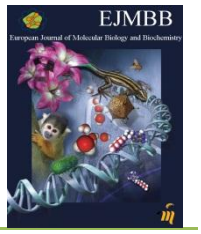
e - ISSN - 2348 - 2206
Print ISSN - 2348 - 2192

European Journal of Molecular Biology and Biochemistry

Journal homepage: www.mcmed.us/journal/ejmbb



ANALYTICAL STUDY OF FLUORIDE ION CONCENTRATION IN THE DRINKING WATER OF BODLA BLOCK IN KABEERDHAM DISTRICT, CHHATTISGARH

Manish Upadhyay

Department of Chemistry, C.V.Raman University, Kota, Bilaspur, Chattisgarh, India.

ARTICLE INFO

Received 25/08/2013
Revised 15/09/2013
Accepted 18/10/2013

Key words:
Fluoridation, Dosage, Fluorosis, Aesthetic, Consumption.

A B S T R A C T

Although fluoride was once considered an essential nutrient, the U.S. National Research Council has since removed this designation due to the lack of studies showing it is essential for human growth, though still considering fluoride a "beneficial element" due to its positive impact on oral health. The U.S. specifies the optimal level of fluoride to range from 0.7 to 1.2 mg/L (milligrams per liter, equivalent to parts per million), depending on the average maximum daily air temperature; the optimal level is lower in warmer climates, where people drink more water, and is higher in cooler. In 1994 a World Health Organization expert committee on fluoride use stated that 1.0 mg/L should be an absolute upper bound, even in cold climates, and that 0.5 mg/L may be an appropriate lower limit A 2007 Australian systematic review recommended a range from 0.6 to 1.1 mg/L. Fluoride's adverse effects depend on total fluoride dosage from all sources. At the commonly recommended dosage, the only clear adverse effect is dental fluorosis, which can alter the appearance of children's teeth during tooth development; this is mostly mild and is unlikely to represent any real effect on aesthetic appearance or on public health. The critical period of exposure is between ages one and four years, with the risk ending around age eight. Fluorosis can be prevented by monitoring all sources of fluoride, with fluoridated water directly or indirectly responsible for an estimated 40% of risk and other sources, notably toothpaste, responsible for the remaining 60%.. Compared to water naturally fluoridated at 0.4 mg/L, fluoridation to 1 mg/L is estimated to cause additional fluorosis in one of every 6 people (95% CI 4–21 people), and to cause additional fluorosis of aesthetic concern in one of every 22 people (95% CI 13.6–∞ people). Here, *aesthetic concern* is a term used in a standardized scale based on what adolescents would find unacceptable, as measured by a 1996 study of British 14-year-olds In many industrialized countries the prevalence of fluorosis is increasing even in unfluoridated communities, mostly because of fluoride from swallowed toothpaste.

INTRODUCTION

Safe drinking water is essential to humans and other life forms. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack Safe drinking water is essential to humans and other life forms. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack access to adequate sanitation. There is a clear correlation between access to safe water and GDP per capita [1, 2, 3]. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability [4]. A recent report (November 2009) suggests that by 2030, in some developing regions of the

Corresponding Author

Dr. Manish Upadhyay
Email:- man_bsp@rediffmail.com

world, water demand will exceed supply by 50%.Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. Approximately 70% of the fresh water used by humans goes to agriculture [5, 6, 7]. Water is the chemical substance with chemical formula H_2O: one molecule of water has two hydrogen atoms covalently bonded to a single oxygen atom [8]. Water appears in nature in all three common states of matter and may take many different forms on Earth: water vapor and clouds in the sky; seawater and icebergs in the polar oceans; glaciers and rivers in the mountains; and the liquid in aquifers in the ground.At high temperatures and pressures, such as in the interior of giant planets, it is argued that water exists as ionic water in which the molecules break down into a soup of hydrogen and oxygen ions, and at even higher pressures as superionic water in which the oxygen crystallises but the hydrogen ions float around freely within the oxygen lattice [9, 10,11]. Fluoride's effects depend on the total daily intake of fluoride from all sources. About 70–90% of ingested fluoride is absorbed into the blood, where it distributes throughout the body. In infants 80–90% of absorbed fluoride is retained, with the rest excreted, mostly via urine; in adults about 60% is retained. About 99% of retained fluoride is stored in bone, teeth, and other calcium-rich areas, where excess quantities can cause fluorosis. Drinking water is typically the largest source of fluoride. In many industrialized countries swallowed toothpaste is the main source of fluoride exposure in unfluoridated communities. Other sources include dental products other than toothpaste; air pollution from fluoride-containing coal or from phosphate fertilizers; trona, used to tenderize meat in Tanzania; and tea leaves, particularly the tea bricks favored in parts of China. High fluoride levels have been found in other foods, including barley, cassava, corn, rice, taro, yams, and fish protein concentrate [12, 13, 14]. The U.S. Institute of Medicine has established Dietary Reference Intakes for fluoride: Adequate Intake values range from 0.01 mg/day for infants aged 6 months or less, to 4 mg/day for men aged 19 years and up; and the Tolerable Upper Intake Level is 0.10 mg/kg/day for infants and children through age 8 years, and 10 mg/day thereafter [15, 16].

Objectives of the Present Work

The quality of water is of vital concern for mankind since it is directly linked with human welfare. It is matter of history that faecal pollution of drinking water caused water bourne diseases which wiped out entire population of cities. The aim of this study was to determine the amount of fluoride in drinking water of Five villages of Bodla Block of Kabeerdham dist.

Polluted water is the culprit in all such cases. The major sources of water pollution are domestic waste from urban and rural areas and industrial wastes which are discharged in to natural water bodies. For this Physico-chemical analysis of drinking water samples will be taken from different Five villages of block Bodla and awares to avoid all problem which come from more fluoride.

Because presence of large amount of fluoride is associated with---

- Dental and skeletal fluorosis and inadequate amount with dental carries.
- U S public health services has stated that fluoride makes the bone more brittle.
- Mottling of teeth disease causes permanent damage to the enamel.
- Skeletal fluorosis followed by pain and stiffless of the joints.
- Osteoporosis found children below age of 10 years also affected.
- In female faces infertility problem.

MATERIAL & METHOD

Samples were collected and analysed as per procedure laid down in the standard methods for examination of water and waste water of American public Health Association (APHA) compsite sampling method was adopted for collection of samples of water from five location of village Sample for chemical analysis were collected in polyethylene container's. Samples collected for metal contents were acitified (1.0 ml HNO_3 per liter samples). Some of the parameter like P^H Temperature, conductivity, dissolves oxygen T.D.S. were analysed on site using portable water analysis kit. The other parameter were analysed at laboratory.

Method: SPADNS SPECTROPHOTOMETRIC

Procedure

Distillation

Distillation is necessary for samples containing high concentration of dissolved solids, see Table. Proceed to step d if distillation is not required. To 400 Ml distilled water in the distillation flask, with magnetic stirrer operating, add 200 mL conc. H2SO4 and a few glass beads. Connect the apparatus as shown in the figure and heat to Laboratory Manual ID: 1.11 Version: 2 Page: 2/3 180 ^{o} C. Prevent overheating by stopping heating when temperature reaches 178^{o}C.

Discard distillate

Cool the acid mixture remaining in the flask to 80oC and add 300 mL sample. With stirrer operating, distil until the temperature reaches 180oC (again stop heating at 178oC to prevent overheating), turn off heat; retain the distillate for analysis.

Add $AgSO_4$ to the distilling flask at the rate of 5mg/mg Cl- to avoid Cl- interference.H2SO4 solution in the flask can be used repeatedly until contaminant from samples accumulates to such an extent that recovery is

affected. This can be ascertained by distilling a known standard and determining recovery.

Standard Curve Preparation: Take the following volumes of standard fluoride solution and dilute to 50 mL with distilled water and note down the temperature:

Pipette 10.00 mL of mixed acid-zirconyl-SPADNS reagent to each standard and mix well. Avoid contamination. Set photometer to zero absorbance with the reference solution and obtain absorbance readings of standards (at 570nm). Plot a curve of mg F- versus absorbance. Prepare a new standard curve whenever a fresh reagent or a different standard temperature is used.

RESULT & DISSCUSSION

Village I – Madmada

A Total number of six samples were collected and tested for their fluoride concentration. Three samples represent surface water collected from river/nallah and represented as s1-sw_1, s2-sw_2,s3-sw_3 while the remaining samples were collected from under-ground water / tube wells s4-sw_4, s5-sw_5,s6-sw_6 .All the six samples were colourless . odourless, and free from solid suspension. The results of absorbance have been compiled below for these samples

Village II Ghongha

A Total number of six samples were collected and tested for their fluoride concentration . Three samples represent surface water collected from river/nallah and represented as s1-sw_1, s2-sw_2,s3-sw_3 while the remaining samples were collected from under-ground water / tube wells s4-sw_4, s5-sw_5,s6-sw_6 .All the six samples were colourless . odourless, and free from solid suspension. The result of absorbance has been compiled below for these samples:-

Village III- Chimra

A Total number of six samples were collected and tested for their fluoride concentration . Three samples represent surface water collected from river/nallah and represented as s3-sw_1, s3-sw_2,s3-sw_3 while the remaining samples were collected from under-ground water / tube wells s3-sw_4, s3-sw_5,s3-sw_6 .All the six samples were colourless . odourless, and free from solid suspension. The result of absorbance have been compiled below for these samples:-

Village IV- Bhonda

A Total number of six samples were collected and tested for their fluoride concentration . Three samples represent surface water collected from river/nallah and represented as s5-sw_1, s5-sw_2,s5-sw_3 while the remaining samples were collected from under-ground water / tube wells s5-sw_4, s5-sw_5,s5-sw_6 .All the six samples were colourless . odourless, and free from solid suspension. The result of absorbance have been compiled below for these samples:-

Village V- Sarekha

A Total number of six samples were collected and tested for their fluoride concentration . Three samples represent surface water collected from river/nallah and represented as s1-sw_1, s2-sw_2,s3-sw_3 while the remaining samples were collected from under-ground water / tube wells s4-sw_4, s5-sw_5,s6-sw_6 .All the six samples were colourless . odourless, and free from solid suspension. The result of absorbance have been compiled below for these samples:-

Table 1. Fluoride Concentration of water samples in village Baraul

samples	Fluoride in mg/l
s1-sw_1	2.40
s1-sw_2	2.80
s1-sw_3	3.50
s1-sw_4	2.50
s1-sw_5	3.0
s1-sw_6	3.0

Table 2. Fluoride Concentration of water samples in village Ramtirath

samples	Fluoride in mg/l
S2-sw_1	2.44
S2-sw_2	2.60
S2-sw_3	3.0
S2-sw_4	2.50
S2-sw_5	2.50
S2-sw_6	2.16

Table 3. Fluoride Concentration of water samples in village BANAPATTI

samples	Fluoride in mg/l
S3-sw_1	2.05
S3-sw_2	3.00
S3-sw_3	3.10
S3-sw_4	3.55
S3-sw_5	3.40
S3-sw_6	1.90

Table 4. Fluoride Concentration of water samples in village BARWAHI

samples	Fluoride in mg/l
S5-sw_1	3.16
S5-sw_2	3.18
S5-sw_3	2.50
S5-sw_4	3.0
S5-sw_5	3.50
S5-sw_6	3.20

Table 5. Fluoride Concentration of water samples in village Fatehpur

samples	Fluoride in mg/l
S6-sw_1	2.0
S6-sw_2	3.05
S6-sw_3	2.30
S6-sw_4	3.0
S6-sw_5	3.50
S6-sw_6	3.18

Fig 1. Fluoride Concentration of water samples in village Baraul

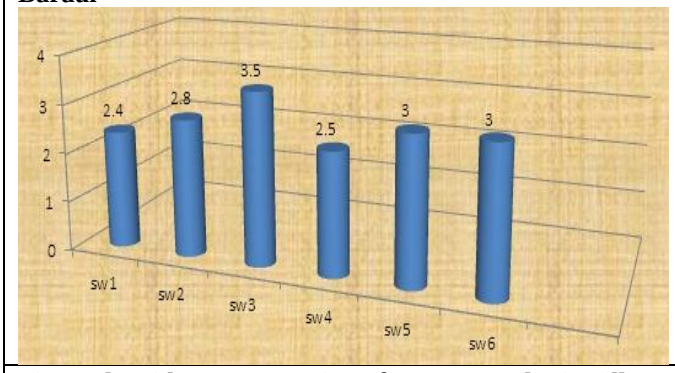


Fig 2. Fluoride Concentration of water samples in village Ramtirath

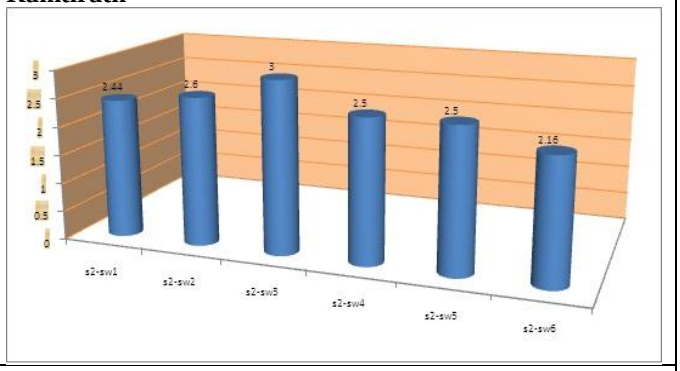


Fig 3. Fluoride Concentration of water samples in village BANAPATTI

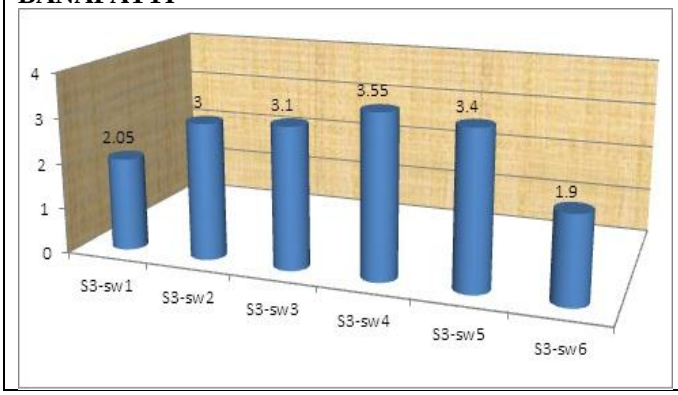


Fig 4. Fluoride Concentration of water samples in village BARWAHI

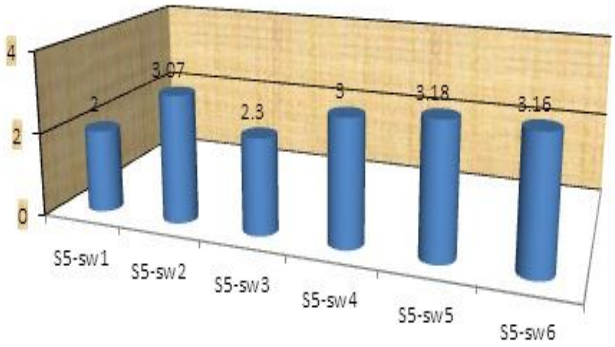
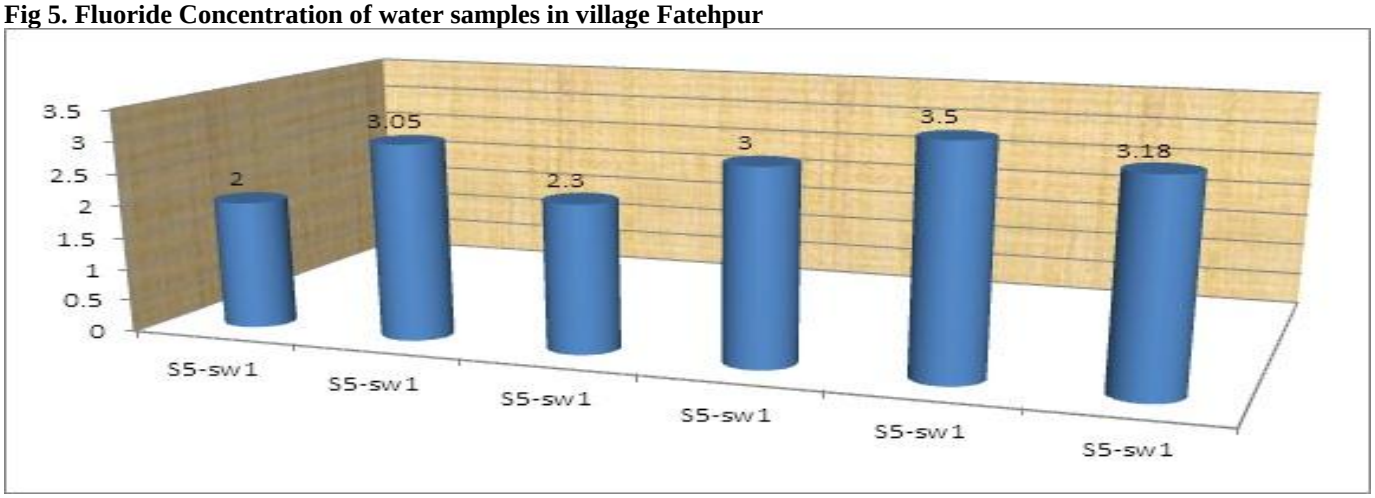


Fig 5. Fluoride Concentration of water samples in village Fatehpur



RESULTS AND DISCUSSION

Result of analyses of Water from Five villages of Kabeerdham dist. of Bodla Block are recorded in table 1,2,3,4 and 5. In all the five villages each have six sampling station (three were collected from the surface and three samples were collected from the tube well) of village- BARAUL fluoride was recorded in the range of 2.40, 2.80, 3.50, 2.50, 3.0 and 3.0 mg/l. Maximum permissible limit for fluoride as world Health organization (WHO) is 1.5 mg/l. all six samples fluoride found excess of their permissible limit.

Water samples analyses of five villages of Kabeerdham dist. of Bodla Block are recorded in table 1,2,3,4 and 5. In all the five villages each have six sampling station (three were collected from the surface and three samples were collected from the tube well) of village- BANAPATTI fluoride was recorded in the range of 2.44,2.44, 3.0, 2.50, 2.50, and 2.16 mg/l . Maximum permissible limit for fluoride as Indian standard (IS) is 0.6 to 1.2 mg/l. all six samples fluoride found excess of their permissible limit.

Mximum permissible limit for fluoride as NEERI manual (1991) is 1.0 mg/l. Water from Five villages of Kabeerdham dist. Of Bodla Block are recorded in table 1,2,3,4 and 5. In all the five villages each have six sampling station (three were collected from the surface and three samples were collected from the tube well) of village- BARWAHI fluoride was recorded in the range of 2.05, 3.00, 3.10, 3.55, 3.40 and 1.90 mg/l. all six samples fluoride found excess of their permissible limit .

The concentrations of fluoride from five villages are recorded in table. In all the five villages each have six sampling station (three were collected from the surface and three samples were collected from the tube well) of village- DHODHAGAON fluoride was recorded in the range of 3.16, 3.18, 2.50, 3.0, 3.50 and 3.20 mg/l. all six samples fluoride found excess of their permissible limit .Maximum permissible limit for fluoride as NEERI manual (1991) is 1.0 mg/l and maximum permissible limit for fluoride as world Health organization (WHO) is 1.5 mg/l.

The concentrations of fluoride from five villages are recorded in table. three were collected from the surface and three samples were collected from the tube well of village- FATEHPUR fluoride was recorded in the range of 2.0, 3.07, 2.30, 3.0, 3.50 and 3.18 mg/l. all six samples fluoride found excess of their permissible limit .Maximum permissible limit for fluoride as NEERI manual (1991) is 1.0 mg/l and maximum permissible limit for fluoride as world Health organization (WHO) is 1.5 mg/l.

CONCLUSION

The preset study has been made to evaluate the Fluoride concentration of water samples collected from the five villages of Bodla Block of Kabeerdham Dist, Chhattisgarh. Each villages have made six sampling station. These samples were analysed for study of fluoride and their effect in surrounding area.

Fluoride in naturally occurring in water can be above or below from recommended levels. Both the excess and deficiency of fluoride in water produces adverse effects on the health.

Maximum acceptable limit for fluoride as world Health organization (1985) is 1.5 mg/l. In present study the fluoride concentration of water samples of all five villages were found over the permissible limit. Therefore, there was harmful effect of fluoride were found in all villages

REFERENCES

1. Burgstahler AW. (2006). Fluoridated bottled water. *Fluoride*, 39, 252-254.
2. Shivarajashankara YM, Shivashankara AR, Rao SH, Bhar PG (2001). Oxidative stress in children with endemic skeletal fluorosis. *Fluoride*, 34, 103-107.

3. Spittle B. (2008). Dyspepsia associated with fluoridated water. *Fluoride*, 41, 89-92.
4. Carton RJ. (2006). Review of the United States National Research Council Report: Fluoride in drinking water. *Fluoride*, 39, 163-172.
5. Susheela AK, Jethanandani P. (1996). Circulating testosterone levels in skeletal fluorosis patients. *J Toxicol Clin Toxicol*, 34, 183-189.
6. Dobaradaran S, Mahvi AH, Dehdashti S, Ranjbar Vakil Abadi D. (2008). Drinking water fluoride and child dental caries in Dashtestan, Iran. *Fluoride*, 41, 220-226.
7. APHA, AWWA, WEF. (2005). Standard methods for the examination of water and wastewater. 21sted. Washington D.C: AWWA.
8. Price JK. (1991). Workbook applied math for water plant operators. Lancaster, Pennsylvania: Technomic Pub. Co.
9. Chakraborti D, Chanda CR, Samanta G, Chowdhury UK, Mukherjee SC, Pal AB, et al. (2000). Fluorosis in Assam. *India. Curr Sci*, 78, 1421-1423.
10. Gupta S, Banerjee S, Saha R, Datta JK, Mondal N. (2006). Fluoride geochemistry of groundwater in Nalhati-1 block of the Birbhum district, West Bengal, India. *Fluoride*, 39, 318-320.
11. Karthikeyan G, Shunmugasundarraj A. (2000). Isopleth mapping and *in-situ* fluoride dependence on water quality in the Krishnagiri block of Tamil Nadu in South India. *Fluoride*, 33, 121- 127.
12. Williams I. (2001). Environmental chemistry. New York: John Wiley & Sons.
13. Mahvi AH, Zazoli MA, Younecian M, Nicpour B, Babapour A. (2006). Survey of fluoride concentration in drinking water sources and prevalence of DMFT in the 12 years old students in Behshahr city. *J Med Sci*, 6, 658-661.
14. Nouri J, Mahvi AH, Babaei A, Ahmadpour E. (2006). Regional pattern distribution of groundwater fluoride in the Shush aquifer of Khuzestan County, Iran. *Fluoride*, 39, 321-325.
15. Mahvi AH, Zazoli MA, Younecian M, Esfandiari Y. (2006). Fluoride content of Iranian black tea and tea liquor. *Fluoride*, 39, 266-268.
16. Hudaykuliyev Y, Tastekin M, Poyrazoglu ES, Baspinar E, Veliogu YS. (2005). Variables affecting fluoride in Turkish black tea. *Fluoride*, 38, 38-43.