	0.4
12	47942	Annavalli	Annavalli	BW	Colourless &Clear	None	0	583	534	4.4	208	67	27	0.2	0.0	0.0	0.0	0.0	13	153	0.1	56	0	0.4
13	47943	Annavalli	Annavalli	Lake water	Slighty brownish	None	4	423	315	4.6	116	220	43	18.5	0.0	0.0	0.0	0.0	9	112	0	17	0	0.4
14	47963	Keela kollai	Keela kollai	pond water	Slightly yellowish	None	5	87	113	5	86	**45**	23	6	0.0	0.0	0	0	0	18	0.1	28	0	0.3
15	47964	Keela kollai	Keela kollai	bore water	Colourless &Clear	None	3.2	165	116	6	117	67	18	4	0	0	0	0	0	36	0.1	21	0	0.3
16	47965	Vegakollai	Vegakollai	bore water	Colourless &Clear	None	0	210	146	4.3	95	112	14	3	0	0	0	0	0	56	0	64	0	0.3
17	47966	Vegakollai	Vegakollai	pond water	Slightly brownish	None	5.3	87	98	6.3	90	89	18	3	0.0	1.00	0	0	0	21	0	12	0	0.2
18	47967	karai kadu	karai kadu	bore water	Slightly Yellowish	None	3.9	510	397	5	343	160	76	7	0.0	1.00		0	9	65	0	15	0	0.2
19	47968	karai kadu	karai kadu	Open well	Colourless &Clear	None	4.6	463	445	4.2	146	160	62	6	0.0	0.50		0	10	122	0	9	0	0.2

TABLE.2 The result of analysis of sample after the effect of 2015 Monsoon

Sl. No	Lab No	Panchayat	Habitation	source	Appearance	Odour	Turbidity	Electrical Conductivity	Total Dissolved Solids	pH	Alkalinity	Total Hardness	Calcium	Magnesium	Ammonia	Iron	Manganese	Nitirte	Nitrate	Chloride	Fluoride	Sulphate	Phosphate	Tidy's
Acceptable limit							1	–	500	7.0-8.5	200	200	75	30	0.5	0.3	0.1	-	45	250	1.0	200	-	-
Cause for rejection when exceeds							5	–	2000	6.5-9.2	600	600	200	150	0.5	0.3	0.3	-	45	1000	1.5	400	-	-
1	47931	Naduveerapattu	Naduveerapattu	BW	Colourless & clear	None	1.0	650	455	5.3	140	35	12	0.0	0.0	0.0	0.0	0.0	4	167	0.0	17	0.0	0.3
2	47932	Naduveerapattu	Naduveerapattu	Open well	Colourless & clear	None	0	1040	728	5.8	180	48	14	0.0	0.0	0.0	0.0	0.0	5	242	0.1	18	0	0.3
3	47933	Vilangalpattu	Vilangalpattu	BW	Colourless & clear	None	0	360	252	5.0	60	21	2	0.0	0.0	0.0	0.0	0.0	1	87	0	9	0	0.2
4	47934	Vilangalpattu	Vilangalpattu	Open well	Colourless & clear	None	0	1350	945	6.0	200	66	9	0.0	0.0	0.0	0.0	0.0	6	253	0	67	0	0.3
5	47935	Vilangalpattu	Vilangalpattu	Lake water	Slightly brownish	None	10.3	200	140	6.2	50	6	8	2	0.0	0.0	0.0	0.0	1	52	0	1	0	0.3
6	47936	Krishnankuppam	Krishnankuppam	BW	Colourless &Clear	None	0.0	230	161	4.9	80	22	6	0	0.0	0.0	0.0	0.0	2	24	0.4	6	0	0.2
7	47937	Krishnankuppam	Krishnankuppam	Open well	Colourless &Clear	None	0.8	485	340	5.0	80	21	7	0	0.0	0.0	0.0	0.0	2	97	0	14	0	0.2
8	47938	Krishnankuppam	Krishnankuppam	Lake water	Brownish	None	7	130	91	5.5	48	8	7	0.68	0.0	0.0	0.0	0.0	0	17	0	5	0	0.2
9	47939	Kullanchavadi	Kullanchavadi	BW	Colourless &Clear	None	0	215	151	4.6	0	80	11	12.5	0.0	0.0	0.0	0.0	0	37	0	5	0	0.3
10	47940	Kullanchavadi	Kullanchavadi	Open well	Colourless &Clear	None	0	375	263	4.8	120	22	15	0	0.0	0.0	0.0	0.0	4	76	0.1	20	0	0.3

TABLE.2 The result of analysis of sample after the effect of 2015 Monsoon

SL No	Lab No	Panchayat	Habitation	source	Appearance	Odour	Turbidity	Electrical Conductivity	Total Dissolved Solids	pH	Alkalinity	Total Hardness	Calcium	Magnesium	Ammonia	Iron	Manganese	Nitrite	Nitrate	Chloride	Fluoride	Sulphate	Phosphate	Tidy's
	Acceptable limit						1	–	500	7.0-8.5	200	200	75	30	0.5	0.3	0.1	-	45	250	1.0	200	-	-
	Cause for rejection when exceeds						5	–	2000	6.5-9.2	600	600	200	150	0.5	0.3	0.3	-	45	1000	1.5	400	-	-
10	47940	Kullanchavadi	Kullanchavadi	Open well	Colourless &Clear	None	0	375	263	4.8	120	22	15	0	0.0	0.0	0.0	0.0	4	76	0.1	20	0	0.3
11	47941	Kullanchavadi	Kullanchavadi	Lake water	Colourless &Clear	None	0	725	508	6.5	220	61	16	0.27	0.0	0.0	0.0	0.0	4	87	0.2	73	0	0.4
12	47942	Annavalli	Annavalli	BW	Colourless &Clear	None	0	570	399	5.4	140	32	14	0.14	0.0	0.0	0.0	0.0	5	117	0.1	21	0	0.4
13	47943	Annavalli	Annavalli	Lake water	Slighty brownish	None	3.8	395	277	6.2	82.1	140	27	17.3	0.0	0.0	0.0	0.0	2	73	0	2	0	0.4
14	47963	Keela kollai	Keela kollai	pond water	Slightly yellowish	None	4	70	49	5	22	24	2	4	0.0	0.1	0	0	0	7	0.1	7	0	0.3
15	47964	Keela kollai	Keela kollai	bore water	Colourless &Clear	None	3.8	140	98	5.3	52	46	10	5	0	0	0	0	0	14	0.1	5	0	0.3
16	47965	Vegakollai	Vegakollai	bore water	Colourless &Clear	None	0	165	116	4.4	35	50	14	3	0	0	0	0	0	21	0	24	0	0.3
17	47966	Vegakollai	Vegakollai	pond water	Slightly brownish	None	3.9	70	49	5.1	22	24	4	3	0.0	0.96	0	0	0	9	0	3	0	0.2
18	47967	karai kadu	karai kadu	bore water	Slightly Yellowish	None	4.2	465	326	6.2	173	150	47	8	0.0	0.96		0	2	26	0	6	0	0.2
19	47968	karai kadu	karai kadu	Open well	Colourless &Clear	None	4	440	308	4.9	86	88	26	6	0.0	0.27		0	2	77	0	3	0	0.2

Effects due to Unfitness of Water

A. Diarrhea

Diarrhea is caused by a variety of micro-organisms including viruses, bacteria and protozoans. Diarrhea causes a person to lose both water and electrolytes, which leads to dehydration and, in some cases, to death. Excreta is the main cause of childhood diarrheal diseases About 4 billion cases of diarrhea per year cause 1.8 million deaths, over 90 per cent of them (1.6 million) among children under five.

Repeated episodes of diarrheal diseases makes children more vulnerable to other diseases and malnutrition. Diarrhea is the most important public health problem directly related to water and sanitation. The simple act of washing hands with soap and water can cut diarrheal disease by one-third. Next to providing adequate sanitation facilities, it is the key to preventing waterborne diseases.

B. Arsenicosis

Long-term exposure to low concentrations of arsenic in drinking-water cause's painful skin keratosis (hardened lesions) and can result in cancers of the skin, lungs, bladder and kidney. Millions of people are potentially in danger from arsenic poisoning since they rely on water supplies that are contaminated with arsenic (mainly from natural sources) and do not have a safe water alternative or are unaware of the risks.

C. Cholera

Cholera is an acute bacterial infection of the intestinal tract. It causes severe attacks of diarrhea that, without treatment, can quickly lead to acute dehydration and death. Cholera is a world-wide problem, especially in emergency situations. It can be prevented by access to safe drinking water, sanitation and good hygiene behavior (including food hygiene). In 2002, over 120,000 cholera cases were reported worldwide.

D. Fluorosis

Fluorosis is a serious bone disease caused by high concentrations of fluoride occurring naturally in groundwater. Fluorosis is endemic in at least 25 countries across the globe. The total number of people affected is not known, but a conservative estimate would number in the tens of millions.

E. Guinea Warm Diseases

People contract the disease (also known as Dracunculiasis) when drinking water contaminated with Dracunculus larvae. The larvae mature into large (up to a meter long) adult Guinea worms and leave the body after about a year, causing debilitating ulcers. The incidence of cases of Guinea worm disease is steadily decreasing worldwide as a result of a concerted international initiative. However, in 2002 there were still 50,000 cases reported in a total of 13 countries in Africa.

F. HIV/AIDS

A hygienic environment, clean water and adequate sanitation are key factors in preventing opportunistic infections associated with HIV/AIDS, and in the quality of life of people living with the disease. AIDS-affected people are more susceptible to water-related diseases than healthy individuals, and they become sicker from these infections than people with healthy immune systems. Maintaining a healthy environment is essential to safeguarding the health, quality of life and productivity of people living with HIV/AIDS.

G. Intestinal Worm Diseases

People become infected with intestinal parasitic worms (also known as helminthes) through contact with soil that has been contaminated with human faces from an infected person, or by eating contaminated food.Intestinal worms infect about 10 per cent of the population in the developing world and, depending upon the severity of the infection, lead to malnutrition, anemia or retarded growth. Children are particularly susceptible and typically have the largest number of worms. About 400 million school-age children are infected by roundworm, whipworm and/or hookworm. In fact, roundworm and whipworm alone are estimated to affect one-quarter of the world's population.

H. Malaria

Malaria is a serious disease caused by a parasite carried by certain types of mosquitoes. Humans are infected when bitten by the mosquitoes. Each year, there are 300 million to 500 million cases of malaria throughout the world and about 1 million child deaths. Reducing the mosquito population in households and communities by eliminating standing water (caused by poor drainage and uncovered water tanks) can be an important factor in reducing malaria cases.

I. Schistosomiasis

Schistosomiasis (also known as bilharzia) is a disease caused by parasitic worms. At various stages of the life cycle, worms and their eggs live in certain types of freshwater snails, water (where they can survive for 48 hours) and human hosts. They penetrate the skin of people swimming, bathing or washing in contaminated water, they then cause infection and can eventually damage the liver, intestines, lungs and bladder. About 200 million people are infected with schistosomiasis, 20 million of whom suffer severe consequences. Studies have found that adequate water supply and sanitation – which reduces contact with contaminated surface water – could reduce infection rates by 77 per cent.

J. Trachoma

Trachoma is an eye infection spread mainly through poor hygiene caused by lack of adequate water supplies and unsafe environmental sanitation conditions. About 6 million people are blind today because of trachoma. It affects women two to three times more than men. Children are also especially susceptible. Studies have found that providing adequate water supplies could reduce infection rates by 25 per cent.

K. Typhoid

Typhoid fever is a bacterial infection caused by ingesting contaminated food or water. Symptoms are characterized by headaches, nausea and loss of appetite. About 12 million people are affected by typhoid every year.

CONCLUSION

Drinking-water reserves, because of their importance to public health, are a collective concern. It is everyone's duty to ensure that they are properly safeguarded and protected. The main causes to pollute the ground water are solid waste disposal, domestic and industrial sewage drainage, so in order to avoid possible water contamination we have to treat them. In Cuddalore district several ponds, lakes, and bore wells have been identified and water samples were collected and analyzed to find out its quality and the calculated values are as follows.

The pH ranges from 4.32 to 9.36. The Turbidity and TDS ranged from 2.31 to 13.52 NTU and 200 to 1000 mg/l respectively. Hardness, ranged from 102.5 mg/l to 597.5 mg/l. The DO and COD were in the range of 122 to 186.5 mg/l and 224 to 544 mg/l. The Chloride and Alkalinity were in the range of 120 to 1384.96 mg/l and 96.5 to 160 mg/l respectively. It was found to be very effective in the determination of bacteria from water.

Pollution is mainly due to domestic effluents which are spread in and around Cuddalore district. A systematic study and analysis of 20 water samples have been analyzed. It is found that 4 samples are contaminated and the remaining samples have been found to be potable. As a result the study revealed that in Annavalli, Krishnankuppam, Karaikadu areas, some of the bore and well water are microbiologically contaminated and were found to be non-potable. It should be properly treated and we have to give awareness to users and they are suggested to use water for drinking purpose after the boiling of water and the major treatment would done by the Government, as well as recycling of waste water along with periodical monitoring of the underground water should take into account.

Hence by means of analyzing the above sampling areas, the following parameters such as Appearance, Odour, total alkalinity, calcium, chlorides Sulphates, Nitrate, Electrical conductivity, total hardness, magnesium, pH, turbidity, Total dissolved solids, iron, phosphate with previous year ranges obtained, it has been clearly noted that ,due to the flood activity, surface runoff occurs and the observed parameters of some areas has been secured to the safe permissible limit of about a certain limit and in some of the areas where the sample has been collected is unfit to use. Hence the secured treatment has to be provided to make the phosphate to retain in safe permissible limit.

REFERENCES

[1] Almasri, M. L., J. J. Kaluarachchi, **2004**, *Journal of Hydrology*, 295 (1-4): 225-245.
[2] Dugan, P.R., **1972**, *Biochemical Ecology of Water Pollution, Plenum Press London*, 159.
[3] Herzog, D. J., **1996**, *Evaluating the potential impacts of mine wastes on ground and surface waters Fuel and Energy.*
[4] Karnchanawong.S., S.K.T.Ikeguchi, **2000**, *Environmental International*, 19(6):579-587.
[5] Mikkelsen, P. S., Hafliger, M. Ochs, P. acobsen, J. C. Tjell., M.Boller, **2006**, *Pollution of soil and groundwater from infiltration of highly contaminated*, 37(2): 139.
[6] Maticie, B, **2011**, *Agricultural Water Management*, 40(2-3): 235-247.
[7] Pani, B.S. **2013**, "*Outfall diffusers*", Abstract of the National Seminar on Air and Water Pollution, University College of Engineering, Burla.
[8] Storm water a case study, *Water Science and Technology*, 36(8-9): 325-330.
[9] Shamruck, M., M. YavuzCorapcioglu, Fayek A. A. Hassona, **2012**, *Groundwater*, 39(1): 59-67.
[10] Zhang, W.L., Z.X.Tian, N. Zhang, X. Q. Li, **2014,** *Ecosystems & Environment*, 59(3):223-231.