

# Study of Quality of Ground Water in Selected Areas of Swarnamukhi River Basin, Srikalahasti, Chittoor.

Dr.C.Venkatakrishnaiah<sup>\*1</sup>, G.Rajasekar<sup>2</sup>, P.Bhanuprakash<sup>3</sup>

Lecturer, Dept. of Zoology, P.V.K.N. Govt. College, Chittoor, A.P., India.<sup>\*1</sup>

Lecturer, Dept. of Zoology, Govt. Degree College for Men, Anantapur, A.P., India<sup>2</sup>

Lecturer, Dept. of Chemistry, P.V.K.N. Govt. College, Chittoor, A.P., India<sup>3</sup>

**ABSTRACT:** In the present work, the quality of ground water in Swarnamukhi river basin, Srikalahasti, Chittoor district, Andhrapradesh has been evaluated through various water quality parameters (WQPs) such as pH, Electrical conductivity, Total hardness, Dissolved oxygen (DO), Total acidity, Total alkalinity, Total dissolved solids (TDS), Nitrates, Chlorides, Sulfates, Fluorides, Arsenic, Mercury and Lead. Further the results were compared with Bureau of Indian Standards (BIS) and World Health Organization (WHO). Five ground water samples (W1-W5) are collected from the bore wells of Swarnamukhi river basin in and around of Srikalahasti and analysed for all the WQPs. The present work reveals that the overall ground water quality of Srikalahasti town is poor and not potable. The experimental results suggest the use of indigenous technologies to make water fit for drinking.

**KEYWORDS:** Swarnamukhi, Water quality, Alkalinity, Electrical conductivity, TDS.

## I. INTRODUCTION

Water is one of the most precious substances needed to sustain human life, animals and plants. It is an essential need for drinking, cooking, washing, for sanitary disposal of domestic and human wastes and for agriculture. It is also one of the most important engineering materials and is used for steam generation, as a coolant in power plants, for air conditioning, fire-fighting, and for concrete constructions. Water plays a unique position for the production of a wide variety of materials like steel, paper, textiles, beverages, dairy products, petroleum, coal, rubber, plastics industry and as a solvent in chemical processing. 90% of the protoplasm is made of water. Hydrosphere consists of 97% sea water and 3% fresh water. Fresh water resources are streams, springs, rivers, lakes, ponds and ditches.

Water pollution is defined as the adding to water of any substance, or the change of physical and chemical characteristics of water in any way, which interferes with its use for human utility. Turbidity, toxicity and rise in the temperature are the three important characteristics of water pollution. Most of the Indian rivers are polluted heavily, more over pure water helps to maintain hygiene of human beings while contaminated one imparts diseases at free of cost [1]. So it is essential to know the whether the water is devoid of pollutants and harmful pathogens. Assessing risk involves identifying the hazard associated with particular occurrence, action, or circumstance. Hence, evaluation of ground water quality and quantity is important for the development of further civilization and to establish database for the planning future water resources development strategies.

Ground water is a globally important liquid, and changes in its quality can have serious consequences. The chemical composition of ground water is a measure of its suitability as a source of water for human and animal consumption, irrigation, industrial and other domestic purposes. It influences the structural and functional aspects of ecosystem. So that it is important to detect change and early warnings of change both in natural systems and its pollution.

The Swarnamukhi river starts in Chandragiri mandal of Chittoor district and flows along Tirupati rural, Renigunta, Yerpedu, Srikalahasthi, Naidupetamandals and enters into Bay of Bengal. During the course, the fresh water in river and ground water is polluted due to the release of untreated effluents, solid waste and waste water into river by many industries situated along the Swarnamukhi river basin. The drainage water of Srikalahasti municipality also

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

enters into the river. The municipal authorities also dump the garbage and solid waste into the Swarnamukhi river. All these contaminants are polluting the surface and ground water in the course.

The objective of the present work is to evaluate the ground water quality and potability by analyzing various water quality parameters (WQPs) [2] in swarnamukhi river basin in and around the Srikalahasti town. It is one of the holy pilgrim centers in the Chittoor district of Andhrapradesh.

## II. MATERIAL & METHODS

Five ground water samples (W1-W5) were collected from the bore wells in Swarnamukhi river basin in and around of Srikalahasti town. The details of sample location have been incorporated in Table 1. The water samples were analysed for various water quality parameters such as Total hardness (TH), PH, Total acidity (TAC), Total alkalinity (TA), Electrical conductivity (EC), Dissolved oxygen (DO), Total dissolved solids (TDS), Chlorides (Cl<sup>-</sup>), Sulphates (SO<sub>4</sub><sup>2-</sup>), Nitrates (NO<sub>3</sub><sup>-</sup>), Fluoride (F<sup>-</sup>), Arsenic (As), Mercury (Hg) and Lead (Pb) as per the methods described in standard methods for the examination of water and waste water by American public health association [3].

**Table 1: The details of water sampling location**

Water sample	Name of the location
W <sub>1</sub>	Kondamitta.
W <sub>2</sub>	Sukabrahmaasramam.
W <sub>3</sub>	Yerpedu.
W <sub>4</sub>	Panagal.
W <sub>5</sub>	Gajulamandyam.

## III. RESULTS AND DISCUSSIONS

The results of various water quality parameters (WQPs) such as pH, Total hardness, Electrical conductivity, Dissolved oxygen (DO), Total acidity, Total dissolved solids (TDS), Total alkalinity, Nitrates, Chlorides, Sulphates, Fluorides, Mercury, Arsenic and Lead were summarized in Table 2.

**Table 2: Observed values of WQPs of various ground water samples of Swarnamukhi river basin in and around of Srikalahasti town.**

S.No	Water quality parameters (WQPs)	Measuring units	Observed values of ground water samples for WQPs				
			W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>
1	Total hardness (TH)	mg/lit	415	390	655	580	320
2	Dissolved oxygen (DO)	mg/lit	0.86	0.78	1.72	0.69	0.98
3	pH	-	6.5	6.8	6.9	6.7	7.4
4	Total acidity (TAC)	mg/lit	38	47	35	55	44
5	Total alkalinity (TA)	mg/lit	390	350	10	375	340
6	Total dissolved solids (TDS)	mg/lit	785	990	815	840	795
7	Electrical conductivity (EC)	µmhos/cm	2440	1250	2310	1249	1325
8	Chlorides (Cl <sup>-</sup> )	mg/lit	170	385	289	607	475
9	Sulphates (SO <sub>4</sub> <sup>2-</sup> )	mg/lit	118	125	95	105	85
10	Nitrates (NO <sub>3</sub> <sup>-</sup> )	mg/lit	11	12	18	30	28.5
11	Fluoride (F <sup>-</sup> )	mg/lit	0.3	0.1	0.4	0.5	0.3
12	Mercury (Hg)	mg/lit	<0.001	0.001	0.002	<0.001	0.001
13	Arsenic (As)	mg/lit	0.069	0.090	0.121	0.086	0.935
14	Lead (Pb)	mg/lit	0.14	0.091	0.21	0.26	0.45

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

Total hardness (TH) indicates the presence of chlorides, sulphates, carbonates and bicarbonates of magnesium ( $Mg^{+2}$ ) and calcium ( $Ca^{+2}$ ). Based on the observations of TH, some samples showed high values as compare to permissible limits of BIS and WHO. The results of hardness suggest that, all these water samples are in very hard in nature. Its value should remain below permissible limit to restore the quality of ground water. To remove excess hardness of water ion exchange method, reverse osmosis, activated alumina filters treatments are suggested.

The standard value for dissolved oxygen of drinking water is 4-5mg/lit. The obtained values of different samples were found lower than permissible limits of BIS (4-5mg/lit). If this water is exposed to atmosphere, free oxygen reacts with the water and oxygen content improve to required limits then this water can be used for all domestic purposes.

The pH value of drinking water is an important index to acidity. The observed range of pH is 6.5 to 7.4. It is observed that pH of all the water samples lie in the permissible limit of 6.5 to 8.5 prescribed by BIS and the limits prescribed by WHO. The low or higher pH may alter the taste of water [4].

Total acidity values were observed that ranging between 35-55mg/lit as  $CaCO_3$ . Sample  $W_4$  was above the permissible limits of BIS and WHO (50mg/lit) which results the formation of weak carbonic acids. Weak acid due to higher values of dissolved  $CO_2$ . This will adversely affect the corrosion rate. Hence the water must be treated before its use for drinking and construction purpose.

Total alkalinity was observed in the range 340-610 mg/lit as  $CaCO_3$ . Sample  $W_3$  was above the permissible limits of BIS. The value of alkalinity in water provides an idea of natural salts present in water. The excess of alkalinity could be due to the minerals, which dissolved in water from mineral rich soil. The various ionic species that contribute mainly to alkalinity includes bicarbonates, hydroxides, phosphates, borates, silicates and organic acids. In some cases, ammonia or hydroxides are also accountable to the alkalinity [5].

Fresh water always contains some dissolved solids. Evaporation method was used to determine the total dissolved solids (TDS) in water samples. Total dissolved solids was observed in the range 785-990 mg/lit. TDS of all the samples were in the permissible limit of 500-2000 mg/lit [6, 7].

The electrical conductivity of water samples depends on the nature of ions that are present and on its concentration. As concentration of dissolved salts increases, conductivity also increases [8]. The electrical conductivity was observed in the range 1249-2440  $\mu$ Mhos/cm. The electrical conductivity of most of the samples falls in the desirable limit up to 2000  $\mu$ Mhos/cm. Electrical conductivity of  $W_1$  and  $W_3$  samples of very few areas were high and exceeds the permissible limit

Chlorides ( $Cl^{-1}$ ) content ranges from 170-607 mg/lit. Samples  $W_2$ ,  $W_3$ ,  $W_4$  and  $W_5$  were the above the permissible limits of BIS and WHO (250mg/lit). The contribution of chlorides to the ground water is due to minerals like apatite, mica and hornblende and also from the liquid inclusions of igneous rocks. So the samples are not used for drinking or construction purposes until proper treatment are done [9].

The concentration of sulphates ( $SO_4^{-2}$ ) in study area ranged between 85-118 mg/lit, it showing  $SO_4^{-2}$  present in samples are under desirable limit as prescribed by BIS (200 mg/lit). Sulphates present in ground water samples may be due to the biochemical, anthropogenic or industrial processes. The presence of sulphate in drinking water can cause noticeable taste and very high levels might cause a laxative effect in unaccustomed consumers [10].

The concentration of nitrates ( $NO_3^{-}$ ) ranges between 11-30 mg/lit, which is lower than the permissible limit (45mg/lit) as prescribed by BIS, which in turn indicates that the ground water has not been affected by nitrate. Human and animals waste, industrial effluents, application of fertilizers and chemicals seepage and silage through drainage system are the main source of nitrate contamination of ground water [11].

Fluoride content in the study area varied from 0.1 to 0.5 mg/lit. The samples were found lower than permissible limits of WHO standards (1.5 mg/lit) which indicates water sample is not fit for drinking. Particularly for children to whom fluoride above 1.0 mg/lit is very much essential for the development of their teeth and bones. Fluoride is considered as an essential element though health problem may arise from deficiency or excess amount. Deficiency of fluorine causes fluorosis disease.

The heavy metals like Arsenic (As), lead (Pb) in all samples exceeded WHO limits and mercury (Hg) in all samples are low level of WHO limits for drinking water. The excess presence of arsenic in water may cause neurological damage, paralysis and blindness. Excess concentration of lead causes damage to the nervous system and causes brain disorders. Excessive lead (Pb) also causes blood disorders in mammals. The excess mercury (Hg) in water can adversely affect growing brains and nervous systems. Long time exposure to arsenic (As) in drinking water can cause cancer in the lungs, skin and kidney. It can also cause other skin changes such as thickening and pigmentation.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

From the results of the present study, we can suggest to adopt some treatment technologies to decrease the concentration of these heavy metals in ground water and surface water to provide drinking water to the public.

We suggest the following simple methods of treatment of ground water. The ground water is allowed to settle the suspended material, which is called sedimentation, and then the water is filtered through a filtering material, called filtration. After removing the suspended impurities water is mixed with the required quantities of bleaching powder and water mixture is allowed to stand for about half an hour for the completion of sterilization. One of the reliable methods for the sterilization of water is the boiling. Boiling of water destroy all disease producing bacteria and algae. Exposure of water to sunlight or ultra violet light also helps to destroy all disease producing micro organisms. The addition of soda ash ( $\text{Na}_2\text{CO}_3$ ) removes the temporary as well as permanent hardness and makes water soft by decreasing the concentration of calcium and magnesium salts in water. Make use of Osmium sanctum (Tulsi) which is a natural water purifier with antibacterial and insecticidal properties. Use the copper or brass vessels to store water as they do not breed bacteria. Practice safe sanitation and use toilets. Ensure safe handling and storage of water, and safe disposal of child faeces. Minimize the use of pesticides, fertilizers and hazardous products like oil based paint. Their effect on our waters can be devastating. Don't dispose of products down the drain. Dispose of household hazardous chemicals. Plant trees as they are more importantly provide organic matter in the form of leaves and twigs to soak up rainfall. Roots hold soil in place on steep slopes and promote infiltration.

## IV. CONCLUSION

Results of the present study on various water quality parameters (WQPs) of ground water revealed that quality of ground water was adversely affected in the selected areas of Swarnamukhi river basin around of Srikalahasti town. The ground water was not suitable for drinking and other domestic purposes. Use of indigenous technologies was suggested to make water fit for drinking.

## ACKNOWLEDGEMENTS

The corresponding author is thankful to the UGC-SERO, Hyderabad for providing the financial assistance and also thankful to the Principal, P.V.K.N. Government College, Chittoor, for providing laboratory facilities and technical support.

## REFERENCES

- [1] M.Milovanovi, Water quality assessment and determination of pollution sources along the Axios/ Vardar River, Southeastern Europe Desalination, Vol.213, pp.159–173, 2006.
- [2] D.Kumar, and S.Ahmed, Seasonal behaviour of spatial variability of groundwater level in a granitic aquifer in monsoon climate. Current Science, Vol.84 (2), pp.188–196, 2003.
- [3] K.Smith, Environment hazards: Assessing risk and reducing disaster (3rd ed.), London: Routledge, p. 324, 2001.
- [4] A.G.Umadevi, M.George, P.Dharmalingam, P.Abraham Jose, Rajagopalan, Dhanya Balakrishnan, P.P.Haridasan, and P.M.Pillai, An Investigation of the Quality of Underground Water at Eloor in Ernakulum District of Kerala India, E-Journal of Chemistry, Vol.7(3), pp. 908-914, 2010.
- [5] Sawyer, N.Clair, L.Perry, McCarty, and F.Gene Parkin, Chemistry for environmental engineering. IVth Ed., Tata McGraw-Hill. New Delhi, 2000.
- [6] WHO, Guidelines for Drinking Water Quality, 3rd Edition. Geneva: World Health Organization Geneva, 2004.
- [7] K.L.Prakash, and R.K.Somashekar, Groundwater quality - Assessment on Anekal Taluk, Bangalore Urban district, India, Journal of Environmental Biology, Vol.27(4), pp. 633-637, 2006.
- [8] S.Gupta, M.Bhatnagar, and R.Jain, Physico-Chemical characteristics and analysis of Fe and Zn in tube well water and sewage water of Bikaner City, Asian j.chem, Vol.15: pp 727-732, 2003.
- [9] P.K.Das, and S.D.Malik, Groundwater of Khatra region of Bankura district, West Bengal: Some chemical aspects in reference to its utilization, J. Indian Water Res. Soc., Vol.8 (3), pp.31-41, 1988.
- [10] N.A.Siddiqui, and Akbar Ziauddin, Water quality index - A tool to determine quality of water, EPC journal, Vol, 10(1), pp.60-63, 2006.
- [11] G.D.Agrawal, S.K.Lunkad, and T.Malkhed, Diffuse agricultural nitrate pollution of groundwater in India, Water Sci. Tech., Vol.39 (3), pp.67-75, 1999.