Research Article

Physico-Chemical Characteristics Variation in Pre-Monsoon and Post-Monsoon of Ground Water Quality at Bhimavaram Industrial Area, West Godavari, India.

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ABSTRACT

The history of human civilization reveals that water supply and civilization are almost synonymous. 71% of the earth's surface is covered by water,97% of water is in oceans and not useful without treatment. The remaining 3% is fresh water and is found in rivers, lakes, and underground aquifer sand locked up as ice are our water wealth. Some centuries ago, water from these sources was clean and potable, but due to heavy industrialization, excessive use of fertilizers and pesticides, unscientifically disposal of sewage ,water pollution has become the main problem for all living organisms.The present study area, Bhimavaram (Industrial area) in West Godavari is no exception as it is one of the rapidly growing industrial areas in the state of Andhra Pradesh. In the present study an attempt has been made to identify the ground water quality of the selected sites in and around Bhimavaram in Pre monsoon and Post monsoon phase of the year 2014. The physicochemical parameters like pH, Electrical conductivity, Total Hardness, Total Alkalinity, Chloride, Sulphate, Fluoride and Nitrate were studied to analyze the ground water quality . Better water quality was found in Pre-monsoon season than that of Post-monsoon season. The present study has its significance for public hygiene in public interest.

Keywords: Parameters, physico-chemical assessment, pre and post monsoon.

INTRODUCTION

Ground Water quality plays an important role in groundwater protection and quality conservation; hence it is very much important to assess the groundwater quality not only for its present use but also a potential source of water for future consumption. Ground water is highly valuable source of water because of its unique properties which may not be possessed by surface water. Most of the water is being utilized by man for domestic and industrial purpose. Ground Water a part of the rain water reaches the earth surface and percolates into the earth. During the percolation, it comes into contact with a number of mineral present in the soil, which may be dissolved in the water. It flows down till it reaches hard rock and may retread in upward direction and comes out in the form of spring water. It should contain no harmful concentrations of chemicals or pathogenic microorganisms, and ideally it should be aesthetically pleasing in regard to appearance, taste and odour.

In India, a large section of population is dependent on untreated ground water which is generally believed to be free from contamination and thus considered safe for drinking purpose. Contamination of drinking water may occur by percolation of toxic substances through the soil . The rapidly growing urbanization and industrialization have resulted in increased discharge of pollutants into the water bodies. Water pollutants categorizes into four basic categories: pathogens and other organic materials, chemicals including organic andinorganic toxic substances, thermal heat, and suspended materials. Organic materials such as pesticides, fertilizers, plastics, detergents, gasoline,oil, factory waste water, and fossil fuels are among the most severe pollutants. Hence there is need to assess the ground water quality in the rural areas. But lack of sanitation, improper

waste and surface water contamination were attributed to polluted ground water consumption . Both the rural and urban areas in India face the most significant environmental problem and threat is inadequate access to clean water and poor sanitation .

STUDY AREA

The town Bhimavaram and its nearby areas of West Godavari District of Andhra Pradesh in India are selected as the study area for the present investigation.

Historical Information-West Godavari District is situated to the west of River Godavari, which runs through the whole length of the Godavari till it falls into the Bay of Bengal. West Godavari district was formed on 15th of April, 1925 with Machilipatnam as its headquarter. West Godavari is basically an agrarian district with rich natural resources.

Socio-economic conditions of the study area-Bhimavaram riches itself as one of the largest centers for aquaculture in India where loads of fish and prawn are reared and is a major sector of income. Agriculture is the other major sector, with rice as the main crop, pulses and coconuts also being important. It has an industrial estate area, comprising of various small scale industries for processing agricultural food products like rice mills, edible oil mills, prawn processing industry, plastic recycling units, brick manufacturing industry, pharmaceutical units. The industrialization has brought a change in socio-economic life of the town. People are enjoying all modern facilities like electrification, banking, transport, medical and communication network. Industrialization has caused a rise in the employment opportunities. Though agriculture is an important activity in the study area, 70% of the people are working as labour in the industries. Industrialization has completely changed the Town pattern as well as made an impact on the environmental conditions. Economic stability and change in attitude of people and availability from different manufactures enable people buy cars, two wheelers in large number. Discharge of untreated sewage by the civic bodies and effluents by industries is of feat concern. Owing to aquaculture craze, conversion of coastal lands in to prawn cultivation ponds. Use of increased quantities of antibiotics and food in aqua ponds, bringing saline water for these ponds from deep bore wells or back water are the predominant are the common sighting in the study area.

MATERIALS AND METHODS

The Study area selected was total industrial area of Bhimavaram industrial area, West Godavari. Water samples were drawn from hand pumps during Pre monsoon and Post-monsoon period of the year 2014. Present study comprises of interpretation and analysis of water samples collected from Twenty different stations in and around Bhimavaram. Drinking water samples were collected using sterilised plastic bottles and before collecting the sample the bottle is washed with dil.HNO3 and rinsed with distilled water. The samples were collected in regular intervals ie.... pre monsoon and post monsoon for the year 2014 The collected samples were brought to the laboratory to determining physio-chemical and microbial parameters by using standard techniques.A comparative study of water samples are analysed for not only pre monsoon & post monsoon but a conformative study was taken up finally for the last four consecutive months ie.... January, February, march and april. The results obtained were compared with drinking water quality standards set by BIS (Bureau of Indian standards).

RESULTS AND DISCUSSIONS

The water quality analysis of different ground water has been carried out which include following parameters pH, Total Dissolved Solids, Chloride, Sulphate, Total Hardness, Total alkalinity, Nitrate and Fluoride. In the Present study,

pH -The average pH is 8.36 during Pre-Monsoon and 8.01 during Post-Monsoon. All the samples were within the maximum permissible limit i.e., 6.5 – 8.5 . But changes were observed during the both Seasons.

Total dissolved solids -Average 783mg/l during pre-monsoon and 436.8mg/l during post-monsoon season.The presence of dissolved solids in water may affect its taste. High concentrations of total dissolved solids (TDS) may cause adverse taste effects ,cancer, coronary heart disease.

Total Hardness -Total Hardness is very important parameter to analyse water quality and decrease the toxic effect of poisonous element. The Average hardness was found to be 270mg/l in Pre-monsoon and 159.2 mg/l during

Post-monsoon.In most of the sampling locations of the study area, the hardness is very high, also beyond permissible limit. It is due to rocks bearing salts of Calcium and Magnesium.

Calcium and magnesium -Calcium and magnesium content in drinking water should be within permissible limit. The permissible limit of calcium and magnesium content in drinking water is 75 mg/L and 30 mg/L respectively . According to the results obtained in the present study calcium (around 50 mg/L) and magnesium content were within permissible limit .Calcium content was high compared to magnesium contents in all drinking water samples. When studied, calcium is high and is almost in the dangerous limits because of the formation of CaCO3 in the pipe lines which causes cracking in pipes

Alkalinity-The Average Alkalinity is 217.7mg/lit in Pre-monsoon and 158 mg/lit during Post-monsoon . Alkaline water may decrease the solubility of metals. The alkalinity varies in accordance with the fluctuation in the pollution load

Fluoride- Flouride in ground water is fluoride-bearing rocks such as fluorspar, fluorite, cryolite, fluorapatite and hydroxylapatite. The Average fluoride concentration in drinking water is 0.08mg/l in Pre Monsoon and 0.09mg/l in Post Monsoon. The fluoride concentration in groundwater of this is only in Nalgonda region (Andhra Pradesh) ranged from 0.1 to 8.8mg/l with mean of 1.3mg/l .

Chlorides- Chlorides are important in detecting the contamination of groundwater by waste water.Chloride concentration of the ground water samples ranges at 166.45 mg/l during pre-monsoon and 117.45 mg/l during post-monsoon Maximum .Chloride contamination in groundwater is due to both natural and anthropogenic sources, such as run-off containing road de-icing salts, the use of inorganic fertilizers, landfill leachates, septic tank effluents, animal feeds, industrial effluents, irrigation drainage, and seawater intrusion in coastal areas

Sulphates-Sulphates occur naturally in numerous minerals, including barite (BaSO4), epsomite (MgSO4·7H2O) and gypsum (CaSO4·2H2O). These dissolved minerals contribute to the mineral content of many drinking-waters. Pre monsoon average 30.2mg/l and Post-monsoon 17.16mg/l. Sulphate content in all the ground water samples is under the limit prescribed by BIS in both the seasons.

Iron- Iron content in drinking water is 0.3 mg/L and it present in different forms such as; in solution or complex with other minerals or organic substances. It is commonly found in water in the ferric form and cause harmful effects to the human body if it exceeds its permissible limit in drinking water. In the present investigation the iron content ranged between 0.1 – 1.2 mg/L.Generally,in this area the Iron content will be more in Hand pumps and shallow hand pumps mainly corroded metal pipes which are used for drinking water supply and iron pipe lining of bore wells which were almost corroded.

Nitrate- Nitrate indicates the pollution in ground water due to sewage percolation beneath the surface. Presence of Nitrate indicates the pollution in ground water due to sewage percolation beneath the surface. The nitrate concentration is found to be in the average of 1.92mg/l during Pre-monsoon 1.05mg/l during Post-monsoon. It is within the desirable limit.

Sulphate- Sodium sulphate and magnesium sulphate exert a cathartic action in the human being and also sulphate is associated with respiratory illness. Therefore the recommended limit of sulphate content in the drinking water is 200 to 250 mg/L. The results obtained in the present study showed that sulphate content in all water samples were ranged around 50 mg/L and is within permissible limit.

The study and the values of the experimented samples including the graphical representation were given below,

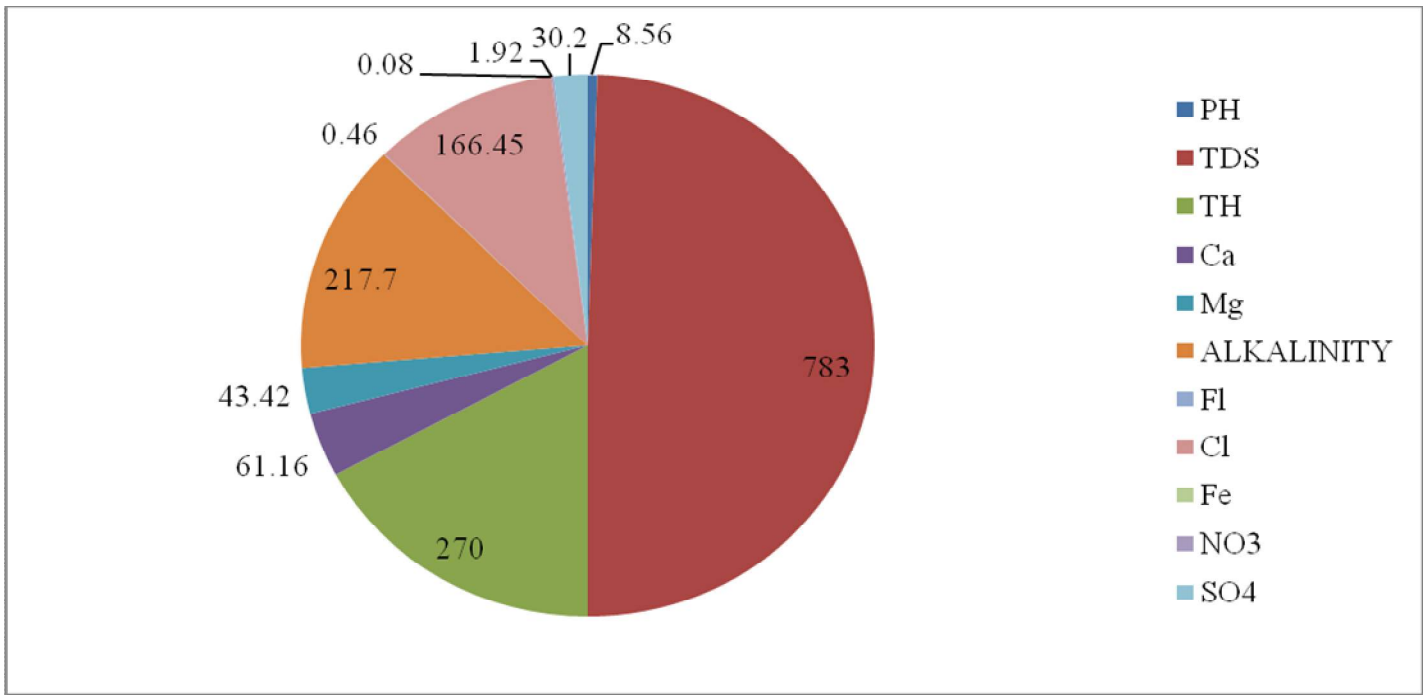
Details of analytical methodology and drinking water quality standards

S. No.	Parameters	Symbols	Methods	Units	*Desirable
1	Temperature	T	-	OC	-
2	Color	-	Hazan unit		5
3	Odour	-	-	-	
4	pH	pH	Potentiometry	pH	6.5-8.5
5	Total dissolved solids	TDS	Gravimetry	mg/l	500
6	Total hardness	TH	EDTA titrimetric	mg/l	300
7	Calcium	Ca	EDTA titrimetric	mg/l	75
8	Magnesium	Mg	by difference	mg/l	30
9	Chloride	Cl	Argentometry	mg/l	250
10	Nitrates	NO3	Spectrophotometry	mg/l	45
11	Sulphate	SO4	Nephloturbidimetry	mg/l	200
12	Alkalinity	alkalinity	Titrimetry	mg/l	200
13	Fluoride	F	ET–AAS	mg/l	1.9
14	Iron	Fe	ET–AAS	mg/l	0.3

PRE MONSOON AND POST MONSOON ANALYSIS

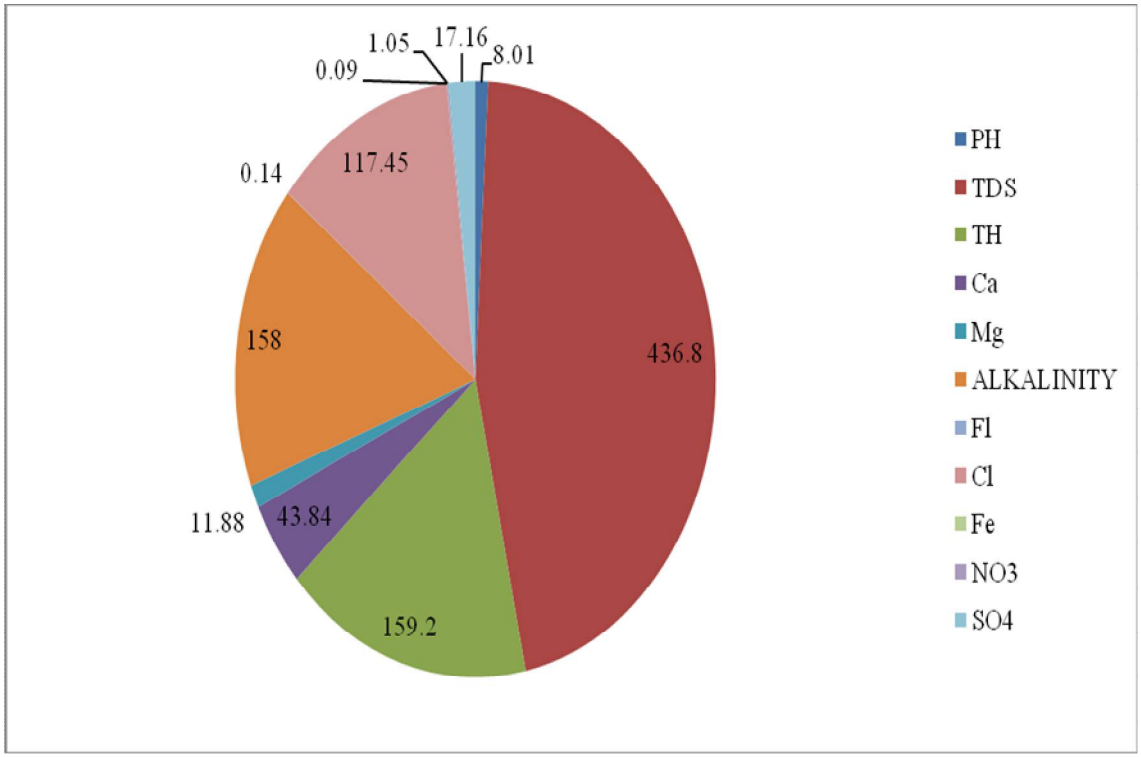
(a)Pre Monsoon

S. No.	Name of the village where the sample is collected	PH	TDS	TH	Ca	Mg	Alkalinity	Fl	Cl	Fe	NO_3	SO_4
1	LN Puram	7.66	452	216	44.8	24.9	220	0.4	32	0.08	0	17
2	ScBoseColony	7.81	1072	556	106	63.8	310	0.4	526	0.08	8	42.4
3	Anandapuram	8.64	900	204	42.4	23.4	320	0.5	114	0.08	0	16.9
4	Gandhi puram	8.68	1400	224	44.8	26.8	230	0.5	214	0	0	17
5	Malavanitippa	8.15	700	328	67.2	38.4	350	0.5	184	0.1	0	19
6	Bondada	8.67	700	272	70.4	23	240	0.5	148	0.09	8	21
7	Jakkaram	8.71	500	328	67.2	38.4	140	0.5	150	0.08	0	19
8	Vempadu	8.71	900	304	80	24.9	230	0.5	150	0.09	0	25.5
9	Pedamiram	8.28	800	400	96	38.4	190	0.5	156	0.1	0	27
10	Kopalle	8.67	1000	264	38.4	323	310	0.4	206	0.1	13	14.3
11	Tokatippa	8.69	1400	128	41.6	5.76	150	0.5	285	0.1	0	16.2
12	Gutlapadu	8.67	500	136	44.8	5.76	170	0.4	206	0.1	8	19
13	Nagidipalem	8.65	600	168	35.2	19.2	200	0.4	128	0.08	0	25
14	Dayyalatippa	8.76	500	344	70.4	67.2	170	0.5	106	0.09	0	32
15	Dirusumarru	8.67	200	272	70.4	23	180	0.4	136	0.09	0	35
16	Taderu	8.64	500	440	102	44	180	0.4	114	0.09	0	42.5
17	Betapudi	8.76	1300	304	80	24.9	130	0.5	156	0.08	0	31.3
18	Pedagaruvu	8.87	1186	216	44.8	24.9	224	0.4	70	0	1.3	22
19	Vempa	8.74	400	120	38.4	5.7	220	0.5	92	0.1	0	26
20	Yanamadurru	8.78	650	176	38.4	23	190	0.4	156	0.09	0	27.3
	Average	**8.56**	**783**	**270**	**61.16**	**43.42**	**217.7**	**0.46**	**166.45**	**0.08**	**1.92**	**30.2**



(b) Post Monsoon:

S. No.	Name of the village where the sample is collected	PH	TDS	TH	Ca	Mg	Alkalinity	Fl	Cl	Fe	NO_3	SO_4
1	LN Puram	7.28	364	136	44.8	5.76	136	0.21	128	0.02	2.2	16.3
2	ScBoseColony	7.79	1040	280	73.6	23	300	0.24	478	0.07	0.19	24.5
3	Anandapuram	8.4	700	168	35.2	19.2	164	0.11	112	0.1	0.9	19
4	Gandhi puram	8.45	509	168	35.2	19.2	160	0.12	120	0.02	1.76	17.3
5	Malavanitippa	7.56	480	144	44.8	7.68	248	0.18	86	0.2	1	12.2
6	Bondada	7.84	229	136	44.8	5.76	132	0.08	80	0.1	0.95	15.4
7	Jakkaram	8.36	455	136	44.8	5.76	136	0.15	98	0.06	1.9	17
8	Vempadu	8.26	684	224	44.8	26.8	212	0.26	140	0.09	1.9	19.3
9	Pedamiram	8.14	596	128	41.6	5.76	160	0	132	0.04	0.88	20
10	Kopalle	8.4	325	128	41.6	5.76	136	0.24	78	0.07	1.82	21.5
11	Tokatippa	8.09	662	120	38.4	5.7	136	0.02	190	0.16	0.32	12.2
12	Gutlapadu	7.83	350	88	19.2	9.6	164	0.3	116	0.11	0.39	8.2
13	Nagidipalem	8.03	186	136	44.8	5.76	132	0.03	90	0.08	0.36	16.4
14	Dayyalatippa	8	315	272	70.4	23	200	0.1	96	0.1	1.8	32.5
15	Dirusumarru	7.85	195	192	38.4	23	124	0.14	88	0.14	0.78	19.5
16	Taderu	7.68	303	200	41.6	23	120	0.14	82	0.09	0.6	17
17	Betapudi	7.87	448	128	41.6	5.72	120	0.2	88	0.12	0.79	15.3
18	Pedagaruvu	8.43	393	152	48	7.6	136	0.05	39	0.06	0.3	12
19	Vempa	7.9	265	112	38.4	3.84	120	0.12	58	0.06	1.19	10.2
20	Yanamadurru	8.02	237	136	44.8	5.76	124	0.12	50	0.12	0.9	17.4
	Average	**8.01**	**436.8**	**159.2**	**43.84**	**11.88**	**158**	**0.14**	**117.45**	**0.09**	**1.05**	**17.16**



CONCLUSION

The present study is focused on the ground water quality of Bhimavaram industrial area and few studies were found in this area. Physico-chemical parameters indicate the quality of ground water. Most of the parameters like Total Hardness, TDS, Chloride were found to have highest concentrations during the study period. Total dissolved solids and chloride concentrations recorded exceeded the BIS permissible level and indicate the over exploitation of ground water and low ground water percolation rate into soil. Total Hardness concentrations were decreased with increasing marine water source and most parameters were increasing due to sea water intrusion into ground water table among the reason of proper land use and land cover pattern.

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