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A SEASONAL ASSESSMENT OF GROUNDWATER QUALITY IN DHARMAPURI REGION

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ABSTRACT - In recent years distressing environmental issues such as hazardous waste, global climate change, stratospheric ozone depletion, groundwater contamination, disaster mitigation and removal of pollutant have become the focus of environmental attention. Groundwater is a vital resource and used for many purposes, including public and domestic water supply systems. Though all the segments of environment are being polluted in various ways, the study of water pollution is selected as it is not an ordinary liquid but is the elixir of life. Moreover, water is the most common liquid but it is also one of the most unusual because of its unique property. Groundwater is contaminated due to the improper disposal of liquid wastes, defective well construction and failure to seal the abandoned wells. These provide possible opening for the downward movement of water into surface formations without the process of natural filtration

The water samples from the study area were collect and analyze for physicochemical parameters. The high values of TDS, total hardness and concentrations of potassium, chloride and nitrate bear the best proof for the impact of industrial effluents. Twenty groundwater samples were analyzed for the water quality parameters which included Turbidity, pH, EC, TDS, TH, Calcium, Magnesium, Sodium, Potassium, Chlorides, Bicarbonate, Carbonate, Sulphate, Nitrate, Total Alkalinity, Fluoride, Iron,Copper, Zinc, Lead, Manganese, COD and BOD for the pre-monsoon, post-monsoon and pre-monsoon seasons.

Key Words: **BOD, COD, Ph ,Turbidity, Alkalinity.**

1. INTRODUCTION

Water is the most important natural resource and it is vital for all life forms on earth.Groundwater is a precious and the most widely distributed resource of the earth and unlike any other mineral resource, it gets its annual replenishment from the meteoric precipitation. Depending on its usage and consumption, it can be a renewable or a non-renewable resource. This most precious resource is sometimes scarce, sometimes abundant and is always very unevenly distributed, both in space and time. Groundwater is an important source of water supply throughout the world. Among the various reasons, the most important are the non-availability of potable surface water. There is a general belief that groundwater is purer and safer than surface water due to the protective qualities of the soil cover. Its use in irrigation, industries, municipalities and rural homes continues to increase. The chemical composition of surface and groundwater is controlled by many factors that include composition of precipitation, mineralogy of the watershed and aquifers, climate and topography. These factors combine to create diverse water types that change spatially and temporally.

1.1 GROUNDWATER QUALITY

Water quality refers to the chemical, physical and organic compounds of water. For this study water quality parameters are determined for (1) Turbidity, (2) Electrical conductivity, (3) Total dissolved solids, (4) Hydrogen ion concentration, (5) Calcium, (6) Magnesium, (7) Sodium, (8)Potassium, (9) Total alkalinity, (10) Bicarbonate, (11) Carbonate, (12) Chloride, (13) Sulphate, (14) Nitrate, (15) Total hardness, (16) Fluoride, (17) Iron, (18) Copper, (19) Lead, (20) Zinc and (21) Manganese.

1.2 SAMPLING LOCATIONS

The area of the selected district is 4497.77Sq.Kms. The Groundwater samples from twenty bore wells water were collected. The sampling locations were selected to cover the entire study area and attention had been given to the areas where pollution was expected.

1.3 METHODOLOGY ADOPTED FOR PHYSICOCHEMICAL PARAMETER ANALYSIS

Sampling and water analysis have been carried out, following the standard procedure of American Public Health Association (APHA, 1995). For the analysis all the instruments were calibrated appropriately according to the commercial grade calibration standard prior to the measurements.

2. ASSESSMENT OF GROUNDWATER QUALITY

Nowadays the quality of groundwater is deteriorating day by day due to over exploitation of groundwater and improper disposal of solid waste and dumping of untreated effluents into the water bodies. The available groundwater

cannot be used directly. The quality of groundwater depends upon its physical and chemical characteristics which play a major role the health of the people. Hence the suitability of groundwater for drinking and irrigation has been assessed and compared for the seasons.

2.1 Groundwater quality assessment based on total dissolved solids.

S.NO	TDS(mg/l)	Classification
1	<1000	Fresh water type
2	1000-10000	Brackish water type
3	10000-100000	Saline water type
4	<100000	Brine water type

2.2. Groundwater quality assessment based on total hardness

S.NO	Total Hardness as CaCO3 (mg/l)	Type of water
1	<75	Soft
2	750-150	Moderately Hard
3	150-300	Hard
4	>300	Very hard

2.3. WATER QUALITY REQUIREMENTS

Water is a very strong solvent capable of dissolving most solids to some degree of the many solutes found in groundwater only a relatively few are present at concentrations greater than 1 mg/l under typical natural conditions. The major ions consist of cations calcium (Ca2 +), magnesium (Mg2 +), sodium (Na+), and potassium (K+) and the anions bicarbonate/carbonate (HCO3 - / CO3 2-), sulphate (SO4 2-), chloride (Cl-) and nitrate (NO3-).

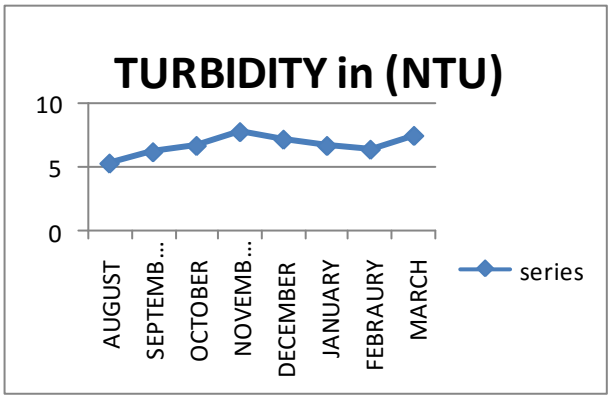
The concentrations of the major ions in groundwater and the concentration of the other dissolved species are a function of the availability of the constituent to the system and the solubility of solids that may limit solution concentration. Tastes and odors are caused by the presence of volatile chemicals and decomposing organic matter. The colour in water is caused by minerals such as iron and manganese, organic materials and coloured wastes from industries. Turbidity is a health concern because the particles involved could harbor pathogens. Water with enough suspended clay particles (10 Turbidity units) will be visually turbid. Many chemical compounds dissolved in water may be of natural or industrial origin and may be beneficial or harmful depending on their consumption and concentration. The drinking water specifications are tabulated in Table 3.5.1 given by ISI (1983) and WHO (1993).

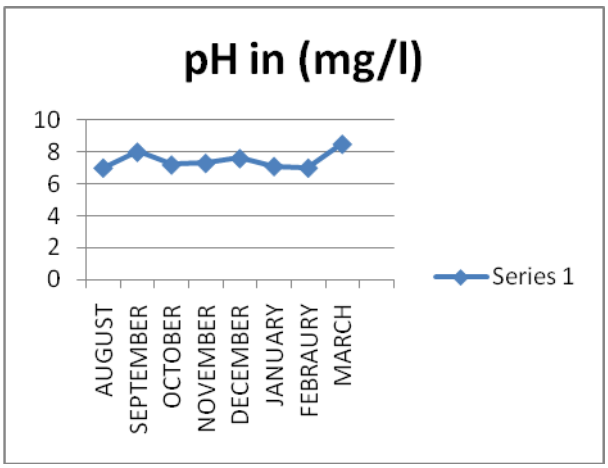
3. RESULTS AND DISCUSSION

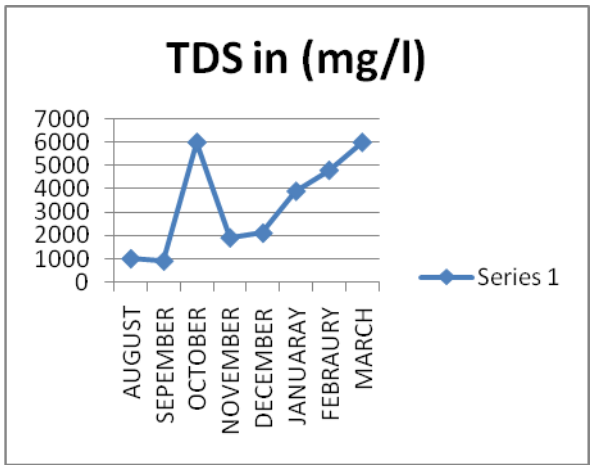
3.1 Summary of Physico-Chemical parameters of groundwater samples

S.No	Parameters	Units	August		September	
			Min	Max	Min	Max
1	Turbidity	NTU	0.5	35	3	15
2	EC	(µS/cm)	305	4950	590	5650
3	Ph	mg/l	7	8.48	7.05	7.35
4	TDS	mg/l	195	4995	375	3565
5	TH as CaCo3	mg/l	114	2510	185	175
6	Ca2	mg/l	14	1005	28	28
7	Mg2	mg/l	1	305	12	12
8	Na+	mg/l	3	210	27	21
9	K+	mg/l	1	85	8	8
10	HCO3	mg/l	48	610	136	135
11	CO3	mg/l	2	230	0.12	1
12	Cl-	mg/l	15	2200	28	41
13	NO3	mg/l	1	110	8	8
14	TA	mg/l	110	620	148	146
15	SO4 2-	mg/l	1	410	5	298
16	PI	mg/l	6.81	80.31	31.45	28.57
17	Fe	mg/l	0	1.12	0.57	1.7
18	Cu	mg/l	0.03	1.6	1.57	1.8
19	Zn	mg/l	1.2	15.35	0.	0.8
20	Mn	mg/l	0.01	0.56	4.3	37
21	COD	-	0.3	11.76	1	0.57
22	BOD	-	0.2	2.69	0.75	0.31

3.2 Seasonal assessment of Chemical parameters







3.3 DISCUSSIONS

Over exploitation and overstressing of the aquifer. Therefore the quantum of available groundwater resource needs to be assessed accurately for its optimum extraction and utilization. Seasonal variations of water quality parameters have also been prepared. Multivariate statistical analyses like factor analysis and correlation matrix were used to study the spatial and temporal variations in the study area. Water quality indices are calculated for the seasons with an aim to give a single value. The study brings out groundwater quality classification based on EC, salinity hazard, sodium hazard or alkalinity hazard, USSL classification, Wilcox diagram, RSC, Permeability Index, NCH, CR etc. Seasonal variations in recharge rates should be evaluated to select sampling times appropriate for collecting the groundwater data needed to characterize seasonal concentration trends. At least two rounds of sampling (i.e., wet and dry season sampling events) are required to evaluate seasonal trends. However, depending on climatic conditions in the recharge area, semiannual or quarterly sampling over several years may be required. Regulatory sampling frequency requirements also should be reviewed to select appropriate sampling intervals.

4. CONCLUSIONS

An investigation has been carried out to understand the groundwater quality of the study area.

The pre-monsoon values indicate that most of the groundwater samples belong to brackish type and that dilution has occurred during post-monsoon where the Total Dissolved Solids values were significantly lower. However, the Total Dissolved Solids values of the groundwater are higher than the permissible limit in all the seasons.

Total Hardness is generally higher in the groundwater thereby, causing the groundwater in most of the study area to be unsuitable for drinking.

Based on sodium percentage, 0 to 25.64%, 4.94 to 55.24%, 2.64 to 28.26% and 0 to 76.42% of the samples belong to excellent, good, permissible, doubtful and unsuitable categories for the drinking purpose.

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