



## EVOLUTION OF GROUND WATER QUALITY- CHEMICAL CHARACTERISTICS

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### Key words:

Ground water, Chemical  
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Hydrochemical study of ground water is generally performed for determining its suitability for drinking, industrial and agricultural purposes. In this study, the evaluation of various chemical parameters such, TDS, bicarbonate and alkali metals (Na, K, Ca and Mg) of ground water has been explored using advanced analytical techniques along with the standard limits as per WHO guidelines for drinking water. The deterioration in the quality of the water could be due to rapid urban-industrialization activities, increase in population with change of life style, excess use of chemical fertilizers, pesticides in soil to meet the increasing demand in the market, destroyed the water quality of ecologically rich soil.

## INTRODUCTION

Ground Water is the major source of drinking water in both urban and rural areas. The importance of ground water for the existence of human society cannot be overlooked. Ground water crisis is not only the result of natural factors but also caused by human action much of ill health which affects humanity, especially in the developing countries can be traced to lack of safe and wholesome water supply. Prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems. Good quality of drinking water is of basic importance to human physiology as man's continued existence depends very much on its availability. Only 1% part is available on land for drinking, agriculture, domestic power generation, industrial consumption, transportation and waste disposal. Our dependence on fresh water resources has

Grown large in last century due to rapid growth in world population and economic development that has resulted in increasing numbers of cases of water borne diseases and other health hazards. High amount of various ions, salts etc. are found in ground water, soil such type of water is used as potable water then it leads to various water-borne diseases. Unsafe drinking water contributes to numerous health problems in developing countries such as the one billion or more incidents of diarrhoea that occur annually. According to world health organization (WHO), there were estimated 4 billion cases of diarrhoea and 2.2 million deaths annually. 1% of the ground water level is threatened either directly or indirectly by pollution. Anthropogenic activities cause serious groundwater contamination; therefore it is important to analyze the ground water as well as water quality, before using it for any purpose and to observe the demand and pollution level of

ground water, Several water analyses have been regularly conducted by different scientific groups across the country.

**Chemical tests:**

**Total Alkalinity:** In monsoon season alkalinity observed from 154.5 to 207 mg/l and it was found within 164.5 to 220 mg/l during winter season. Slight increase in alkalinity was observed during winter season.. Natural water mostly found in alkaline form due to presence of sufficient quantities of carbonates. The major portion of alkalinity in natural water is caused by hydroxide, carbonate and bicarbonate. Alkalinity in itself is not harmful to human beings

**Total Hardness:** Total hardness ranges from 156 to 210 mg/l during monsoon season and it was ranged from 166.5 to 224 mg/l during winter season.. Hardness is caused by a variety of dissolved polyvalent metallic ions; predominantly Calcium and Magnesium cation, other cations like Barium Iron, Manganese, Strontium, and Zinc also contribute. The high concentration of Total Hardness in water Samples may be due to dissolution of polyvalent metallic ions from sedimentary rocks, seepage and run off from the soil

**Chloride:** Chloride ranges from 111.12 to 128.51 mg/l during monsoon season and it was ranges from 99.4 to 117.86 mg/l during winter season. Chloride present in all types of natural water. The high concentration of chloride in water is considered as an indication of pollution due to high organic waste of animal origin.

**TDS:** TDS ranges from 149.8 to 350.8 mg/l during monsoon season and it was found between 142 to 349.3 mg/l during winter season. High total dissolved solids in

groundwater may observed because of groundwater contamination, when waste water from residential and dying units were discharged into ponds, lagoons, pits; such waste water migrate down to the water table and causes contamination of groundwater. Total Hardness (TH) (mg/l), Sulphate (mg/l), Nitrate (mg/l), Chloride (mg/l), Fluoride (mg/l) it can be measured by Aqua check water testing kit provided by Hi-media, Mumbai, India.

**The elemental detection** can be performed by IC-PMS (Inductive Coupled-Plasma Mass Spectroscopy) (Perkin-Elmer NexIon 300X, USA). Elements that can be detected are In (Indium), Ba (Barium), Pb (Lead), Ag (Silver), Al (Aluminum), As (Arsenic), Ba-1 (Barium), Be (Beryllium), Bi (Bismuth), Ca (Calcium), Cd (Cadmium), Co (Cobalt), Cr (Chromium), Cs (Cesium), Cu (Copper), Fe (Iron), Ga (Gallium), S (Sulphur), K (Potassium), Li (Lithium), Mg (Magnesium), Mn (Manganese), Na (Sodium), Ni (Nickel), Mo (Molybdenum), R (Rubidium), Se (Selenium), Sr (Strontium), Ti (Titanium), U (Uranium), B (Boron), V (Vanadium), Zn (Zinc), Hg (Mercury), Si (Silicon), P (Phosphorus), N (Nitrogen), Cl (Chlorine), Zr (Zirconium), Xe (Xenon), Sn (Tin), I (Iodine), Ce (Cerium).

**Arsenic and Nitrate:** Water samples for analysis of arsenic and nitrate can be mixed with the acid (1M HCl in the 5ml for 500 water sample). The physicochemical parameter of community water and household water were not measured as they are just replicated source from the springs (spring water is collected to community reservoirs tank which was supplied to the household).

**Table 1: Drinking water standards and unit weights (all values are in mg/l except EC & pH), recommended by WHO & ISI**

Parameter	WHO	Indian Standard	Unit Weight (Wn)
pH	7.0-8.0	6.5-8.5	0.317
TDS	1000	500	0.0054
TA	120	200	0.0135
TH	500	300	0.009
Ca	100	75	0.036
Mg	30	30	0.09
Cl	250	250	0.0108
EC	1000µS/cm	-	0.001
DO	4-6	-	0.54

## CONCLUSIONS

Ground water is generally found to have even higher as compared to standard limit that may be due to excess use of chemicals and non judious or unplanned out flow of effluent. So, there is a need to establish sewage treatment plants in major human settlements so that untreated sewage couldn't contaminate the water bodies. Hence, regular and quantified monitoring of geochemical characteristics of the ground water will be useful for sustainable water management.

## REFERENCES:

1. Ramkumar T, Venkatramanan S, Anithamary I, Ibrahim SM (2013) Evaluation of hydrogeochemical parameters and quality assessment of the groundwater in Kottur blocks, Tiruvarur district, Tamilnadu, India. *Arabian Journal of Geosciences* 6: 101-108.
2. Raven PH, Berg LR (2006) *Environment*. 5th edn, John Wiley & Sons.
3. Dan'Azumi S, Bichi MH (2010) Industrial pollution and heavy metals profile of Challawa River in Kano, Nigeria. *Journal of Applied Sciences in Environmental Sanitation* 5: 23-29.
4. Tahir M.A., Rasheed H. and Malana A., Method development for arsenic analysis by modification in spectrophotometric technique, *Drik. Water Eng. Sci. Discuss*, 1, 135-154, (2008)
5. Diersing N., *Water Quality: Frequently Asked Questions*, PDA. NOAA (2009)
6. Postel S., *Last Oasis: Facing Water Scarcity*, W.W. Norton and Company, INC (1992)
7. Mishra A. and Bhatt V., Physico-chemical and microbiological analysis of under ground water in V.V Nagar and near by places of Anand district, Gujrat, Ind. *E. J Chem.*, 5(3) 487-492 (2008)
8. Bhardwaj V, Singh DS (2010) Surface and groundwater quality characterization of Deoria District, Ganga Plain, India. *Environ Earth Sci*. doi:10.1007/s12665-010-0709x
9. BIS (1992) Indian standard specifications for drinking water. BIS:10500(<http://hppcb.gov.in/EIAs/orang/Spec.pdf>)
10. Elango L, Kannan R, Senthil Kumar M (2003) Major ion chemistry and identification of hydrogeochemical processes of groundwater in a part of Kancheepuram district, Tamil Nadu, India. *J Environ Geosci* 10:157-166
11. Gibbs RJ (1970) Mechanisms controlling world water chemistry. *Science* 170:795-840
12. Greenwood NN, Earnshaw A (1984) *Chemistry of the elements*. Pergamon Press, Oxford
13. Han DM, Liang X, Jin MG, Currell MJ, Song XF, Liu CM (2010) Evaluation of groundwater hydrochemical characteristics and mixing behavior in the Daying and Qicun geothermal systems, Xinzhou Basin. *J Volcanol Geotherm Res* 189:92-104
14. Handa BK (1975) Geochemistry and genesis of fluoride-contamination ground waters in India. *Ground Water* 13:275-281