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# Quality of Ground Water in Medak

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Abstract: ***In this paper, an attempt is made to study the quality of ground water which is used for domestic and agricultural purpose. The study is restricted to the areas in Medak District, Telangana state, with 50 ground water samples taken from bore wells belongs to North Latitude 17045' to 17050' and East Longitude 17050' and 77030' and 77040' with an area of 167 sq. kms. A detailed statistical analysis is carried out to study the elements in the ground water based on the sample to measure the quality of water with respect to the components they contains, Na, K, Ca, Mg, F, Cl, Fe, Co, Cu, Zn, Ni, As, Li, B, Al, V, Be, Se, Rb, Sr, Mo, Ag, Cd, Sb, Ba, Pb are examined. The significant level of each component is studied with respect to its standard values in the normal water. A detailed statistical analysis is carried out using some univariate and multivariate statistical techniques and drawn conclusions.***

**Keywords:** Ground water, Medak, Pollution, Chemicals, PCA, Human health..

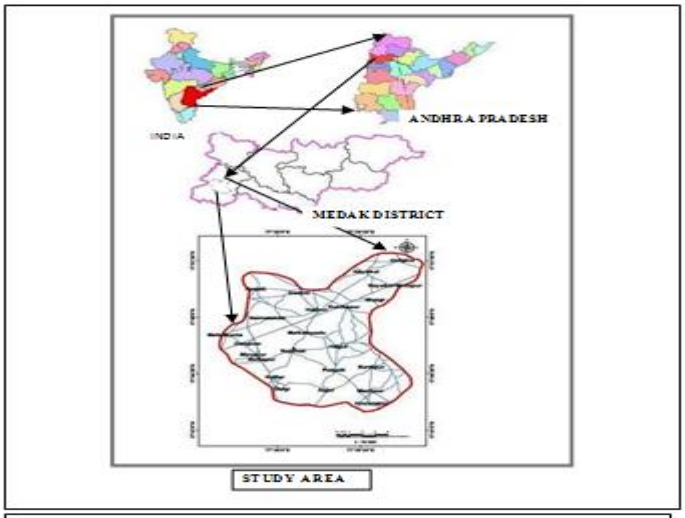
## 1. Introduction

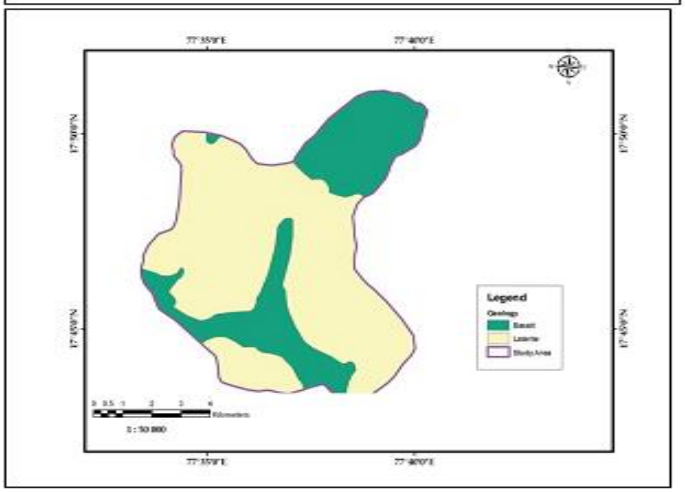
Water contamination is one of the environmental pollution and most important issue to be studied. It is contaminated with some of the heavy metals. In the metals, some of them in the water are essential for the growth, development and health of living organisms and some of them are destructible in excessive concentration. If the heavy metals enter to environment constantly the soil capacity will be decreased and finally they percolate in lower layer of soil and enter to water and cause water pollution

## 2. DATA MATERIAL

An attempt is made to study the water contamination in detail, restricted to the geographical area bounded in Medak district of Telangana State collected during the period 2009-10. The ground water sample information is gathered from 50 bore wells ( belongs to the villages in the Medak district: Didigi, Kothoor (2), Malkapur (2), Mirzapur (3), Gangwar, Alkapur, Metalkunta (4), Darga, Naimathabad, Hasolly (2), Gunjothi (2), Mungi, Nyalkal (4), Holegre, Rukmapur (2), hadnoor, Malkalaphad (2), Regental, Yolgol (3), Rejental, Potpalli (4), Algol (3), Bardipur (3), Machnur, Krishnapur (2), Holgera ) belongs to North Latitude $17^0$45' to $17^0$50' and East Longitude $17^0$50' and $77^0$30' and $77^0$40' with an area of 167 sq. kms. From each water sample, all trace elements and heavy metals are examined as per the standards of American Public Health Association (APHA) . The information gathered is related to the metals Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Fluorine (F), Chlorine (Cl), Iron (Fe), Cobolt (Co), Copper (Cu), Zinc (Zn), Nickel (Ni), Arsenic (As), Lithium (Li), Boron (B), Aluminum (Al), Vanadium (V), Beryllium (Be), Selenium (Se), Rubium (Rb), Strontium (Sr), Molybdenum (Mo), Silver (Ag), Cadmium (Cd), Antimony (Sb), Barium (Ba), Lead (Pb).

The study area comprises of 26 villages falling in Zaheerabad and Nyalkal Mandals and falling in survey of India toposheet number 56 G/9 and 56 G/10 (Fig.1). The study area is represented monotonously by a single formation known as Deccan basalt and lateritic formations comprising nearly horizontal lava flows. In the present study geological mapping is done using IRS-1C, LISS-III image, using image processing software ERDAS for better exposition of hydro-geological features. GIS package ARC-INFO is used for the mapping of the features (Fig 3.1). Basalts are showing greenish tone with coarse texture and the laterites show yellow tone (Fig 1.2). Basalts occurring in and around Nyalkal exhibit both vesicular and non-vesicular forms.



## 3. Statistical Analysis:

In this section an attempt is made to present to present the sample observations of each component as per the WHO standard values for each component in the normal water significance when tested at 5% level against with its standard value (v) The effect due to excess of component in water are presented below.

**1. Arsenic (As) :** Arsenic occurs naturally in small amounts in sulfide ore deposits. As per WHO standard it wil be 0.01 mg/L. The mean is significantly differing with its standard value at 5% level. In samples 12, 20,35,46 it is more. It is a component of pesticides and may enter streams or groundwater through pesticide application, waste disposal, or agriculture drainage. Small amounts of arsenic are poisonous and can cause numerous health problems and even death.

2. **Boron (B):** In water Boron will be 300-500 mg/L (as per WHO standards). Boron is necessary for good plant growth. It is significantly differing with its standard value. Only in sample S12 it is more than its standard value. Above the standard value may cause disease increase in tumour incidence

**3. Sodium (Na):** The threshold concentration of Sodium in water is ranging from 20-40 mg/L. It is readily soluble mineral. It is more active than iron and may be more difficult to remove in regular water treatments. The sample mean is 52.15. It is significantly differing with its standard value at 5% level. It can be observed from the sample that in 24 samples it is below the WHO standard value and in few samples it is found to be more. Excessive of WHO standard value may cause for hypertension.

1. **Potassium (K):** The standard value of potassium in the water is 2 – 5 mg/L. The potassium level in the water is significant when compared with its standard value. From the samples, it is observed that except in two samples in none of the sample it is outside the limit. Excess may cause for functioning of kidney, heart, coronary artery, hypertension, diabetes, adrenal insufficiency, pre-existing hyper-kalmia.

2. **Calcium (Ca):** Calcium is a cause for hardness in water and incrustation in boilers. Calcium is a major constituent of various types of rock. It is one of the most common constituents present in natural waters ranging from zero to several hundred milligrams per liter depending on the source and treatment of the water. The WHO standard value of Calcium in water is 75-200 mg/l. It can be observed that this is also significantly differ with its standard value at 5% level. If in any village it is beyond the limit, then it will effect for domestic use.

3. **Magnesium (Mg):** Magnesium salts are important contributors to the hardness of water which breakdown when heated, forming scale in boilers. Chemical softening, reverse osmosis, electro dialysis, or ion exchange reduces the magnesium and associated hardness to acceptable levels. The WHO value of Magnesium in water is 29-292 mg/L. It significantly differ with it standard value at 5% level.

**4. Aluminum (Al):** Aluminum standard range in water is 50-200 μg/L. It is insignificantly differing with its standard value. But in the samples 10 and 12 it is more. Excessive concentrations may cause gastrointestinal irritation.

5. **Vanadium (V):** Vanadium standard value in water is 0.002 mg/L. Its mean is significantly differing with its standard value at 5% level. Its exposures may damage the respiratory system. In sample12 it is more.

6. **Chromium (Cr) :** Chromium has a primary standard of 100 μg/L in water. It is significantly differing with its standard value. Trivalent chromium ($Cr^{+3}$) is an essential element for maintaining good health; a deficiency may result in atherosclerosis. Hexavalent chromium ($Cr^{+6}$) is very toxic and can damage the liver, skin, kidneys, respiratory and digestive organs, and cause cancer. **D**eficiency may cause for atherosclerosis, allergic dermatitis. and can damage the liver, skin, kidneys, respiratory and digestive organs, and cause cancer

**7. Manganese (Mn):** Manganese standard in water is 50μg/L. It is significantly differing with its standard value. The values in the samples 10 and 12 are above the WHO standard value. Beyond this limit taste/appearance are affected, has adverse effect on domestic uses.

**8. Iron (Fe):** Iron concentration in natural water is small and is less than 300μg/L. In sample 12 it is more than its standard value. High levels of iron can also be traced to well casings, pipes, pumps, storage tanks, and other cast iron equipment.

9. **Nickel (Ni):** The WHO value of Nickel(Ni) is 0.002 mg/L. It is significantly differing with its standard value. In sample 10, its value is more than its standard value. may cause allergic reaction.

**10. Cobalt (Co):** WHO standard values of Co in water is 40 mg/L. Its value is significantly differing with its mean value based on the sample. Cobalt is essential micronutrient required for the formation of vitamin $B_{12}$ and for its function in enzymatic process. The values in the samples except 11 are below WHO limit.

11. **Copper (Cu):** Copper has a WHO standard of 10 - 130mg/l. In the sample 12 it is more Copper is an essential element for maintaining good health. Deficiency may cause for anemia, loss of pigment, and reduced growth and exceed causes liver or kidney damage.

12. **Zinc (Zn):** The WHO standard value of Zn is 5 mg/L. It is significantly differing with its standard value. In the samples 12, 17, 20, 46 it is more. Excessive concentrations may cause for irritability, muscle stiffness and pain, loss of appetite, and nausea.

13. **Selenium (Se):** The WHO standard value of Se in water is 0.05 mg/L. Concentration in groundwater rarely exceed 1 μg/l. It is an essential element for maintaining good health. A deficiency may result in opathies (muscle diseases) and possible liver damage. An excessive amount may produce inhibited growth and skin dermatitis. It is significantly differing with its standard value. It causes for hair or fingernail loss; numbness in fingers toes circulatory problems

14. **Molybdenum (Mo):** Molybdenum is a rare element and it will be in 70 mg/L as per WHO standards and is an essential element for maintaining good health. Its value is significantly differing with its standard value at 5% level. In 49 samples it is below the WHO standard value and only in one $S_{35}$ it is more. Excessive concentration cause to liver, kidney, spleen, and adrenal damages.

15. **Silver (Ag):** Silver is a rare metallic element found mostly in igneous rocks. It is used in the production of photographic film and other industries. Its standard value is 0.1mg/L. It is insignificant at 5% level. But in 35 samples it can be found below the WHO standard value and in 15 village it is above the WHO standard value. Overload of silver causes allergy, skin and hair loss and adults may get kidney problems; high blood pressure.

16. **Antimony (sb):** WHO standard value of Sb is 0.005 mg/L. all the samples contains above the WHO standard value. It is significantly differing with its standard value. High levels can be toxic to the gastrointestinal tract, heart, respiratory tract, skin, and liver.

17. **Barium (Ba):** Barium occurs in in lime stones, igneous and sandstone rocks. The standard value in water is 2,000 µg/L (2 mg/L) as per WHO standards. Its sample mean is and is significant at 5% level. high levels of barium can cause organ damage and circulatory problems and also may lead to increase in blood pressure.

18. **Lead (Pb)** : Lead is a rare metallic element is widely dispersed in igneous and sedimentary rocks such as shales and carbonates. Lead has an action level of 15 µg/L. Its value is below the standard value in 41 samples and in 9 samples it is more($S_1$, $S_2$, $S_{12}$, $S_{15}$ , $S_{26}$ , $S_{31}$, $S_{33}$ , $S_{38}$, $S_{44}$). It is significant at 5% level. Excess concentrations of Lead cause irreversible brain damage. Physical or mental development in children could show deficits and Adults may get kidney problems, high blood pressure

19. **Fluorine (F):** Fluoride does not occur in the elemental state in nature due to of high reactivity, i.e. most electro negative. The Fluoride can be found in ground water 0.4 to 1.0 mg/l.. The mean score is significant at 5% level. It is beneficial in reducing tooth decay, but above 1.5 mg/l causing for tooth enamel and pathological changes such as stiffness of the back Bone disease (pain and tenderness of the bones)and children may get mottled teeth and difficulty in performing natural movements may take place. ($S_1$, $S_3$, $S_{13}$,$S_{24}$,$S_{30}$ samples are below and $S_{12}$ , $S_{12}$, $S_{17}$, $S_{20}$, $S_{23}$, $S_{29}$, $S_{46}$ samples are above the WHO limit).

20. **Chlorine (Cl):** The chlorine is ranging from 140-386 mg/L and mostly below 250 mg/l. if the ground water having more than 1000 mg/L it is not suitable for drinking water directly. The lack/more of chlorine causing for taste, indigestion, heart and kidney diseases. In one of the place it is more and above and In 37 places it is below WHO limit. It is significantly differ with its standard value.

some basic statistical values like sample means, standard deviations, minimum and maximum values and their 3σ limits are presented **Table-3.1.**

**Table 3.1**

| | Max | Min | Mean | S.D. | Mean ± 3 S.D. | |
|---|---|---|---|---|---|---|
| **Be** | 0.05 | 0 | 0.01 | 0.01 | 0 | 0.05 |
| **Ag** | 0.38 | 0.05 | 0.1 | 0.06 | 0 | 0.29 |
| **Sb** | 0.77 | 0.03 | 0.1 | 0.11 | 0 | 0.42 |
| **Co** | 2.38 | 0.18 | 0.44 | 0.34 | 0 | 1.46 |
| **As** | 3.78 | 0.47 | 0.95 | 0.58 | 0 | 2.7 |
| **Cd** | 20.42 | 0.05 | 1.52 | 3.04 | 0 | 10.64 |
| **Li** | 10.73 | 0.68 | 1.78 | 1.5 | 0 | 6.29 |
| **Mo** | 104.07 | 0.11 | 2.67 | 14.65 | 0 | 46.62 |
| **Rb** | 67.49 | 0.88 | 3.68 | 9.54 | 0 | 32.31 |
| **Se** | 34.85 | 4.52 | 7.92 | 4.66 | 0 | 21.89 |
| **Cr** | 61.6 | 5.2 | 11.61 | 8.47 | 0 | 37.04 |
| **Ba** | 53.93 | 0.06 | 12.09 | 7.95 | 0 | 35.93 |
| **Pb** | 50.22 | 5.11 | 13.48 | 9.58 | 0 | 42.22 |
| **Mn** | 119 | 3.12 | 16.14 | 18.77 | 0 | 72.44 |
| **Cu** | 93.15 | 4.76 | 19.32 | 12.96 | 0 | 58.19 |
| **V** | 181.88 | 1.92 | 26.99 | 28.22 | 0 | 111.66 |
| **Ni** | 258.97 | 5.72 | 27.86 | 39.87 | 0 | 147.48 |
| **Zn** | 427.05 | 18.74 | 91.28 | 78.14 | 0 | 325.7 |
| **Al** | 386.98 | 30.16 | 105.5 | 74.51 | 0 | 329.02 |
| **Fe** | 520.45 | 66.44 | 134.94 | 66.48 | 0 | 334.38 |
| **Sr** | 788.13 | 0.9 | 206.89 | 171.84 | 0 | 722.39 |
| **B** | 1359.7 | 105.86 | 253.61 | 170.16 | 0 | 764.11 |
| **Si** | 1818.48 | 53.6 | 321.86 | 231.11 | 0 | 1015.19 |
| **K** | 36883.15 | 0 | 2423.47 | 5128.84 | 0 | 17809.99 |
| **Mg** | 83574.73 | 713.76 | 20253.91 | 13644.28 | 0 | 61186.75 |
| **Ca** | 169504.4 | 5505.24 | 49339.28 | 25205.67 | 0 | 124956.3 |
| **Na** | 177936.4 | 20284.43 | 52546.9 | 32980.79 | 0 | 151489.3 |

Table 3.2 Variance Explained each Component

| Component | Initial Eigen values | % of Variance | Cumulative % |
|---|---|---|---|
| 1 | 1529689118 | 79.027 | 79.027 |
| 2 | 367833970 | 19.003 | 98.03 |
| 3 | 24397528.1 | 1.26 | 99.29 |
| 4 | 13675834 | 0.707 | 99.997 |
| 5 | 43387.671 | 2.24E-03 | 99.999 |
| 6 | 10833.858 | 5.60E-04 | 99.999 |
| 7 | 5648.337 | 2.92E-04 | 100 |
| 8 | 2676.186 | 1.38E-04 | 100 |
| 9 | 1286.527 | 6.65E-05 | 100 |
| 10 | 733.362 | 3.79E-05 | 100 |
| 11 | 184.746 | 9.54E-06 | 100 |
| 12 | 121.137 | 6.26E-06 | 100 |
| 13 | 78.125 | 4.04E-06 | 100 |
| 14 | 56.556 | 2.92E-06 | 100 |
| 15 | 33.927 | 1.75E-06 | 100 |
| 16 | 15.003 | 7.75E-07 | 100 |
| 17 | 9.417 | 4.87E-07 | 100 |
| 18 | 6.022 | 3.11E-07 | 100 |
| 19 | 4.075 | 2.11E-07 | 100 |
| 20 | 3.103 | 1.60E-07 | 100 |
| 21 | 2.114 | 1.09E-07 | 100 |
| 22 | 0.118 | 6.10E-09 | 100 |
| 23 | 7.01E-03 | 3.62E-10 | 100 |
| 24 | 5.35E-03 | 2.77E-10 | 100 |
| 25 | 2.16E-04 | 1.11E-11 | 100 |
| 26 | 1.74E-04 | 8.98E-12 | 100 |
| 27 | 2.47E-05 | 1.28E-12 | 100 |

## 4. Conclusions:

Groundwater quality in Medak District has been analyzed in the present work. The groundwater is acidic in nature and total hardness observed in all samples fall under hard to very hard category. The concentration of physiochemical constituents in the water samples were compared with the Bureau of Indian Standards to know the suitability of water for drinking. The human interventions affects of the groundwater quality in the study area is presented. Except few components most of them are not as per the standard values specified by WHO. In almost all places the water is polluted & contaminated and is harmful for health. It is also observed some of the cluster belts for some of the components.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