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POLLUTION OF GROUND WATERS IN ANDHRA PRADESH- REVIEW

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ABSTRACT

Availability of clean potable water is rare in all the places. Same is the case in the state of Andhra Pradesh. The state is rich of hard rock's formations ranging in age from Archaean to Recent. These rocks are enriched with harmful elements of fluorine, lead, tungsten etc, The occurrence and movement of ground water is controlled by thickness of weathering and structural features and solution cavities. Groundwater contamination with F is high in Kurnool, Visakhapatnam, Vizianagaram, West Godavari, Prakasam, Nellore, Guntur etc, so, the published reports were studied for the quality of Ground water and a possible remedial measures were suggested/ discussed. Since, the ground water is trapped in between the fractures of Khondalites, charnockite, migmatites, granite gneisses, carbonatites apart from the sedimentary rocks of sandstone, limestone, the toxic trace elements are associated The fluoride ion (F) is a harmful anion and a major pollutant in Groundwater. As per the data the concentrations are varying from 170-280 ppm which is higher than the permissible limits. Similarly, Arsenic, Nitrate, Iron concentrations in few samples is above the permissible limits.. Also, the TDS and TSS are high. Also, in few places of Anantapur, Chittoor, Kadapa, Krishna, Kurnool, Visakhapatnam, Vizianagaram, West Godavari it is high. The Sodium Absorption Ratio (SAR) and Residual Sodium carbonate (RSC) factors used to find the suitability of water for irrigation purpose is also high. The PH values are high which indicates the alkali contents are more. So, this can be explained hitherto that the natural processes and anthropogenic activities contribute the contamination of Fluorine. However, the seasonal monitoring data indicated that the toxic elements including Fluorine in the waters is from the pesticides which are being used in large scale in the nearby agricultural fields is causing. The Fluoride contamination in drinking water is harmful to the human beings and animals and not easily removable, so proper remedial measures need to be adopted by management/authorities.

Keywords: fluorine , ground water, Sodium absorption ratio, total dissolved solids, toxic elements.

INTRODUCTION

Back Ground

The State of Andhra Pradesh has various geological formations ranging in age from Archaean to Recent. Nearly 70 percent of the State is underlain by hard rock formations consisting of granites, gneisses, metamorphic and intrusive (Archaeans), Precambrian quartzites, shales and limestone's (Cuddapahs & Kurnools), Mesozoic Deccan Trap basalts etc., while the remaining area is underlain by Gondwana, Tertiary sedimentary and Sub Recent-Recent alluvium. The occurrence and movement of ground water in hard rock's is chiefly controlled by thickness of weathering and structural features like fractures and solution cavities. In general, the depth of weathering varies from 5 to 20 m and occasionally up to 40 m. Ground water is developed generally by means of shallow-deep bore wells ranging in depth down to 100 m, occasionally even beyond 100 m with discharges generally ranging from 2-5 lps. The semi-consolidated formations of Gondwana & Tertiary comprising sandstones, shales, siltstones, conglomerates form thick and multi aquifer systems down to 600 m bgl under confining conditions. The aquifers are often prolific with discharges varying up to as high as 100 lps. Ground water in coastal alluvium, deltaic alluvium representing un-consolidated formations is generally saline with fresh water restricting to shallow depths (< 20 m).

METHODOLOGY

A systematic survey of literature has been done. Though Various studies have been conducted to determine the F concentration in groundwater sources of the state but the source of Fluorine and other toxic elemental concentrations is still remain a debate. Also, no review has so far been conducted to evaluate the extent and magnitude of F contamination in this area. So, groundwater F contamination reported by various studies from different parts of have been compiled and are compared. About 85% of rural population of the Andhra Pradesh State uses Ground water for drinking and domestic purposes. High concentration of fluoride in ground water beyond the permissible limit of 1.5 mg/l poses the health problem. Nearly the occurrences of fluoride beyond permissible limit (> 1.5 mg/litre) has been observed based on the chemical analysis of water samples collected from the groundwater observation wells. The weathering and leaching of bedrocks releases F, which finds its way into groundwater sources. Natural sources determine the higher concentrations of F in ground water, and F is closely linked to areas of igneous activity. Apart from natural causes of higher F levels in groundwater, industry is also a major cause of F pollution. The dissolution and solubility of F in groundwater is dependent on different factors such as the calcium and NaHCO3 concentrations in the groundwater, climatic conditions of the area, ground water retention time in an aquifer, pH, depth and temperature of groundwater, recharge area distance from the source, interaction of water with soil and rocks, and evapotranspiration. In acidic waters of pH<5, F ions interact with metal ions to form complexes. However, at high pH values, the F ion prevails freely in water.

Author's work

The fluoride ion (F) is an important anion and a major pollutant of groundwater, affecting thousands of people in the State Various published reports have been gone through and found that regarding the source of the fluorine and other toxic elemental concentrations in ground water in districts of Andhra Pradesh were not properly explained till date. The geological activities are responsible for the

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contamination of ground water resources such as F-bearing minerals in igneous (including volcanic), sedimentary, and metamorphic rocks. There are also anthropogenic sources arising from activities such as the mining of rocks and various industrial activities, In addition, some agricultural activities are also associated with F pollution, such as the use of fertilizers, pesticides, and irrigation water as well as direct human exposure through water fluoridation, F supplements, and the use of fluoridated toothpastes and mouth rinses. In A.P, the F content in groundwater sources varies considerably from the World Health Organization (WHO) and national standard value of 1.5 mg/L. In addition to the climatic conditions of an area, the factors controlling the F concentration in groundwater sources include the weathering and leaching of F-bearing minerals and rocks. F contamination of groundwater sources is widespread and is often intense with the highest mean concentration.

RESULTS AND DISCUSSION

The Fluorine and other toxic elements are once released into the environment, F may enter the human body through the consumption of potable water and other contaminated sources like food, toothpaste and air. However, with a few exceptions potable water is typically the major source contributing to the human intake of F and is a determinant of the health problems. According to the study, human exposure due to airborne F is small. Usually, food products contribute little to F exposure. After intake, human tissues partially absorb F, and the remaining portion is excreted in urine. Accumulation of F in the human body is due to the regular exposure to various sources of F that release a small amount of F slowly. Several research studies indicate that F contamination in groundwater sources is strongly associated with the mineral composition of the bedrock which contributes higher concentrations of F to underground water reservoirs. According to the data available 345 people died while over 2000 people affected with contamination of ground water with toxic substances till 2018 data. Also, about 140 persons affected by dialysis due to ground water pollution. Fluoride toxicity may cause malfunctioning of kidneys, bones and other organs as per a medical study.

The name of the districts having F spot values of >1.5 mg/l and higher the salinity, iron and nitrate contents distribution in Ground Water are as follows:

Ground Water Quality Problems	
Contaminants	**Districts affected (in part)**
Salinity (EC > 3000 µS/cm at 25 ° C)	Ananthapur, East-Godavari, Guntur, Kadapa, Krishna, Kurnool, Nellore, Prakasam, Srikakulam, Visakhapatnam, West-Godavari
Fluoride (>1.5 mg/l)	Anantpur, Chittoor, Guntur, Kadapa, Krishna, Kurnool, Nellore, Prakasam, Visakhapatnam, Vizianagaram, West Godavari
Iron (>1.0 mg/l)	Chittoor, Cuddapah, Guntur, Krishna, Kurnool, Nellore, Vishakhapatnam
Nitrate (>45 mg/l)	All the districts of the state

From the above table, in many districts partially the toxic constituents are above permissible limits.

Table: average sample analysis

District	TDS	Total hardness	pH	F	RSC	SAR
Anantapur	1096	520	8.45	1.65	-3.80	1.86
Chittor	1123	488	8.67	1.56	2.80	2.33
Kadapa	1034	503	8.87	1.57	3.28	1.98
Krishna	1056	432	7.56	1.52	-2.67	2.15
Kurnool	1086	508	8.54	1.54	2.45	1.90
West Godavari	1045	422	7.47	1.58	-2.12	2.05
Visakhapatnam	943	365	7.34	1.51	-2.65	2.22

Precise Concluding Remarks

The fluoride ion (F) concentrations are varying from 180-300ppmin the study area in Groundwater, which is higher than the permissible limits. Similarly, TDS, TSS, other toxic elements like Arsenic, Nitrate, Iron concentrations are also alarming in few Districts of A.P. (Anantapur, Chittoor, Kadapa, Krishna, Kurnool, Visakhapatnam, Vizianagaram, West Godavari). The Sodium Absorption Ratio (SAR) and Residual Sodium carbonate (RSC) factors were examined to find out the suitability of water for irrigation purpose . The alkali content in ground waters were also studied and found high. So, these could be explained that the natural processes and anthropogenic activities have contributed the contamination. However, the toxic elements including Fluorine in the waters is from the pesticides which are being used in large scale in the nearby agricultural fields is causing. As the Fluoride contamination in drinking water is harmful to the human beings and animals and not easily removable, so the seasonal monitoring data is required clubbed with remedial measures need to be adopted by authorities.

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