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STUDIES ON THE CONCENTRATION OF FLUORIDE ION CONTENT AND pH IN GROUND WATER/SURFACE WATER IN THE DISTRICTS OF HOOGHLY AND PASCHIM MEDINIPUR OF THE STATE WEST BENGAL

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According to WHO (World Health Organization) and EPA (Environmental Protection Agency) the fluoride ion Concentration of Water to be supplied for domestic and drinking purposes should not exceed 1.5 mg/L. This demands a careful analysis of domestic and drinking water as certain the fluoride content (write the reference). The Concentration of Fluoride ion in water has been determined accurately with the help of an Electrochemical cell, Known as the fluoride –ion- meter known as "ORION-4-STAR". Set of 3-5 standard solutions is arranged in a raw and the fluoride electrode is dipped in each of these solutions one by one. The electrode is Washed with distilled water after its withdrawl from each solution and wiped with Tissue papers to avoid contamination.

The electrode potential corresponding to each standard solution is recorded in the voltmeter in mili volt which is increased linearly with the increase in the concentration of standard solutions.

Keywords: TISAB (Total Ionic Strength Adjustment Buffer). Calibration, Recalibration. Mitigation

INTRODUCTION

Water is the essence of life. A man cannot survive without water. Hence the drinking water which we are drinking daily must be clean and safe. Major sources of our drinking water are wells, boreholes, Ponds, Rivers, Lakes, Tube wells and hand pumps. Most of the surface

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water sources are either free from fluoride or Contain traces amount of Fluoride. According to the census, 2011, the total rural population of West Bengal is 91,300,000 (Nine crore thirteen lakh), with highest population density of 1029 people per sq. Km, in 3,354 village panchayats in 23 districts. Groundwater-fluoride problems have been recorded in over 200 districts in 19 Indian States (FR & RDF). In Andhra Pradesh, Gujarat, Rajasthan, and Telangana, 50–100% of districts are affected by high-fluoride drinking water. In Bihar, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa (Odisha), Punjab, Tamil Nadu, and Uttar Pradesh, 30–50% of districts are affected; and in Chhattisgarh, Delhi, Kerala, and West Bengal, the figure is less than 30% (RGNDWM, 1993). According to project report of West Bengal Government for drinking water, fluoride-contaminated groundwater was first detected in West Bengal in 1997. Excessive concentrations were noted in the Nasipur area of Nalhati I block in the district of Birbhum, after which the government took rapid action to provide an alternative water supply based on river-bed tube wells from River Tripita.

In order to achieve its Vision 2020 to provide safe, reliable and sustainable drinking water to about 1.65 million of fluoride and salinity affected people in the areas of Bankura, North 24 paraganas and Medinipur districts in the state, the government of West Bengal has launched a project supported by Asian Development Bank (Government of Bengal, 2011). According to a report prepared during the preparatory stage of the said project, Bankura district of west Bengal is the worst fluoride affected area and Murshidabad district stands second. The fluoride concentrations in the contaminated groundwater of those areas are as high as 1.06-1.75 mg/l (WBPCB report 2016). According to the PHED, Government of West Bengal, 11.9 % of the rural population of West Bengal is at risk from fluoride contamination of drinking water.

The presence of fluoride in the ground water or fresh water sources causes greatest inorganic threat to health. Though the permitted limit of fluoride concentration in drinking water as set by WHO is 1.5 mg/L, the allowed concentration of fluoride in India has been set as 1.0 mg/L. Approximately 200 million people or more have been reported at risk worldwide from fluoride concentrations value above the desirable limit set by WHO in ground water and natural fresh water (Edmunds and Smedley, 2013). Saxena and Sewak in 2015 have reported approximately 67 million populations in India at risk due to consumption of fluoride concentration above the desirable limit in drinking water and 8 million people suffering from skeletal fluorosis. The skeletal or dental fluorosis is the most prevalent health problem which is related to the long term exposure to fluoride from drinking water. The developed stages of symptoms of fluorosis are irreversible. In dental fluorosis, the interaction of fluoride with enamel of tooth results in the decolouration and consequent loss of tooth. Children are very much prone to the fluoride exposure due to which their growth of teeth and bones are severely affected. The severity of the disease depends largely on and the dose and extreme of exposure.

The total number of fluorosis cases nationwide was 1.2 million people as of 1 April 2014 as per the report given by ministry of Health and Family welfare, Government of India.

In the present paper, attempts have been made to estimate fluoride concentration in ground water of various regions in West Bengal along with its pH measurements for the mitigation of fluoride.

EXPERIMENTAL METHODOLOGY

The main instrument used to carry out this study was

Fluoride-ion-meter- 'ORION-4-STAR. For preparation of stock solution and other experimental needs, a magnetic stirrer with a Teflon coated small negative needle, volumetric flasks (made up of polypropylene as glass containers may react with the fluoride) of 50 mL and 100 mL capacity, 25ml capacity beakers and 10 mL capacity pipettes (all made up of polypropylene) were used. The standard fluoride solution was prepared by dissolving 221 mg of pure NaF in distilled water taken in a 1000 mL volumetric flask and finally the solution was made up to mark by adding distilled water. The total ionic strength adjustment buffer (TISAB) was used. The electrode connected with the ORION-ion- meter 4-star were frequently recalibrated by checking the potential reading of 1 mg/lt standard fluoride solution and adjusting the calibration control, if necessary until the meter reading as before.

Experimental Methods and Investigation :

The following two solutions were prepared:

1. The intermediate standard fluoride Solution Concentration 10 mg/L.
2. Working Standard fluoride Solutions.

The electrode was connected with the Fluoride ion meter (ORION-4-STAR). Two standard solutions which differ by a factor of 10 and can locate the concentration strength, were selected. Both the sample and standard solution were maintained at room temperature. In a polypropylene beaker of 25 mL capacity accurately measured 10 mL of the standard solution of lower concentration was taken by the help of a clean pipette and was placed over a magnetic stirrer followed by addition of 1 mL total ionic adjustment buffer (TISAB). The electrode inside the standard Solution of the lower concentration was inserted. The stirring was avoided before immersing the electrode as the entrapped air around the crystal can produce erroneous readings or needle fluctuations. Before taking a final multivolt reading, the electrode is allowed to remain in the solution for 3 minutes. If the reading is not as per reading of the standard solution, the display value is carefully adjusted as per the standard. The electrodes are rinsed with distilled water and blot dry with a tissue paper or filter paper

between reading (blotting may poison the electrode if not done gently). Dipping the electrodes inside the over standard Solution and the reading of this solution is taken in the similar fashion. Similarly, Then the instrument automatically is switched over to measurement mode. In the similar fashion the reading of the sample is taken after repeating the above mentioned steps and treatment with 1 mL TISAB etc. The electrode is allowed to remain in the sample until a steady reading is displayed. The fluoride concentration of other samples was determined in the similar way.

RESULTS AND DISCUSSIONS

Table -1

Details of Fluoride Content in Various food items is shown in the following Table

S.No.	Source of food item	Fluoride (PPM)	S. No	Source of food item	Fluoride (PPM)
1	Dried Seaweed	326.0	10	Shrimp	4.5
2	Sardines	11.0	11	Crab	2.2
3	Wheat Germ	2.4	12	Chicken	1.5
4	Cheese	1.7	13	Soyabeans	1.4
5	Butter	1.5	14	Beef	1.2
6	Eggs	1.3	15	Spinach	1.0
7	Lamb	1.2	16	Whole Wheat	0.8
8	Parsley	0.9	17	Tea	32
9	Pork	0.7			

Table -2

Estimation of Fluoride Content and pH in different Rivers of the districts of Hooghly and Paschim Medinipur of the State West Bengal.

S.No.	Source of Fluoride Content & pH (Rivers)	Estimated Fluoride Content	pH
1	Ganga River	0.482	8.01
2	Damodar River	0.322	7.80
3	Darakeswar River	0.312	7.89
4	Silabati River	0.244	7.46
5	Rupnarayan River	0.268	7.85
6	Thumi/Sankari River	0.310	7.82

Table-3

Estimation of Fluoride Content and pH in different Municipalities and Grampanchayets in the district of Hooghly and Paschim Medinipur of the State West Bengal :

Sl.No.	Location	Estimated Fluoride Content	pH
1.	Kharar Municipality	0.327	7.99
2.	Ghatal Municipality	0.308	8.15
3.	Khirpai Municipality	0.309	8.00
4.	Ramjibanpur Municipality	0.250	8.02
5.	Chandrakona Municipality	0.312	8.11
6.	Midnapur Municipality	0.335	8.34
7.	Arambagh Municipality	0.305	8.01
8.	Tarakeswar Municipality	0.302	8.02
9.	Sultanpur G.P.	0.291	7.25
10.	Birsing G.P.	0.320	7.40
11.	Kishorepur G.P.	0.280	7.30
12.	Salepur I G.P.	0.285	7.40
13.	Salepur II G.P.	0.282	7.45
14.	Mansuka I G.P.	0.305	8.05
15.	Mansuka II G.P.	0.308	8.10
16.	Ajabnagar G.P.	0.320	7.92
17.	Bali G.P.	0.260	7.30

It can be seen from the tables that the fluoride content of rivers vary significantly with pH. The water of the river having near neutral pH has less fluoride concentration. This same can also be seen from table 3, where the estimated fluoride content of Sultanpur G.P., Kishorepur G.P, Bali G.P. are less at near neutral pH. The variation of fluoride concentration in ground water may be seen as a result of varying dilution and also due to variation of dissolved cacium concentration in it.

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