Volume : 4 | Issue : 9 | Sept 2015 • ISSN No 2277 - 8179

Research Paper

Ground Water Analysis in the Surrounding Areas of Madhugiri Taluk, Tumkur District, Karnataka, India.

Chemistry

KEYWORDS : Madhugiri Taluk, Rural areas, Ground Water, Drinking water.

Nanda N — Department of Chemistry, B M S College for Women, Basavanagudi, Bangalore, Karnataka, India.

Puneeth Kumar — Department of Chemistry, Sambhram Institute of Technology, Bangalore, Karnataka, India.

ABSTRACT

Water is essential natural resource, basic amenity and universal solvent used for sustaining life and environment which we have always thought to be available in abundance and free gift of nature. Groundwater forms a major source of drinking water in urban as well as natural areas. The quality of ground water of any area is of great importance for human being and irrigation. Current emphasis is not only how abundant water is, but also on whether its quality status is good enough to sustain its various uses. However, people in certain rural areas are not at all aware of the major problems are being faced due to the presence of excess fluoride, arsenic and nitrate in groundwater. Fluoride is present in water and it is necessary for human health, excessive ingestion of fluoride results into a disease called fluorosis. The objective of the present study to carry out the physico-chemical analysis like colour, pH, turbidity, total hardness, total dissolved solids, chloride, fluoride, sulphates, and nitrates of ground water samples collected from different villages in madhugiri taluk. It has been taken up to evaluate its suitability for portable purpose. In some samples, fluoride concentration was exceeding the permissible limit and in some samples concentration was lower than permissible limit.

Introduction:

Water plays an important role in the development of a healthy society. However chemical composition of water is one of the prime factors on which the suitability of water for domestic, industrial and agriculture purpose depends.

Fresh water occurs as surface water and ground water, in this ground water contributes only 0.6% of the total water resources on earth. It is major and preferred source of drinking water in rural and urban areas particularly in India. Water contains many minerals like calcium, magnesium and fluoride etc. Among these fluoride is essential in minute quantity for normal mineralization of bone and teeth. A fluoride concentration of approximately 1.0 mg/l in drinking water effectively reduces dental caries without harmful effects on health. Fluoride may occur naturally in water or it may be added in controlled amounts. Some fluorosis may occur when the fluoride level exceeds the recommended limits. In rare instances the naturally occurring fluoride concentration may approach 10 mg/l; such water should be defluoridated.

In India approximately 62 million people including 6 million children suffer from fluorosis because of high consumption of high fluoride content [3]. Longer exposure to fluoride leads to certain types of bone disease [4]. Statistics reveal that fluoride poisoning is more spread than the arsenic contamination in ground water in the country [5]. Fluoride epidemic has been reported in as many as 19 Indian states and union territories. India is one among the 23 nations, in the world, where fluoride contaminated ground water is creating health problems. The state and Art report of UNICEF confirms the fluoride problems in 177 districts of 20 states in India [6].

Fluoride is one among 92 naturally occurring and thirteenth most abundant element. It is a member of the halogen family and extremely reactive pale yellow gas, which exists always in combined state in the form of fluorides. Fluoride is present naturally in almost all foods and beverages including water, but levels of which can vary widely [1]. The fluoride accumulation of ground water varies according to the source of water, geological formulation of the area and amount of rainfall [2] etc.

Ground water is the major drinking water sources in the villages of Madhugiri taluk. Keeping in view of the increased interest in recent years in fluoride contamination of ground resources of certain rural areas of Tumkur district, Karnataka, India and its impact on human health; it is proposed to carry out a systematic study on fluoride.

Materials and methods:

Six water samples were collected from the different panchayath areas of Madhugiri taluk. The places selected for the analyses are given below,

S_1- Keregala Palya, S_2-Meke Bandae, S_3-Sira Gate, S_4-Vinayaka Nagar S_5-Siddapura, S_6-Agasara Hole. Collected samples were stored in a dark place in room temperature in plastic containers until the fluoride analysis was done. All the chemicals and reagents used were of analytical grade. Double distilled water was used for the preparation of solutions. The analysis of parameters namely color, odour, taste, p^H, turbidity, Total Hardness (TH), Total Dissolved Solids (TDS), Chloride, Fluoride, Sulphates, nitrates, were carried out according to American Public Health Association (APHA). Determination of Fluoride has been carried out using Zirconium-Alizarin dye method.

Results and discussion:

The color value of the sample in the study area varied widely between 0-20 Hazen units with a mean of 4.19 Hazen units. The presence of coloring material in the water is due to contact with organic debris, such as leaves, lignin containing materials and wood, which contributes in various stages of decomposition generally, tannins, humic acid and humates from the decomposition of lignin are considered as the principal color debris in the present study. It is important to note that the iron and its compounds also contributed to color.

The p^H value of the samples in the study area varied from 6.73-8.10 with a mean of 7.41 indicating slightly acidic to slightly alkaline nature (Table I). In the study area 9.45% of ground water samples were found exceeding the acceptable limit of Bureau of Indian Standards (BIS-10500). It was noticed that the pH value of the water appears to be dependent upon the relative quantities of calcium carbonates and bicarbonates. Turbidity in the study area range from 0.2-1.3NTU (Nephelometric Turbidity Unit) with mean of 0.55NTU and found that it was not within the acceptable limits of BIS. This indicates the presence of suspended colloidal matter such as silt, clays and fibrous particles like asbestos minerals. The Total Hardness (TH) as $CaCO_3$ was found in range from 80-680.6 (Table I) with a mean value of 380.3mg/l and was found to be within the permissible value. The Total Dissolved Solids (TDS) in the study area varied from 155-1006 mg/l with a mean value of 580.5 mg/l and 50% of the samples were found exceeding the limit of BIS (Table I). The

Volume : 4 | Issue : 9 | Sept 2015 • ISSN No 2277 - 8179

chlorides varied widely from19.4-403 mg /l with a mean value of 166.69 mg/l and 66.6% of samples were found exceeding the acceptable limit of BIS (Table-II). The calcium content varied from 22.4 to 183 mg/l with a mean value of 93.85 mg/l and found that it is not exceeding the acceptable limit of BIS (Table-II). Magnesium value ranges from 5.8-41.7 mg/l (Table-II) with a mean value of 35.9 mg/ l and found within the acceptable limit of BIS. The sulphate content varied from 5.6-109.5 mg/l with a mean value of 46.8 mg/l (Table-II).Which shows that the value is below the acceptable limit of BIS. Fluoride content in the study area varied from 0.8-17.2 mg/l (Table-II) with a mean value of 4.87 mg/l and 83.33% of the samples were found exceeding the acceptable limits of BIS standards. Fluoride samples, which exceeded the acceptable limit, are not recommended for consumption without treatment. Fluoride is considered as an essential element though health problems may arise from either deficiency or excess amount [7]. Much of the fluoride entering the human body is obtained from drinking water [8]. Fluoride concentration of 0.4 ppm in drinking water causes mild type of dental fluorosis[9,10,11]. The alkalinity ranged between 145.44-404 mg/l (Table-II) as $CaCO_3$ with a mean value of 249.44 mg/l as $CaCO_3$ indicated high alkaline nature of water in the area and 16.66% of samples were found below the acceptable limit of BIS. Nitrate concentration in the study area ranged from 0.81-10.5 mg/l (Table-II) with a mean concentration of 4.29 mg/l which indicates that the ground water has minimum amount of nitrate and do not have any effect.

Physical properties Table-I

Batch no	Colour Hazen units	odour	Taste	pH	Turbidity	TH as $CaCO_3$ in mg/l	TDS in mg/l
Description	Colourless transparent liquid						
1	<2.0	Agreeable	Agreeable	8.10	0.8	208.18	388
2	<2.0	Agreeable	Agreeable	6.8	1.3	80	155
3	<2.0	Agreeable	Agreeable	7.06	0.4	364.3	518
4	<2.0	Agreeable	Agreeable	6.73	0.2	680.6	1006
5	<2.0	Agreeable	Agreeable	6.75	0.2	456.4	720
6	<2.0	Agreeable	Agreeable	7.15	0.4	308.3	458
BIS	5-25			6.5-8.5	5-10	300-600	500-600

Chemical Properties Table-II

Batch No.	Chloride in mg/l	Calcium in mg/l	Magnesium in mg/l	Sulphate in mg/l	Fluoride in mg/ l	Alkalinity as $CaCO_3$ in mg/l	Residual free Chlorine in mg/l	Nitrate in mg/l
1	74.3	60.9	13.62	18	17.2	319.1	0.05	3.1
2	19.4	22.4	5.8	5.6	0.8	145.44	0.05	0.81
3	135.48	101	27.2	46.2	3.87	323.2	0.05	1.42
4	403	183	55.4	109.5	2.5	395.92	0.05	5.81
5	236	113.8	41.7	70.8	3.5	404	0.05	4.13
6	132	82	25.2	31.1	1.4	279	0.05	10.5
BIS	250-1000	75-200	30-100	200 -400	1.0-1.5	200-600		45-no relaxation

Conclusion:

The ground water sources in the six village panchayats of rural area of Madhugiri taluk, Tumkur district, Karnataka, India, have been evaluated for their chemical composition and suitability for drinking purpose and irrigation uses with special concern of fluoride. Most of the water samples do not meet the water quality standards for fluoride concentration and many other quality parameters. Except Meke bande and Agasara Hole, all other areas at risk from a potential fluorosis. Hence, it is not suitable for consumption without any prior treatment. Though they are not apt for drinking purpose, people do drink the same. Most of the ground water samples are suitable for irrigation purpose under normal condition.

REFERENCE

1. DHHS (Department of Health and Human Services), (1991). Review of fluoride benefits and risks. Department Health and Human Services, Washington D C. | 2. Meenakshi R C and Maheswari, (2006). Fluoride in drinking water and its removal, Journal of Hzardous Materials, B-137, 456-463. | 3. Bendale D S, Chaudhari G R and Gupta G K, (2010). An evaluation of ground water quality in yawal taluk, Jalgaon dist, A Physico-Chemical and metallic study. Asian J, Chem and Envi. Vol 3(1); 65-71. | 4. Sai Srikanth, (1974). Symposium Fluorosis Hyderbad proceedings, pp- 407-409. | 5. Jai Prakash N, Vijaya Kumar and E T Puttaiah, (2007). Fluoride distribution in ground water of magadi taluk, Bangalore rural distribution of Karnataka, J, Curr, Sci. 10(1), 279-82. | 6. Sunitha V, Murilidhara Reddy B, Ramakrishna Reddy M, (2012). Variation of Fluoride and correlation with alkalinity in ground water of shallow and deep aquifers. A case study in and around anantapur district, andhrapradesh, Int, journal of Applied Sciences and Engineering Research, Vol 1(4), 569-575. | 7. Gopal Ram and P K Gosh, (1985). Fluoride in drinking water- its effects and removal, Def, Sci. J, 35(1), 71-88. | 8. Saralakumari D and Rao P R, (1993). Endemic fluorosis in the village ralla, anantapuram in andhra Pradesh, An epidemiological study, fluoride, 26(3), 177-180. | 9. Dinesh C; Fluoride and human health causes for concern, (1999). Indian J Environ.Protect. 19(2), 81-89. | 10. Gupta S C, G S Rathore and C S Doshi, (1993). Fluorida distribution in ground water of south eastern Rajasthan. Ind. J. Environ. Hlth, 35(2), 97-106. | 11. Yadav J P and S Lata, (2004). Fluoride levels in drinking water sources in rural areas of block Jhajjar, Jhajjar district, Haryan, J Indian water works association, 131-136.