Determination of Fluoride in and around Visakhapatnam City, Andhra Pradesh

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ABSTRACT: Physico – Chemical analysis of well and bore well water samples was carried out from ten sampling stations of Visakhapatnam District for a period of 1 year during different seasons in 2009. The analysis of different parameters namely- temperature, pH, color, electrical conductivity and fluoride were carried out as per standard methods. All the parameters studied were within the permissible levels except fluoride. The results indicate that fluoride content in some sampling stations (S_2 ,S_7, S_{14}, S_{15} and S_{16}) was found above standards probably due to seasonal variations and salt water contamination.

Key words: Fluoride content – Visakhapatnam District –Mithilapuri colony- Sagarnagar– Madhurawada -Yendada –AP

INTRODUCTION:

Fluorine is the 13th most abundant element on earth's crust . It occurs in combined form because of its highly reactiveness(DHHS,1991). It is present naturally in almost all foods and beverages including water, but levels of which can vary widely. Fluoridation is the addition of fluoride compounds into drinking water, to adjust concentrations to levels between 0.8 and 1.0 mg/lt for the beneficial effect of tooth decay prevention. The fluoride accumulation of ground water varies according to the source of water, geological formulation of the area, the type of rock that water flows through and amount of rain fall(Meenakhi,S, 2006). The recommended limits of concentrations of fluoride vary among countries. WHO has set a limit range between 0.5 to1.0 mg/Lt and Bureau of Indian Standards has prescribed a permissible limit of 0.6 to 1.2 mg/Lt (Sivasankari,2010). Low concentrations of fluoride provide protection against dental caries, especially in children. Fluoride can also have an adverse effect on tooth enamel and may give rise to mild dental Fluorosis . In India, approximately 62 million people including 6 million children suffer from fluorosis because of high consumption of high Fluoride content (Bendale et al., 2010). Longer exposure to fluoride leads to certain types of bone diseases(Sushhela ,2001). Statistics reveal that fluoride poisoning is more spread than the Arsenic contamination in ground water in the country . Industrial processes such as cement, electronics and steel making furnaces also contribute to high concentrations of fluoride in the environment (Giesen 1999) . In view of the above , it is proposed to carry out a systematic study on fluoride contamination of ground water resources in certain areas of Visakhapatnam Dt AP, India**.**

Materials and methods:

Water samples(Bore Well & Open well) collected from 16 sampling stations selected for the analysis were given bellow: S_1 – Madhurawada S_2 – Ganeshnagar, S_3 –Kommadi Junction, S_4 –Vambey colony,S_5 –Mithilapuri colony ,S_6 – Sivalayam street ,S_7- Pilakavanipalem, S_8 – Church area, S_9- Revenue colony,S_{10} - Chandram palem, S_{11} -Gollala Yendada, S_{12} – Rushikonda S_{13} –Gitam University, S_{14}- Sagarnagar, S_{15} – Gudlavani palem and S_{16} -Musalayyapalem .

Samples for analysis were collected in sterilized bottles using the standard procedure for grab (or) catch samples in accordance with standard methods of APHA (1995) while collection temperature of these areas was noted by 110^0C thermometer. The analysis of parameters namely pH, temperature and Fluoride were carried out – as per the methods described in APHA (1995).Determination of Fluoride has been carried out using fluoride ion selective electrode. D.D water was used for the preparation of solutions. All the chemicals and reagents used were of analytical grade.

Results and discussion:

The results obtained on the analysis of various parameters are presented in Table - 1.

Temperature: Temperature of water is an important parameter because it effects bio-chemical reactions in aquatic organisms. A rise in temperature of water leads to the speeding up of chemical reactions in water, reduces the solubility of gases and amplifies the tastes and odours. The average temperature of the present study ranged from 26.37 - 28.44 ^{0}C.

The alteration of pH of water is accompanied by change in other physico-chemical aspects of the medium. The pH values of the present investigation were within the prescribed standards (7.24 – 8.23).

Electrical conductivity (EC)

It is an important parameter for determining the water quality for drinking and agricultural purposes. Many dissolved substances may produce an esthetically displeasing color, taste and odour. It is an indication of salinity in a specified area The average values of EC obtained are in the range 0.20 to 0.85 mmhos/cm.

Fluoride:

The major sources of Fluoride in ground water are fluoride bearing rocks such as fluorspar, cryolite, fluorspatite and hydroxyl apatite etc. Excess fluoride consumption affects plants and animals. Out of 16 sampling stations studied in all most 14 samples, fluoride concentration remained with in the permissible limits (0.44—1.76 mg/lt) for drinking water. On the other hand in the remaining 2 samples (S_7 , S_{11} , S_{14} and S_{15}) the fluoride content is (exceeded 1.5 mg/lt) above the permissible limits prescribed by ICMR standards.

Conclusions:

It is observed form the above study that fluoride content in certain areas was found above the levels than required. Fluoride concentration can be diluted by inducing ground water recharge techniques, ie. construction of percolation tanks, flooding of ground water by mixing surface water by promoting rain water harvesting. Further, it can also be said that monitoring system is to be established to periodically evaluate the prevalence of fluorosis and dental caries in the effected areas . A registry of water fluoride concentrations may be kept in municipalities, for the benefit of public health providers, health professionals and the public. with regard to fluoride intakes from drinking water.

Table – 1: Physico – Chemical Parameters of Water Samples Collected in and around Visakhapatnam City

Stn. No.	Season	Temp 0_C	Color	pH	Electrical Conductivity (mhos/cm)	Fluoride (mg/lt.)
S1	Winter	27.60	Color less	7.36	0.42	1.38
	Summer	28.20	Color less	7.63	0.37	0.92
	Monsoon	27.24	Colorless	7.38	0.68	1.08
S2	Winter	27.18	Color less	7.48	0.49	1.52
	Summer	27.55	Color less	7.62	0.85	1.74
	Monsoon	26.96	Color less	7.24	0.76	1.50
S3	Winter	27.04	Color less	8.20	0.37	0.82
	Summer	28.08	Color less	7.94	0.52	0.96
	Monsoon	27.53	Color less	7.45	0.54	0.91
S4	Winter	27.10	Color less	7.58	0.24	0.69
	Summer	27.72	Color less	7.56	0.58	0.65
	Monsoon	27.40	Color less	7.53	0.38	0.65
S5	Winter	27.05	Color less	7.35	0.31	0.59
	Summer	28.32	Color less	7.82	0.42	1.03
	Monsoon	27.52	Color less	7.47	0.46	0.49
S6	Winter	27.25	Color less	7.64	0.56	0.85
	Summer	28.15	Color less	7.65	0.64	1.29
	Monsoon	27.53	Color less	7.69	0.64	0.69
S7	Winter	27.02	Color less	7.81	0.38	1.53
	Summer	27.80	Color less	7.80	0.48	1.76
	Monsoon	27.42	Color less	7.25	0.56	1.37
S8	Winter	28.44	Color less	8.08	0.46	0.44
	Summer	28.04	Color less	8.04	0.36	0.84
	Monsoon	27.47	Color less	7.48	0.28	0.59
S9	Winter	26.37	Color less	7.67	0.20	1.02
	Summer	26.90	Color less	6.97	0.29	1.22
	Monsoon	26.95	Color less	7.93	0.61	1.15
S10	Winter	27.72	Color less	7.80	0.42	1.05
	Summer	28.24	Color less	7.70	0.61	1.20
	Monsoon	27.72	Color less	7.27	0.46	1.03
S11	Winter	27.50	Color less	7.62	0.61	1.34
	Summer	28.14	Color less	7.84	0.78	1.56
	Monsoon	27.71	Color less	7.46	0.57	1.58
S12	Winter	27.52	Color less	7.51	0.72	1.02
	Summer	27.86	Color less	7.53	0.42	1.41
	Monsoon	27.43	Color less	7.51	0.76	1.11
S13	Winter	27.45	Color less	7.24	0.39	1.05
	Summer	27.86	Color less	7.53	0.42	1.21
	Monsoon	27.80	Color less	7.51	0.76	1.01
S14	Winter	27.85	Color less	8.12	0.27	1.75
	Summer	28.25	Color less	8.11	0.81	1.50
	Monsoon	27.57	Color less	8.15	0.82	1.58
S15	Winter	28.23	Color less	7.61	0.36	1.24
	Summer	27.35	Color less	8.23	0.76	1.69
	Monsoon	27.98	Color less	7.71	0.72	1.46
S16	Winter	26.87	Color less	7.82	0.46	1.12
	Summer	28.12	Color less	7.63	0.68	1.48
	Monsoon	27.90	Color less	8.02	0.48	1.29

* All the values are the average of 3 determinations.

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