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Fluoride Status of Sudha Dam Water Near Bhoker Maharashtra, India

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Fluoride Status of Sudha Dam Water Near Bhoker Maharashtra, India

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Abstract - Fluoride is one of the critical chemical parameter, which influences the quality of dam water. Fluoride in water was determined by SPADNS method by using a UV-visible spectrophotometer at **570 nm.** Excess intake of fluoride through drinking water causes fluorosis on human beings in many states of India, including Maharashtra. The concentration of **F** was estimated from three sampling sites named as up stream, mid stream and down stream i.e. S_1, S_2 and S_3. The entire study was carried out during January to December 2010. The observed values showed the variations during the research study were ranged between **0.25-1.2 mg/L.** The concentration of **F** was found within the permissible limit **i.e.1.5 mg/L.**

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I. Introduction

Water is essential natural resource for sustaining life and environment which we have always thought to be available in abundance and free gift of nature. However, chemical composition of surface or subsurface, geothermal or non - thermal, is one of the prime factors on which the suitability of the water for domestic, industrial or agriculture purpose depends.

The quality of surface water and its vulnerability to pollution is a highly topical issue. Pollution can potentially occur as a result of precipitation, lithological alteration and soil erosion, but other causes may include anthropogenic sources connected to urban development, industry and agriculture (Simeonov et al. 2003 and Singh et al. 2005).

Fluoride is one of the chemical elements necessary for human life. Fluoride exists naturally in water sources and is derived from fluorine, the thirteenth most common element in the Earth's crust. Fluorine is the most electro negative of all elements and is physiologically more active than any other ion. Fluorine in drinking water is totally in an ionic form and hence it rapidly and passively passes through the intestinal mucosa and interferes with metabolic activities of the living system.

Fluorine is particularly available in rocks, soils, water and biological chains in living organisms. It has higher electro negativity and reactivity. Fluoride occurs naturally in water due to weathering of rocks that contain fluoride rich minerals such as hornblende, biotite, apatite and fluorite (Breiter et. al, 2006 and Zhu, 2007). Fluoride can also leach into water from anthropogenic sources such as phosphate fertilizers and electronic waste materials (Arnesen, 1998).

Abundance of fluoride in water depends on several factors. Fluoride is readily available in water with lower **Ca** and higher **Na**. Anthropogenic inputs such as fertilization and farming activities can elevate the concentrations of fluoride in water (Totsche et.al 2004 and Gilpin, 1998). On the other hand, as a major component in acidic soils, iron hydroxides serve as an important sink for fluoride in soil resulting into the enhancement of fluoride concentration in water under acidic conditions (Zhu et.al 2006). Fluorine is not highly redox sensitive and therefore it occurs naturally as fluoride in a wide range of **pH** and under positive oxidation reduction potential **(ORP).** However it can be available as **HF** under strongly acidic conditions (Takeno, 2005).

II. Study Area

The Sudha Dam is construed on the Sita river at Ranapur, 4 km from the Bhoker. Bhoker is the hilly area and Tehsil place in Nanded district of Maharashtra. The dam is situated $19^0 15'$ latitude and $73^0 43'$ longitude. The catchment area of the dam is **106 sq.kms**. The area covered by this project is about **175.385** hectares. This project is highly benefited by several villages along with Bhoker town.

The two maps showed the undertaken work is to Fig.1a show the location of sampling show in Nanded city which is located in Maharashtra and second one is Fig. 1b map show the location of sampling station show in Bhoker Taluka of Nanded district And also showing in the water sampling station S_1, S_2 and S_3.

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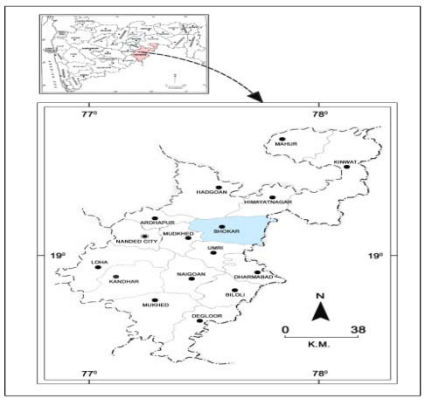
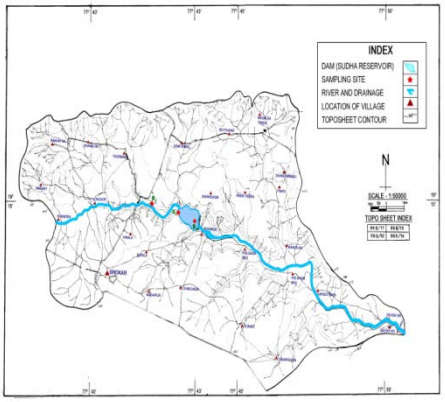


Map 1a : Location of Water Sampling Sites of Sudha dam.



Map 1b : Location of Water Sampling Station of Sudha dam.

The Sudha dam water is basically used for the purpose as drinking, domestic, irrigation and agriculture application and very rarely for small scale industries, factories etc. The water supplies to entire Bhoker city and near by several villages. More than 75,000 people get benefited from this dam.

III. Material and Methods

a) Water sample

The water samples were collected from Sudha dam, the sampling and the study was undertaken during January to December 2010. Water samples were placed in stoppered polythene containers, which were previously rinsed with portion of distilled water and water samples. The water samples were filtered immediately using filter paper properly labeled and maintained well. The chemical analysis was carried out by using the standard methods on spectrophotometer.

b) Experimental

All solutions were prepared with deionized water. Stock solution of the fluoride containing 1000 mg F- was used for preparation of the standards for the calibration curve. Fluoride concentration was determined by spectrophotometrically using SPANDS method. The procedure depends upon the principle that, under acidic condition fluoride reacts with zirconium reagent SPANDS solution and 'lake' (colour of SPAND reagent) gets bleached due to formation of ZrF_6. Since. Bleaching is a function of fluoride ions it is directly proportional to the concentration of fluoride. Zero absorbance was measured spectrophotometrically at 570 nm. Sudha dam water fluoride concentrations were calculated with the help of standard fluoride calibration curve. The temperature and pH was measured by using mercury micro thermometer and pH paper was on the water sampling sites. Further pH was measured by pH meter was calibrated for 4.0 and 9.2 buffer solution. (APHA 1992).

VI. Result and Discussion

The pH can be affected by chemicals in the water. It is an important indicator of water that is changing chemically (Ahipathy and Puttaiah, 2006). The variation in pH was from 7.2 to 7.6 at S_1, S_2 and S_3 during the sampling period. The temperatures were ranged from 20^0C -26^0C at S_1, S_2 and 21^0C - 26^0C at S_3. All values of pH and temperature were within the permissible limit.

Table1: Variation of Fluoride (mg/L) content of Sudha Dam water during January to December 2010.

Months	pH			Temperature			Fluoride		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
January	7.5	7.4	7.5	23	23	22	0.44	1.1	0.82
February	7.2	7.3	7.3	22	22	21	0.49	0.565	0.64
March	7.5	7.4	7.5	24	24	23	0.57	0.835	1.07

April	7.4	7.3	7.3	26	26	26	0.73	0.39	0.56
May	7.3	7.2	7.2	24	25	24	1.2	0.93	1.05
June	7.4	7.3	7.3	26	26	26	0.59	0.65	0.71
July	7.4	7.3	7.3	23	24	23	0.25	0.28	0.31
August	7.5	7.5	7.4	26	25	25	0.47	0.5	0.53
September	7.6	7.6	7.6	24	25	24	0.51	0.69	0.87
October	7.4	7.5	7.4	23	22	22	0.85	0.98	1.11
November	7.3	7.5	7.3	21	22	21	0.55	0.635	0.72
December	7.5	7.5	7.5	20	20	22	0.69	0.77	0.85

S_1, S_2, S_3 : Sampling sites of sudha dam water.

Fluoride analyses of the water during the study period are presented in Table 1. The concentration of fluoride was within the permissible limit. It ranged between 0.25- 1.2 mg/L at S_1, 0.28- 1.1 mg/L at S_2 and 0.31- 1.11 mg/L at S_3. The highest fluoride concentrations observed in the month of January, May and October were 1.1, 1.2, and 1.11 mg/L and the lowest concentration in the month of July 0.25 mg/L at S_1, 0.28 mg/L at S_2 and 0.31 mg/L at S_3.

Gautam et al (2011) found fluoride concentration between 0.6 to 0.9 mg/L and 0.07 to 0.9 mg/L from Kagina river of Gulburga district in post and pre-monsoon seasons respectively. Also they observed fluoride ranged from 0.3 to 0.6 mg/L and 0.1 to 0.9 mg/L from Krishna river of Bagalkot district, Karnataka in post and pre-monsoon seasons respectively.

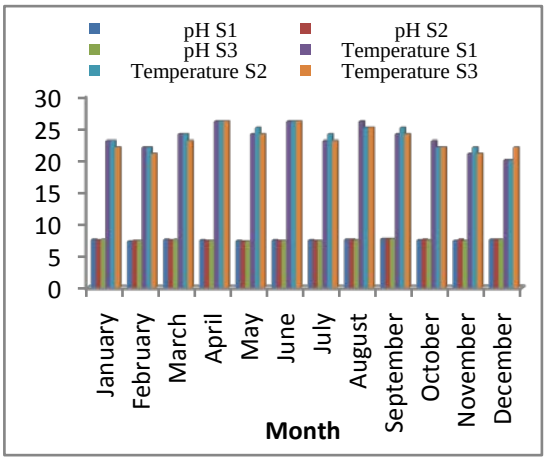


Fig. 2a : Values of pH & temperature level observed during Jan. to Dec. 2010.

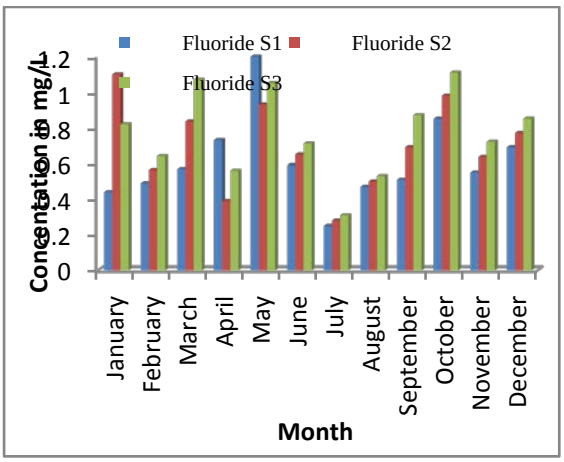


Fig. 2b : Values of Fluoride level observed during Jan. to Dec. 2010.

Rao et al (2001) obtained fluoride content ranged from 0.102 to 0.894 mg/L, 0.254 to 0.83 mg/L and 0.115 to 1.61 mg/L from western, eastern zones and BED village drinking respectively water ponds of Kolleru lake region during the period of three years. (Rao et al, 2001).

Akoto and Adiyiah (2007) Fluoride varied from 0.32 to 1.03 mg/L. Minimum (0.32 mg/L) and maximum (1.03 mg/L) concentration of F- was observed from Pruso and Fiaso villages respectively

AKM Fazlul Hoque et al (2003) studied Fluoride concentrations in 304 water samples from different sources ranges from 0.02 mg/L to 2.32 mg/L with a mean of 0.43 ± 0.40 mg/L.

Gikunju et. al (2002) observed fluoride levels in the river water samples showed only small zonal

variations. The highest level was 0.85 ppm in Laikipia District and the lowest was 0.08 ppm in Murang'a District.

V. Conclusion

This study provides an overview of the fluoride content in dam water and show that is within the permissible limit of fluoride. The favorable factor which contributes to rise of fluoride in Sudha dam water is presence of fluoride rich rock system. The result of current study as well as other available data from water quality should be taken in to account when developing strategies for safe drinking water supplies.

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