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Research article

Assessment of fluoride content in ground water by spectrophotometric method

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ABSTRACT

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 climates. High concentrations of fluoride (F–) in drinking water are harmful to human health. This communication reports F– incidence in ground water and its relation with the prevalence of dental and skeletal fluorosis in Ambikapur Block, Sarguja District, and Chhattisgarh, India. In 1994 a World Health Organization (WHO) 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 Australian systematic review recommended a range from 0.6 to 1.1 mg/L Assay of fluoride concentration in ground water samples around Ambikapur district in Sarguja revealed that fluoride content in beyond the permissible limit in a some residential areas. The extent of Fluoride present in different samples was obtained by spectrophotometer. the extent of fluoride was found in village Badadamali found to be from minimum 2.0 to 3.0 mg/l. village Khirbar found to be from minimum 2.1 to 3.0 mg/l. but in village Mudesha and Nandamali found to be from minimum 2.1 to 3.50 mg/l. it is further added that extent of fluoride content in water depends on the climatic conditions and increase in summer.

Keywords: Climate, Fluorosis, range, Fluoride Permissible limit, Spectrophotometer.

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 access to safe water and over 2.5 billion lack accesses to adequate sanitation. There is a clear co-relation between access to safe water and GDP per capita. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability [1]. 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 [2]. Water is the chemical substance with chemical formula H2O one molecule of water has two hydrogen atoms covalently bonded to a single oxygen atom [3]. Water appears in nature in all three common states of matter and may take many different forms on Earth [4]. 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 [5].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 super ionic water in which the oxygen crystallizes but the hydrogen ions float around freely within the oxygen lattice [6]. 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 [7].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 [8]. In many industrialized countries swallowed toothpaste is the main source of fluoride exposure in UN fluorinated communities.

Objectives

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 borne 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 Ambikapur 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 and aware to avoid all problems which come from more fluoride.

Selected area

Ambikapur district with an area of 16034.4 Sq.kms with 54 percent of tribal population is one of the under developed districts in Chhattisgarh. About 36% of area encompasses reserved and protected forest land. The net irrigated area is 31968 hectare out of which 6077 hectare. (19 percent only) is irrigated by ground water. District is a great table land of numerous hills and plateau. The two important Physiographic features of the district are the Main pat plateau and the Jami pat plateau. The former is 28.8 km long and 12.8 km wide and rises to a maximum height of 1152.45 meters. It forms the southern boundary with Raigarh district. The Jami pat is about 3km wide. It forms the eastern boundary of Sarguja with Jharkhand State. The principal rivers of the district are Kanhar, Rihand, Morna, Mahan, Geur, Geger, Neur, and Gej. There are two distinct drainage systems in the district. One is northerly and the other is southerly.

MATERIAL AND METHOD

Samples were collected and analyzed as per procedure laid down in the standard methods for examination of water and waste water of American public Health Association (APHA) composite 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 acidified [9]. (1.0 ml HNO_3 per liter samples).Some of the parameter like pH Temperature, conductivity, dissolve oxygen T.D.S. were analyzed on site using portable water analysis kit. The other parameter was analyzed at laboratory [10].

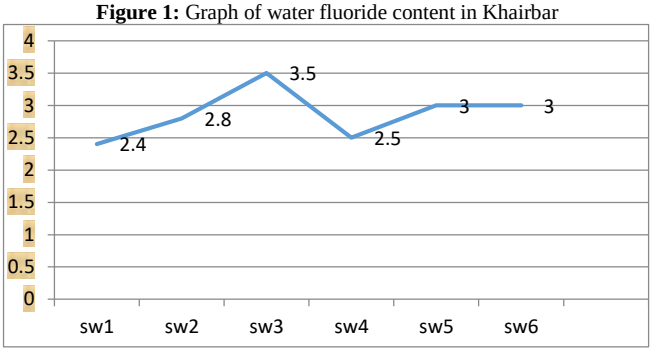
Village I- Khairbar

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 colorless, odorless and free from solid suspension. The results of absorbance have been compiled for these -1 samples in (table and figure no. 1)

Table 1: Fluoride Concentration of water samples in village Khairbar

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

Figure 1: Graph of water fluoride content in Khairbar



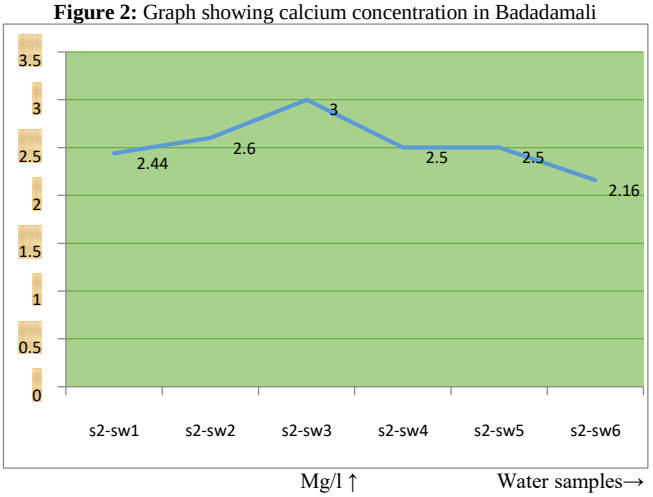
Village II- Badadamali

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 colorless . Odorless, and free from solid suspension. The results of absorbance have been compiled for these samples in (table and figure no. 2)

Table 2: Fluoride Concentration of water samples in village Badadamali

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

Figure 2: Graph showing calcium concentration in Badadamali



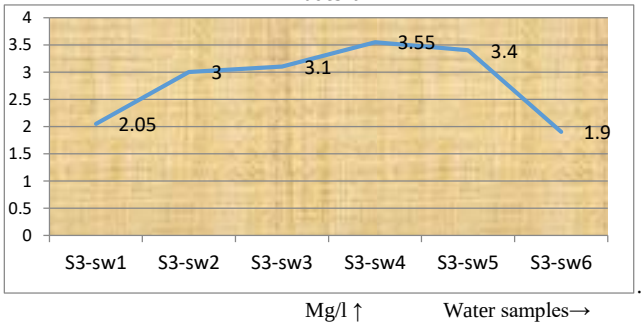
Village III- Mudesha

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$_2$, and s3-sw$_3$ while the remaining samples were collected from under-ground water / tube wells s3-sw$_4$, s3-sw$_5$, and s3-sw$_6$. All the six samples were colourless. odourless, and free from solid suspension. The results of absorbance have been compiled for these samples in (table and figure no. 3)

Table 03: Fluoride Concentration of water samples in village Mudesha

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

Figure 3: Graph showing fluoride Concentration of water samples in village Mudesha



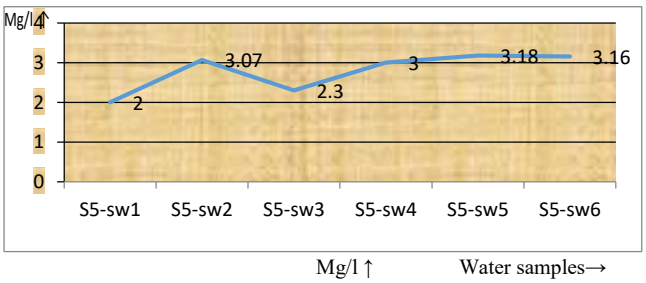
Village IV- Nandamali

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$_2$, and s5-sw$_3$ while the remaining samples were collected from under-ground water / tube wells s5-sw$_4$, s5-sw$_5$, and s5-sw$_6$. All the six samples were colourless, Odourless, and free from solid suspension. The results of absorbance have been compiled for these samples in (table and figure no. 4)

Table 04. Fluoride Concentration of water samples in village Nandamali

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

Figure 4: Graph showing fluoride Concentration of water samples in village Nandamali



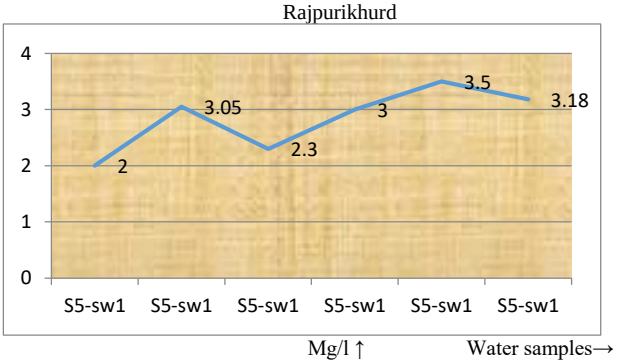
Village V- Rajpurikhurd

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 for these samples in (table and figure no. 5)

Table 5: Fluoride Concentration of water samples in village Rajpurikhurd

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

Figure 5: Graph showing Fluoride Concentration of water samples in village Rajpurikhurd



DISSCUSSION

Result of analyses of Water from Five villages of district is 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- Khairbar 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(11). All six samples fluoride found excess of their permissible limit. Water samples analyses of villages of district 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- Badadamali 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. Maximum permissible limit for fluoride as NEERI manual (1991) is 1.0 mg/l. Water from villages is 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- Mudesha 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 concentration of fluoride from villages is recorded in table. In all the

villages each have six sampling station (three were collected from the surface and three samples were collected from the tube well) of village- Rajpurikhurd 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 (12). 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 concentration of fluoride from villages is 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 BIS (1991) is 1.0 mg/l and maximum permissible limit for fluoride as world Health organization (WHO) is 1.5 mg/l [11, 12].

CONCLUSION

The present study has been made to evaluate the Fluoride concentration of water samples collected from the villages of Ambikapur Dist, Chhattisgarh. Each village has made six sampling station .These samples were analyzed 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 (1984) 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.

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