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# WATER POLLUTION ASSEMENT OF VEMULAPALLI MANDAL OF NALGONDA DISTRICT ANDHRA PRADESH, INDIA

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**ABSTRACT**

The validation of adsorption efficiency of prepared carbon materials towards fluoride and copper removal, the author adopted one revenue sub division i.e. Vemulapalli, from Nalgonda District, Andhra Pradesh, India. Totally 17 samples were collected from the various locations of the study area including borewell and handpump water and analysed for pH, EC, TDS, turbidity, total hardness, fluoride, chloride, nitrate and nitrite, sulphates, phosphates, calcium, magnesium, sodium, potassium, iron and dissolved oxygen. On an average in almost all the samples, one or the other chemical constituent was beyond the permissible limits. It also concludes water sources study area is not fit for drinking as well as agricultural purpose. The study indicates the need for periodic monitoring of ground water in the study area.

## Introduction

Water is one of the essential components for the sustenance of life on earth. Among the various sources of water, ground water is said to be the safest water for drinking and domestic purposes. The quality of ground water is influenced by the nature of the sub surfaces as well as the environment where recharge takes place. Water used for industries, agricultural and human needs, adds continuously contaminants to the ground water. The indiscriminate disposal of industrial and human activities makes the ground water susceptibility to pollution. It is reported that two third of all illness in India are related to water born diseases. Vemulapalli revenue sub division located in Nalgonda district, Andhra Pradesh, and the district was well known for endemic fluorosis. From the literature it was confirmed that nobody could study entire physico-chemical analysis of all drinking water sources in the particular areas. So in the light of the above, an attempt has been made to study the quality of ground water in and around vemulapalli sub division.

## Experimental material and method

### *Water sample collection*

Water samples have been collected manually from all existing sources of drinking water in the study area and for the present investigation separate sets of samples were collected for chemical analysis from the source. The bottles for sample collection have been thoroughly cleaned by rinsing with 8M $HNO_3$ , followed by repeated washing with double distilled water and they are further rinsed with sample water before collection, Physico chemical analysis was done by standard procedure. The results were compared with WHO, ISI, USEPA standards.

Various physical parameters like pH, EC, DO, and TDS which are important to evaluate the suitability of waste water for irrigation and ground water for potability, were determined on the site with the help of digital portable water analyser kit (CENTURY-CK-710) The chemical analysis was carried out for calcium($Ca^{+2}$),magnesium($Mg^{+2}$),Chloride ($Cl^{-}$),sulphate($SO_4^{-2}$), carbonate($CO_3^{-2}$) and bicarbonate($HCO_3^{-}$) by volumetric titration methods, while fluoride($F^{-}$) by spectrophotometric(AIMIL-C160-80314)method, sodium($Na^{+}$) and potassium($K^{+}$) by flamphotometry ELICO-CL-220).

**Results and Discussion**

The study of analytical data reveals that the study area was completely fluoride endemic area and also reveals than remaining water quality parameters are also exceeding tolerance limits and water quality compared with the various organizational standards were reported in the Table. In the following discussion each and every parameter was completely discussed.

pH governs the solvent properties of water and determines the extent and type of physical and chemical reactions likely to occur within a water system or between the water and surrounding rocks and soils. The pH of most natural water falls approximately within the range of 4 to 9 depending upon the concentration of carbonate and bicarbonate ions present.

| S.No. | Parameters | BIS:1999 | ICMR:1975 | WHO:2003 | USPH Stnadards |
|---|---|---|---|---|---|
| 1 | PH | 6.5 – 8.5 | 7.0-8.5 | 6.5-9.5 | 6.5-8.0 |
| 2 | EC ( µseimens/cm) | - | - | 1400 | 1400 |
| 3 | TDS | 2000 | 500 | 600 | 600 |
| 4 | $Na^{+}$ | - | - | - | - |
| 5 | $K^{+}$ | - | - | - | - |
| 6 | $Ca^{2+}$ | 200 | 200 | 100 | 100 |
| 7 | $Mg^{2+}$ | 10 | 200 | 150 | 150 |
| 8 | $Cl^{-}$ | 1000 | 200 | 250 | 250 |
| 9 | $F^{-}$ | 1.5 | 1 | 1.5 | 1.5 |
| 10 | $CO_3^{2-}$ | - | - | - | - |
| 11 | $HCO_3^{-}$ | - | - | - | 500 |
| 12 | $SO_4^{2-}$ | 400 | 200 | 250 | 250 |
| 13 | $NO_3^{-}$ | 100 | 50 | 50 | 50 |
| 14 | TH | 600 | 600 | 500* | 500 # |

(All values except pH and EC are expressed in mg/L)
* TDS • EC = Electrical Conductance
* WHO, 1993
• EC = Electrical Conductance
# USPH = United States Public Health
• T H = Total hardness

Figure 1: Locations of water samples collected.

In the present investigation, the pH values vary from 7.15 to 8.37 and from 7.19 to 8.28 in water from hand pumps and bore wells respectively. The results indicate that, the ground water source in the study area is alkaline in nature. This may be due to the presence of higher amounts of carbonate and bicarbonate substances in the ground water and the pH values of all the samples are within the maximum permissible limit.

EC values in borewell and handpump water in the study area are ranged from 670 to 6887 µS, from 364 to 2648 µS respectively. EC has been found to be higher in deeper borewell. Many water samples in both handpump and borewell water EC values were exceeding the permissible limits (1400 µS). The higher values may be due to the reck soils and the presence of high dissolved solid in the study area. For all domestic and agricultural purposes, the EC value is less than 2500 µS is ideal.

The concentration of dissolved solids in water gives an idea about suitability of this water for various uses including that of potable water. It also indicates the salinity of water. Dissolved solids tend to increase with increasing pollution of water. Water containing 500 mg/L is the desirable limit and 15000 mg/L

as the maximum permissible limit have been suggested for drinking water. In the present investigation, the TDS values have varies from 351.2 to 2816 g/L and from 326.12 to 3511 mg/L in the water from hand pumps and borewells respectively in the study area.

The results of total dissolved solids indicate that many samples of water from borewells and handpumps contain high dissolved solids. The TDS values in water samples from handpumps water samples exceeding the limit, and from Borewell water only within the limit.

In the present investigation, the turbidity values have varied from 1to 7 NTU, from 1 to 8 NTU in handpumps and borewells water respectively in the study area. In borewell water and in handpump water samples are above the permissible limits. On Defluoridation these values greatly decrease.

In this study area, the total hardness in water from all the groundwater resources range from 108.24 to 1993.42 and from 108.24 to 766.7 as $CaCO_3$ of samples from borewell and handpump water respectively. The higher value of TH may be due to the presence of high amount of calcium and magnesium substances in the water. The TH values fluctuate in all the two types of samples.

The concentration of fluoride in all the samples in the study area has varies from 1.45 to2.78 and from 1.46 to 2.82 mg/L, respectively. A careful observation of the results reveals that, the distribution of fluoride level in ground water sources in all the regions in the study area is not uniform. The results also indicate that many water samples from borewells and handpumps water samples contain above the maximum permissible limit.

The concentration of chloride in all the samples in the study area ranges from 58.22 to 570.31 and from 96 to 241 mg/L and sulphate ion concentration ranges from 4.96 to 81.36 mg/L and from 13.12 to 33.62 mg/L in borewell and hand pump water samples respectively. High chloride contents are observed in handpumps water and in borewells water samples both chloride and sulphates are within the permissible limits. The higher concentration is usually indicative of polluted nature of water.

The concentration of nitrate in all the samples in the study area ranges from0.9348 to2.7306 mg/L and from 0.39 to 3.92 mg/L respectively. The results indicate that the nitrate concentration is within the permissible limit in all the samples. The concentration of nitrite in all the samples in the study area renges from 0.07 to 1.98 mg/L and 0.123 to 2.46 mg/L in two different types water samples respectively and the values are well below the permissible limit.

The concentration of phosphate in all the water samples in the study area ranges from 0.0016 to 0.52 mg/L to 0.0 to 0.52 mg/L in two different types water samples respectively. The values are relatively very low. The excess amount of phosphate may cause serious health hazard.The careful observation of the results reveals that the distribution of phosphate concentration is not uniform in the ground water in the study area.

Calcium and magnesium are the most abundant ions in natural surface and ground water and exist mainly as bicarbonate and chloride. The levels of calcium and magnesium salts regulate the hardness of water bodies.In the present study calcium content ranged from 29.56 to 230.05 mg/L and from 58.4 to 270.8 mg/L in handpumps and borewell water. The concentration of calcium in potable water ranges from 75 to 200 mg/L. The results indicate that the distribution of calcium is not uniform in all the samples in the study area.The concentration of calcium is exceeding the tolerance limit in one sample of handpump water and all samples of borewell water. This may be derived from the contact of ground water with sedimentary rocks particularly calcite, dolomite and gypsum. The concentration of magnesium varies from 8.65 to 91.84 mg/L in water from handpump and from 2.0 to 133.86 mg/L in water from borewell water are well with the excessive limit(150 mg/L) specified by WHO.

Sodium is also commonly present in water and its concentration in unpolluted water is less than that of calcium or magnesium. Ground water usually has higher sodium concentration and in surface water pollution

greatly increases its concentration. The concentration of sodium ranges from 152 to 426 mg/L in borewells, 173 to 280 mg/L in handpumps water respectively in the study area.

Potassium is a naturally occurring element. Its concentration however usually quite lower than that of sodium, calcium and magnesium. The concentration of potassium ranges from 0.82 to 162.36 abd 0.0 to 9.84 mg/L respectively.

In the present study it is observed that the concentration of iron has caries from 0.26 to 3.28 mg/L from 0.05 to 3.19 mg/L in all the samples.

DO reflects the water quality status and physical and biological process in water and show the metabolic balance. Levels of DO act as an indicator of status of the water body. A good amount of D average varied 10.66 to 36.9 mg/L and17.4 to 28.16 mg/L respectively.

**Conclusions**

The result of this study indicates that the quality of ground water varies from place to place. Higher values of certain parameters at certain borewells and handpump water samples are not fit for drinking as such. The water quality index, sodium absorption ratio studies and sodium percentage studies indicates poor quality of water for drinking as well as agricultural purpose. Hence proper care must be taken to avoid any contamination of ground water and its quality be monitored periodically.

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