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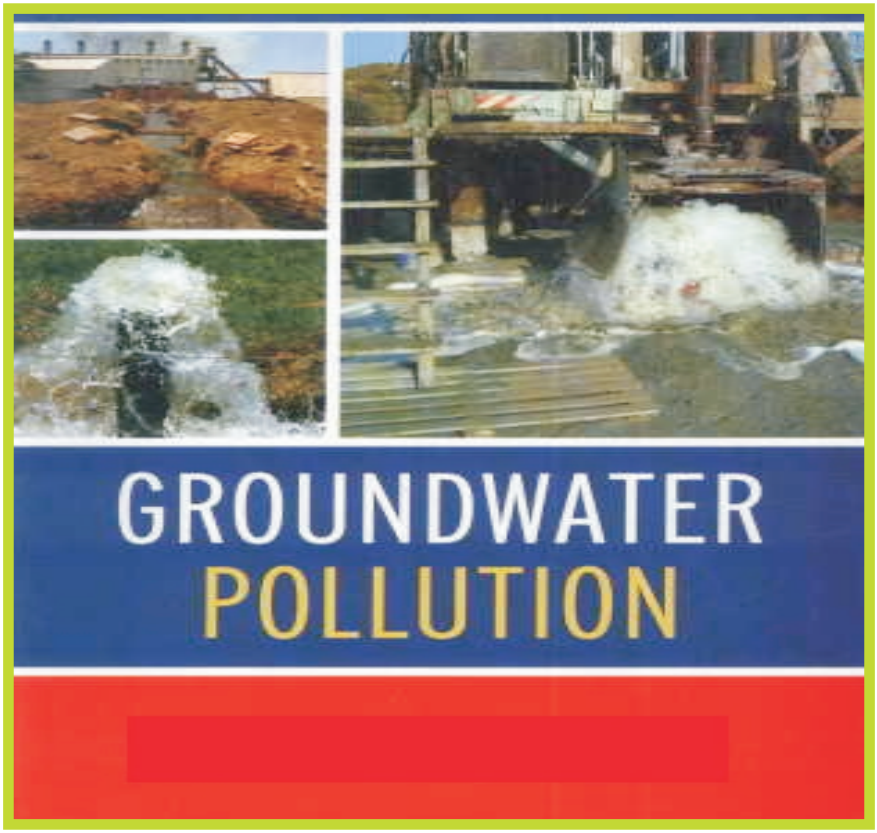
REVIEW OF RESEARCH

GROUNDWATER QUALITY IN VISAKHAPATNAM RURAL AREA, ANDHRA PRADESH



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Abstract :

Today, there is a great threat to the fresh water resources as well as the fresh water quality all over the world. The main reason for fresh water pollution can be attributed to the discharge of untreated waste, dumping of industrial affluent and run-off from agricultural fields. Polluted water causes problems to health leading to water-borne diseases. Another important problem in the study area is the sea-water intrusion which decreases fresh water recharge. Visakhapatnam city, which forms the present area of investigation presents such situation and has been witnessing a serious burden on land and ground water resources for the last couple of decades besides witnessing a remarkable decrease in rainfall.

Keywords: Ground water pollution, Khondalities, Charnockites.

Groundwater Quality In Visakhapatnam Rural Area, Andhra Pradesh

INTRODUCTION

Generally, it is expected that development in any field will create better opportunities and comforts for living. But, the recent technological developments achieved by men are to a great extent resulting in exploitation of the important natural resources. Man's race for technological development is causing indelible damage to the natural ecosystem either consciously or unconsciously.

The increased industrial installations in turn lead to mass concentrations of effluents around them and the cities and towns around these industrial complexes are posing a variety of environmental problems, which sometimes have far-reaching consequences. The growth of population in an area imposes a huge pressure on available water resources. The groundwater regime of any given area is generally a sensitive part of the ecosystem and will be the immediate victim to environmental degradation, resulting due to industrialization and urbanization.

Although the proportion of groundwater is very little when compared to the water available on the earth, it is very vital for living beings especially the human beings. Human influence on ecosystem was mainly increased because of the increasing human activity through industrialization. This has a direct bearing on the natural ecological balance and often leading to crisis situations.

MATERIALS AND METHODS

The chemistry of groundwater in the present area of investigation with respect to some major and trace elements as well as their chemically related properties have been determined using standard laboratory procedures. The major cations consist of calcium(Ca),magnesium(Mg),sodium(Na),potassium(K) and anions such as carbonate (CO3),bicarbonate(HCO3), chloride(Cl), sulphate(SO4),fluoride(F), and nitrate(NO3). The trace elements such as copper (Cu), lead (Pb), zinc (Zn) and iron (Fe) are also determined. Besides these, the chemically related properties such as hydrogen ion activity (pH), total dissolved solids (TDS), total alkalinity (TA) and total hardness (TH) were also determined. While carrying out the hydrochemical analysis, the values are taken in mg/l units in order to make it easy in comparing them with standards given by ICMR/ISI.

RESULTS AND DISCUSSION

The study area is marked by the occurrence of groundwater in two distinct aquifer materials in different groundwater configurations. The acquifer material in the area of present investigation can be broadly visualized into two broad groups as:

i)Khondalities, and
ii)Charnockites

The p^H data have been analyzed with reference to the groundwater configuration and surfacial material. As already mentioned, the groundwater configuration of the study area has been classified into 4 categories (based on depth).

They are:

Category-I (0-7m), Category-II (7-10m) Category-III (10-12m) Category-IV (>12m)

In general, the PH value of water in the study area is ranging from 7.0 to 8.6 and the majority of wells are showing pH values between 7.0 to 7.9 variation in pH values in the area of present investigation has been shown in Fig.4.1,Fig.4.1A and Table-4.1 presents the pH values observed in wells from the four depth categories.

Category-I (0-7m)

The PH value of water from this category of wells range from 7.3 to 8.0. The higher value of PH(8.0) is observed in the water from these areas viz. Kothapalem, Kancharapalem and Gnanapuram. Water from the areas PM Palem and Rushikonda have recorded pH values of 7.8 and 7.7 respectively. PH values of 7.5 and 7.3 are observed in the water from Buchirajupalem and Jeeripothulapaelem areas. The aquifer material in this category is khondalite. When this material is considered, the pH value of water ranged from 7.3to 8.0 in the khondalite area and 7.8 to 8.0 in areas where there is weathered khondalite.

CATEGORY-II (7-10M)

Wells belonging to this category have shown the pH values ranging from 7.2 to 8.6. Most of the wells are having pH value around 7.6 . Considering the aquifer material, it is mainly khondalite in these areas while 5 of the present charnockite. The pH value of water in khondolite areas ranged from 7.3 to 8.6. PH value of water in the charnockite area ranged from 7.7 to 8.0. It can be observed that there is an increase in pH value with increase in the depth of the wells.

CATEGORY-III (10-12M)

The observed pH values of water can be attributed to the depth of the wells as well as the acquifer. Khondolite areas have recorded the highest pH value of 8.4 and the lowest value of 7.2 is observed where the khondolite has weathered.

CATEGORY-IV (>12M)

Water from the wells of the category has pH values in the range of 7.0 to 7.9. The lowest pH value of 7.0 is observed from the waters of pedagadi, Nathayyapalem and Sattivanipalem areas while the highest value (7.9) is recorded from Mudasarlova Cheruvu area. Acquifer material in this areas is also khondolite showing weathering at some places.

TOTAL DISSOLVED SOLIDS (T.D.S)

One of the important measures of groundwater quality is the measurement of total dissolved solids. In other words, it is simply the total quantity of dissolved solids in water taken as mg/l. This is done in two ways, one way is to multiply the E.C.values of ground waters with factors usually ranging from 0.55 mg/l to 0.75 mg/l considering the nature of ions present because the electrical conductance and total dissolved solids are interdependent.

The T.D.S values are considered as an important parameter in comparison of groundwater quality as well as for groundwater classification because of its convenience. T.D.S. values as low as 25 mg/l are generally observed in areas with very high rainfall and insoluble rocks. In contrast, the values will be as high 30,000mg/l where the groundwaters are saturated with sodium chloride such as brines etc. Classification of waters based on total dissolved solids as given by the U.S. Geological survey is as given below.

TABLE 1- THE CHEMICAL COMPOSITION OF GROUNDWATERS WITH REFERENCE TO TOPOGRAPHY

Chemical Parameters (mg/L)	Low topographic places (<15m contour line)			High topographic places (>15m contour line)		
	Minimum	**Maximum**	**Avg**	**Minimum**	**Maximum**	**Avg**
pH(units)	6.6	8.5	7.8	7	9.2	8.2
TDS	1150	4800	1538.27	332	994	705.51
TH	130	1180	422.45	120	300	223.05
Ca	5	550	22.08	7	124	36.81
Mg	20	185	65.01	6	149	31.91
Na	62	1060	618.48	38	750	191.02
K	13	255	41.10	6	38	16.15
HCO_3	140	1200	171.45	40	550	193.66
CL	126	2020	539.24	50	340	155.23
SO_4	4	1343	157.45	1	136	42.65
NO_3	1.12	24.50	10.91	2.65	28.99	13.64
F	1.32	7.50	1.83	0.50	1.14	0.94

TABLE 2: THE CHEMICAL COMPOSITION OF GROUNDWATERS IN VISAKHAPATNAM RURAL AREA

Chemical parameters	Minimum	Maximum	Average
	mg/L		
pH (units)	6.6	9.2	8.14
TDS	332	4800	973.10
TH	120	1180	255.38
Ca	5	550	32.06
Mg	6	185	42.59
Na	38	1060	173.57
K	6	255	24.20
HCO_3	40	1200	186.46
Cl	50	2020	275.64
SO_4	1	1343	84.25
NO_3	1.12	28.99	9.80
F	0.5	7.5	1.24

To assesss the quality of groundwaters of the study area, Indian drinking water quality standards have been adopted. The term "desirable limit" in the standards applies to waters that would be generally acceptable to consumers. As such, waters with higher than the desirable limits may bave adverse conditions. However, such types of waters can be utilized where better quality of water is not available. For this reason, maximum permissible limits have been suggested for purposes of drinking water. Thus, the values more than the maximum permissible limits markedly impair the portability of water.

HYDROGEN ION CONCENTRATION (P^H)

Hydrogen ion concentration of the groundwaters in the study area ranged from 6.6 to 9.2 and its distribution. Though it has no direct effect on the human health, all biochemical reactions are sensitive to the variation of pH.

TOTAL HARDNESS:

Hardness of water is characterised by contents of calcium or magnesium salts or both. The contents of calcium and magnesium in potable water ranges from 75 to 200mg/L and from 50 to 100 mg/L respectively.

CHLORIDE:

Chloride imparts a salty taste to water. For people, who are not accustomed to high chlorides in water are subjected to laxative effect. Hence, the limit is fixed at 250 mg/L at which level water will not taste salty. But the maximum permissible limit is given as 100mg/L for drinking waters.

SULPHATE:

Sodium and magnesium sulphate exert a catharitic action in human beings. It is also associated with respiratory diseases. Therefore, the recommended content of sulphate in drinking water is limited to 200-400mg/L.

NITRATE:

The concentration of nitrate in groundwater of the area ranged from 1.12 to 28.99mg/L. The desirable concentration of nitrate for public water supplies is 20mg/L. High nitrate levels in drinking water have been reported to be responsible for prevalence of methemoglobinemia or blue baby syndrome in infants.

FLUORIDE:

It is important in human nutrition for the normal development of bones. In general, it should not exceed 1.5 mg/L. The concentration of fluoride with less than 0.5 mg/L indicate the desirability if fluoridation of the water supplied to

prevent the dental decay in children. The concentration of fluoride in the study area varied from 0.5 to 7.5 mg/L . Excessive fluoride content was observed in the groundwaters where the wells were affected by industrial and urban effluents, chemical, fertilizers, seawater, and fluorine minerals.

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