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Evaluation and Systematic Studies on Fluoride Level from Freshwater Reservoir near Bhokar

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ABSTRACT

Surface water is most broadly distributed and essential natural water resources all over the world. In India, most of the population uses surface water as a primary source of drinking water[1]. The surface water is getting polluted due to rapid urbanization, solid waste, industrial effluents and sewage in urban areas.

Hazardous waste, increasing mining, petroleum operations, agricultural development activities, particularly application of pesticides, fertilizers is actively playing the role in excess waste addition. Unsanitary conditions are also contributing to the surface water pollution, has considered fluoride as one of the very few chemicals that have been shown to cause significant effects in the people[2].

There is a narrow margin between the desired and harmful doses of fluoride. Therefore, the efforts were made to study the concentration of fluoride in surface water of Dhanora reservoir near Bhokar. The present study was carried out for about two years, from four different sampling sites. The water samples collected once in month during June 2016 to May 2018. These samples were analyzed in the laboratory using SPADNS method on UV spectrophotometer. Most of fluoride results observed and four within permissible limit, the final values are expressed in mg/L.

KEYWORDS: Dhanora reservoir, Fluoride evaluation, SPADNS, Spectrophotometer

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INTRODUCTION

Fluoride is a common constituent of surface water. It is the most electronegative of all chemical elements and is never encountered in nature in the elemental form. Freshwater occurs as on surface, ground water, contributing only 0.6 % of total water resources on the earth. Fluoride is ion of the chemical element fluorine which belongs to the halogen group of minerals and is natural constituents of the environment[3]. It is found in the form of chemical compound such as sodium fluoride as well as hydrogen fluoride, which is present in minerals like fluorspar, fluorapatite, topaz and cryolite etc. High concentration of fluoride is caused by excess alkalinity and low calcium content.

Fluoride occurs on earth in several mineral, particularly fluorite, but is only present in trace quantities in water. Fluoride contributes a distinctive bitter taste. It contributes no colour to fluoride salts. Rivers and lakes generally contain fluoride level less than 0.5 mg/L, but ground water, particularly in volcanic or mountainous areas, can contain as much as 50 mg/L. Low concentration of fluoride in drinking water have been considered beneficial to prevent dental carries, but excessive exposure to fluoride can give rise to a number of adverse effects such as causing fluorosis[4].

In most drinking water, over 95% of total fluoride is the F^- ion, with the magnesium-fluoride complex (MgF^+) being the next most common[5]. Because fluoride levels in water are usually controlled by the solubility of fluorite (CaF_2), high natural fluoride levels are associated with calcium-deficient, alkaline and soft water.

Fluoride may also be introduced to environment due to burning of coal and during manufacturing process of aluminum, steel, bricks. Accumulation of fluoride in the soils eventually results in leaching by percolation into surface water aquifer and thereby increases the concentration of fluoride[6].

STUDY AREA

Bhokar and its surrounding area is somehow represents little more amount of fluoride as per the earlier studies. Also few peoples got detected excess level of fluoride. The reservoir selected for the present research which is situated at Dhanora village of Bhokar tehsil, Nanded Maharashtra. The location of the reservoir is at 19°14'33"N latitude 77°37'25"E longitude.

It is eastern most district of Marathwada region of the Maharashtra. It lies in the Godavari basin. It is situated between 18^0 16' to 19^0 55' N latitude and 76^0 56' to 78^0 19' E longitude. Nanded district covers an area of 10528 km^2 and has a population more than thirty lakhs. The construction of Dhanora water reservoir is completed in 1968, It is a minor and purely for drinking and irrigation

purpose. This project is constructed for the benefit of agriculture and fisheries; dam is constructed on Suddha river sub-basin near Bhokar.

Present investigation for the fluoride content in surface water, we have selected Dhanora reservoir Tq. Bhokar of Nanded district. Our purpose is to collect the fluoride level in and around of Sudha river also to this surroundings. Four different sites were selected for fluoride sources study and about 24 times water samples collected and brought in the laboratory for analysis i.e. June 2016 to May 2018. Water samples were collected in pre-cleaned polythene containers only. The fluoride is calculated by SPADNS method and results expressed.

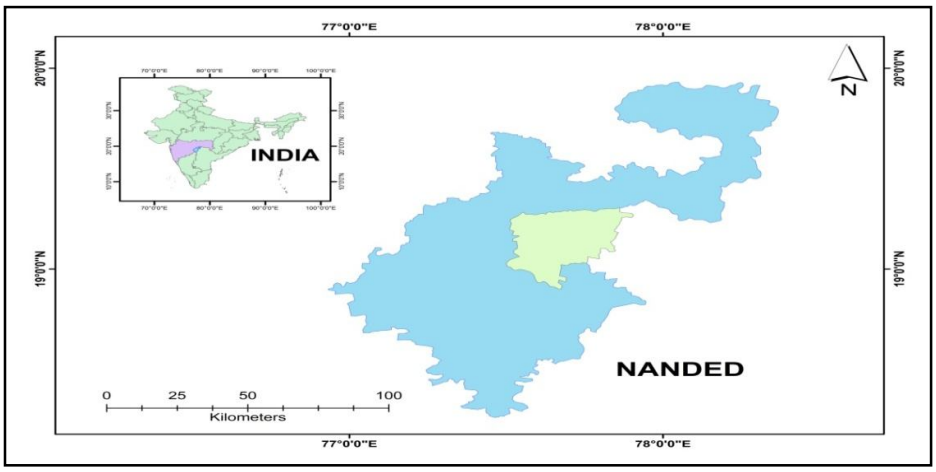


Fig 1: Location of Maharashtra state in India and Nanded.

Fig 2: Google earth image of Dhanora water reservoir.

MATERIAL AND METHODS

Fluoride is measured by colorimetric or specific ion meter. The SPADNS colorimetric method is based on the reaction between Fluoride and a Zirconium-dye lake, where acidity of

reaction mixture influences the rate of reaction[7]. As the amount of fluoride increases, the colour produced becomes progressively lighter[8].

The water sampling sites located and these samples were collected from four different sampling sites of Dhanora reservoir i.e. Site 1 (S_1) as the river water enters in the dam, Site 2 (S_2) mid part of dam, Site 3 (S_3) periphery of dam, Site 4 (S_4) main reservoir respectively sampling location made as they represent the indicator of its water also the totality of its water chemistry especially nutrient contents.

Nearly 100ml of water sample placed in the flask, if the sample contains residual chlorine remove it by adding one drop of arsenate or sodium thio-sulphate. Preparation of known concentration of fluoride was taken, in the range of 0-2 mg by appropriate dilution of with using standard fluoride solution. With addition of 5ml of SPADNS solution in each sample, zirconyl acid solution and waited. Applied distilled water for the preparation for blank. All the samples absorbance experimented on UV spectrophotometer (Shimadzu 1800) at 570nm with blank. Standard curve plotted between concentration and absorbance. Calculated the fluoride values from all the samples and the results are noted as mg/L.

$$Fluoride\ (mg/L) = \frac{\text{mg of fluoride} \times 1000}{\text{ml of sample}}$$

RESULTS AND DISCUSSION

Necessitates an accurate, simple, rapid and cost effective analytical method is of high importance. Spectrophotometric method, which is widely used in determination of fluoride is based on the reaction of fluoride with coloured metal chelate complexes, producing either a mixed-legend ternary complex or replacement of the legend by fluoride to give a colorless metal-fluoride complex and the free legend with a colour, different of the metal-legend complex[9]. The details of all the values noted are well indicated in the Table: 1.

Studies on the ground water quality status with respect to fluoride contamination in Vinukonda mandal, Guntur district (Andhra Pradesh) and defluoridation with activated carbon[10]. The study reveals that reason for decreasing quality of water in this region may be due to over consumption for drinking, domestic and agricultural purposes. Hence, rapid and reliable monitoring measures are essential for keeping a close watch on water quality and health environment.

The fluoride level of Sudha dam water for fluoride level at Bhokar of Maharashtra. They studied during, January to December 2010 (entire year) and were observed the amount of fluoride as 0.25 to 1.2 mg/L which is within the permissible limit[11].

Analysed water samples collected from Unkeshwar spring, Sahastrakund of Maharashrashtra during year 2013, they found the mean fluoride level from water sample is around 0.89 mg/L[12].

Studies on the fluoride contamination in drinking water from rural habitations of northern Rajasthan. This study reveals that the fluoridise has been appeared as an alarming problem in this region[13].

Monitored fluoride values of Siddheshwar dam at Hingoli during July 2009 to June 2011. They found the fluoride range varied from 0.081 mg/L to 2.4 mg/L which is above the permissible limit[14].

Water quality Studied from the ground water of Sanganer area of Jaipur district Rajasthan. This study showed that the 75% of the villagers are suffering from dental fluorosis and skeletal fluorosis[15].

Investigation for the concentration of fluoride from Godavari river at Nanded during January 1999 to December 1999. They observed the concentration of fluoride which was ranged as minimum 0.82 mg/ L to maximum 1.69 mg/L[16].

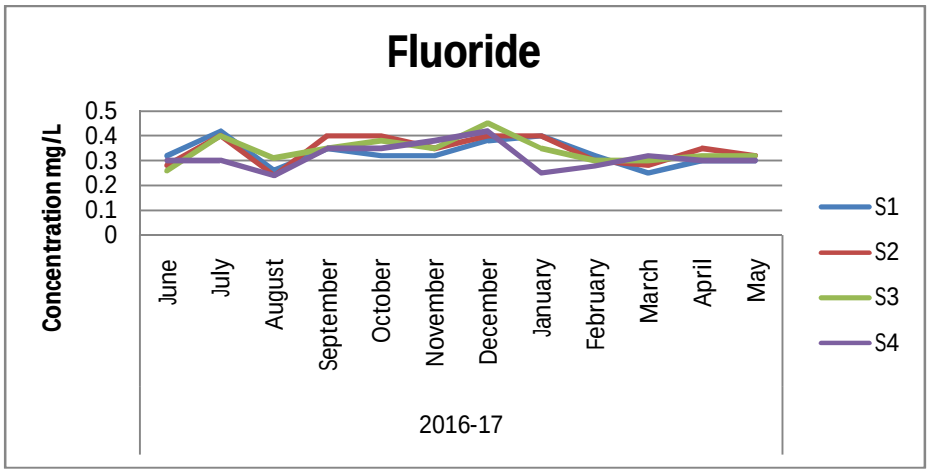
The surface water samples from the study area with four sampling sites were undertaken for the fluoride estimation. Water samples were filtered and analyzed for the content of fluoride. All water samples were colorless and odorless at the time of collection. The temperature was varied from 21 to 27.5^{o}C. The fluoride content of four sampling sites in the month of June, 2016 to May, 2018 is shown in Table: 1, the temperature and pH parameters were took as a supportive factor for various activities in water reservoirs and also physico-chemical parameters.

Table No 1: The monthly mean values of Fluoride content (mg/L) from Dhanora reservoir during June, 2016 to May, 2018.

Month	Site	Temperature (^{0}C)		pH		Fluoride (mg/L)	
		2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
June	S1	27.5	26.0	7.35	7.50	0.32	0.33
	S2	27.3	25.5	7.30	7.50	0.28	0.28
	S3	27.5	26.0	7.25	7.40	0.26	0.28
	S4	27.0	26.0	7.35	7.40	0.30	0.32
July	S1	25.5	25.5	7.40	7.50	0.42	0.40
	S2	25.0	25.0	7.30	7.40	0.40	0.42
	S3	25.5	25.0	7.50	7.40	0.40	0.40
	S4	25.0	25.5	7.50	7.50	0.30	0.38
August	S1	24.0	25.0	7.40	7.50	0.26	0.28
	S2	24.0	25.0	7.30	7.60	0.24	0.22
	S3	24.5	24.5	7.30	7.65	0.31	0.30
	S4	24.0	24.5	7.20	7.65	0.24	0.26

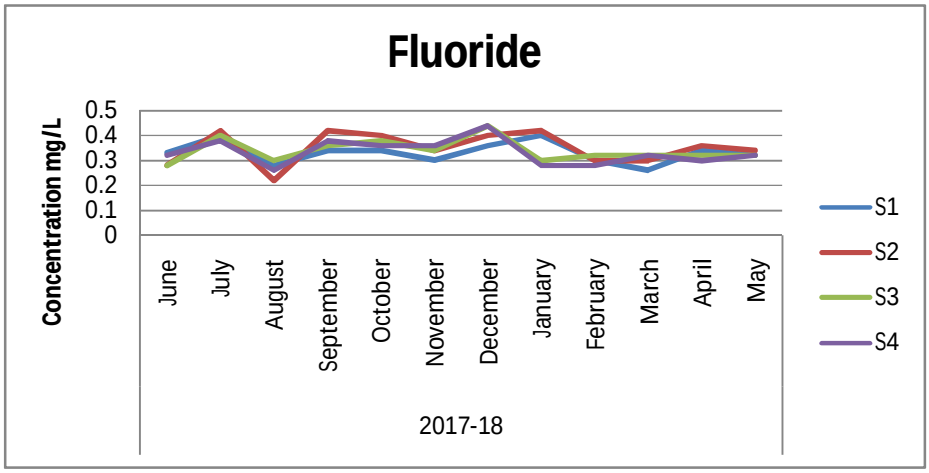
September	**S1**	24.0	24.0	7.40	7.60	0.35	0.34
	S2	23.5	24.0	7.50	7.65	0.40	0.42
	S3	23.5	23.5	7.50	7.6	0.35	0.36
	S4	24.0	23.0	7.65	7.65	0.35	0.38
October	**S1**	23.0	23.0	7.60	7.60	0.32	0.34
	S2	23.5	22.0	7.60	7.65	0.40	0.40
	S3	23.0	22.0	7.65	7.50	0.38	0.38
	S4	22.0	22.0	7.65	7.60	0.35	0.36
November	**S1**	22.0	21.0	7.60	7.50	0.32	0.30
	S2	22.5	21.5	7.65	7.50	0.35	0.34
	S3	22.5	21.0	7.65	7.40	0.35	0.34
	S4	22.0	21.0	7.65	7.60	0.38	0.36
December	**S1**	21.5	20.5	7.60	7.50	0.38	0.36
	S2	21.0	20.0	7.60	7.65	0.40	0.40
	S3	21.0	20.5	7.70	7.65	0.45	0.44
	S4	21.0	20.5	7.70	7.60	0.42	0.44
January	**S1**	22.0	20.5	7.65	7.60	0.40	0.40
	S2	22.0	20.0	7.60	7.60	0.40	0.42
	S3	22.5	20.0	7.60	7.65	0.35	0.30
	S4	22.0	20.5	7.65	7.70	0.25	0.28
February	**S1**	22.5	21.0	7.65	7.65	0.32	0.30
	S2	22.5	21.0	7.60	7.60	0.30	0.30
	S3	23.0	21.5	7.60	7.60	0.30	0.32
	S4	22.0	21.5	7.50	7.65	0.28	0.28
March	**S1**	22.0	21.0	7.60	7.65	0.25	0.26
	S2	23.5	21.0	7.65	7.65	0.28	0.30
	S3	23.5	21.0	7.60	7.60	0.30	0.32
	S4	23.0	21.5	7.65	7.60	0.32	0.32
April	**S1**	25.0	22.0	7.50	7.60	0.30	0.34
	S2	25.5	22.5	7.60	7.50	0.35	0.36
	S3	26.0	23.0	7.60	7.50	0.32	0.32
	S4	27.0	23.0	7.50	7.60	0.30	0.30
May	**S1**	23.5	25.0	7.60	7.60	0.30	0.32
	S2	27.0	25.5	7.50	7.65	0.32	0.34
	S3	26.5	26.5	7.50	7.70	0.32	0.32
	S4	26.5	26.5	7.65	7.60	0.30	0.32

Fig 3: The Fluoride mean values of Dhanora reservoir during June, 2016 to May, 2017.



From the figure 3 and 4, it is clear that the fluoride content of sample site S_2 is low as 0.22mg/L, highest at S_3 as 0.45mg/L compared to other sampling sites, following all the observed values are shown in Table: 1. Water samples analyzed pertains to be within the permissible level. The mean value of the fluoride observed during entire two years of study represents 0.33mg/L.

Fig 4: The Fluoride mean values of Dhanora reservoir during June, 2017 to May, 2018.



CONCLUSION

As a matter of water quality management especially for potable also for other purpose uses has significantly plays the role in every one's life. The undertaken study is useful in regard of fluoride supplementation through food chain and water also knowing its above limit for taking precautions will be highly fruitful.

Our aim is correlate this work for ecological and finding out the pollution status of the reservoir. With the overall findings and the values observed this has been found to be in the

permissible limit. Hence this study will be useful for this arena for the baseline data and other multiple uses for further planning.

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