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Short Communication

Study of effect of immersion activities on the fluoride content in water of the water bodies

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Abstract

The amounts of fluoride anion in the Varaala lake water were estimated by complexometry colour bleaching reaction. The sample taken from 3 dissimilar places of lake during entire activities of Idol immersion. Comparative study about the concentration of F^- with the standard value is done. There is increase in the concentration of fluoride during and after idol immersion activity, but before immersion activity the concentration of fluoride is less than the standard value prescribed by BIS and WHO at some site.

Keywords: Fluoride, Spectrometer, Colour bleaching reaction.

Introduction

As we all know that for the survival of different kinds of lives on this planet, the very basic and the first thing which we require is water without which there will be no existence of life. Therefore it become very essential to have a check on the characteristics of water at a regular time interval because if any contaminants are there in the water then it can be easily traced at early stage and necessary action may be taken to find, analyse and try to reduce the toxic effect of harmful substance found in the water reservoir. In order to prevent from various spreadable, death causing dangerous diseases, the good quality of drinking water should be maintained. The source which leads to contagion and sedimentation in under study lake water is the Ganesh Chaturti immersion of Idol activities as this lake provides drinking water to the local peoples. Surface water and ground water get contaminated due to disposal of sewage waste, leaching of soil, mining process and weathering of rocks along with the different festival activities[1].

As a part of religious activities dumping of organic wastes and Immersion of painted idols causes deterioration of quality of water and add excess load to water system[2]. Peoples used different material like thermocol, artificial colours in the form of paints, soil, clay, gum, bonding agent, wood, paper, cloth, POP to make the Idols. This all materials along with the Idols enters in the water which leads to change in the balanced reaction, process of water body and entire water system get disturbed from proper functioning of habitual activities for survival and growth of aquatic fauna and flora[3,4]. Water sample from the lake utilized to find the level of fluoride anions as it is required to manage and protects ground and surface water qualities[5].

Pollutants are very rapidly accumulated in the lake water due to lack of substantial cleaning process and also because of fragile and complicated ecosystem[6]. The original qualities of water get affected because of release of various non required, non essential substance in the water due to this activities. Concentration of fluoride ion has not yet been determined in this water of lake so far as indicated by the survey of the literature, therefore it is necessary to find this ion in order to acquire knowledge about how much of fluoride ion is present in the water and up to what extent it creates a harmful effect on living bodies. Thus concentration of fluoride were analysed and comparative study is done with the WHO, BIS and USPH[7].

Significant contribution to the society from this research work is that excess fluoride level develops hazardous and harmful effects on the health of human being. There are different sources of this ion in water like mineral dissolution from earth which also leads to increase in fluoride level in the ground water that provides drinking water. High level of fluoride from the water gets accumulated in the tissues of the bones in the adult (age group of up to 55 year). Metabolism process such as lipids, carbohydrates, enzymes, vitamins synthesis are affected by elevated level of fluoride[8]. Many ions found in water like beryllium, tantalum, tin, scandium, iron, niobium, aluminium can be dissolved by the fluoride ions which makes the water bad and contaminated. Drinking water which is fluoridated is discharged in to the nearby water body leads to increase in the concentration of fluoride ion in water. Large numbers of industries like glass, herbicides, plating, brazing, adhesives, ceramics, steel, brick, aluminium, insecticides, metal fluxes, smelting, welding, electronics have an application of fluoride, also discharging wastewater in water body[7]. Water released from stainless steel, phosphate fertilizer plants and aluminium industries surround 8.0 to 70.0ppm of fluoride[9].

Thirteenth most abundant Fluorine element constituting 0.08 percentage of Earth crust, has maximum electronegativity. Occurrence of fluoride in soils, air, water and rocks are due to its release from pesticides, aerosol propellants, ceramics, manufacture of refrigerants, Teflon cookware, glassware, byproduct of aluminium, iron ore manufacture and fertilizer. For the prevention of dental caries, the medicinal use of fluorides began in January 1945 when the public water supplies in Grand Rapids, US, were fluoridated (1mg/lit) as a dental caries prevention measure[10]. Consumption of Fluoride occurs in small amounts in human body though it is found naturally in the environment. Exposure can occur through fluoride supplements, respiration and dietary intake. But fluoridated drinking water is the mainly significant factor for exposure to human being than other sources[11].

The safety and quality of drinking water, is carefully concerned as an integral need of human continued existence. Quality of safe drinking water is governed by chemical composition of water not being decomposed by any other elements. This composition is found to be dependent on geogenic and anthropogenic sources. There are different ways by which water is getting polluted by contamination due to fluoride is acquiring much attention in todays era for both developed and underdeveloped countries. For prevention of dental carries and fluorosis, fluoride is mixed with drinking water in developed countries[12].

As the hardness of water reservoirs increases, the concentration of fluoride ions in the water will become less available for aquatic flora and fauna and its level will be safe for the aquatic living organisms. There are different kinds of algae growing in water bodies which are required for the process of photosynthesis, get affected by excessive concentration of fluoride in water and this effect depends on the concentration of fluoride ion, its extent of exposure to algal species and species of algae itself. Accumulation of fluoride generally takes place in the skeleton system of the invertebrate and in cells and tissues of bones of the hydra animal. Metabolic process like protein synthesis, glycolysis and many enzymatic processes are inhibited and stopped by high concentration of fluoride because it acts as a poison for enzymatic action. As the level of chloride and calcium increases, intraspecific size of body increases, the toxicity of fluoride to fishes and invertebrate decreases at elevated temperature in the water.

Marine and estuarine aquatic animals are found to be less effective with respect to fluoride concentration as compared to fishes and invertebrate such as adults of Salmon which migrates upward in the water stream and larvae of caddis fly (net-spinning). Fresh water living organisms can be saved from fluoride toxicity, if its level is made below 0.5ppm fluoride ion per liter because if the concentration of fluoride goes below 0.5ppm then also it affects the aquatic organism basically in soft water. Therefore it is recommended to maintain the fluoride level as low as 0.5ppm or lower than that[13,14].

Now a days socially deprived family having tooth decay problems believe that artificially or naturally fluoridated drinking water is cost effective, simple and safe health measurement of public to stop dental problem. But too high concentration of fluoride in drinking water causes anesthetically fluorosis[9].

Materials and methods

Lake Varal Devi is situated in Bhiwandi and is one of the largest lake of city. Many visits were done to lake for collection of water sample. Sampling is done from various locations on the lake such as Ganpati Vicersion point Phulegaon, Ganpati Vicersion Ghat Chandan Baug (Kamat Ghar Gaon, Near Peace Park) and Lake View Restaurant. The sampling done from all this sites during morning hours. Period of sampling are before, during and post idol immersion activities and is carried out before many week of immersion, and after many weeks of immersion also for fluoride analysis[15,7]. Standard method and procedures are adopted for preservation of samples after sampling for the safe and accurate estimation. AR quality chemicals and double distilled water were used for estimation of fluoride[16].

UV-Visible spectrophotometry is applied for fluoride estimation as follows. Zirconyl Nitrate is added to a solution of Alizarin Red S (1,2 Dihydroxyl Anthraquinone) at acidic pH. This result in the formation of a reddish violet colour solution. This reddish violet colour complex reacts with fluoride ion, and gets bleached due to the formation of colourless fluorizirconate ZrF_6^{2-} anion. Therefore as the fluoride concentration increases intensity of colour reduces. This reaction of colour bleaching results in the series of colour from pink to yellowish green. This effect is more prominent in acidic solution. Standard solutions of fluoride were prepared with a series of different concentration of fluoride ion in ppm, complex formation and colour reduction is studied after addition of Alizarin Red S and Zirconyl Nitrate.

Results and discussion

Study of present work indicates that from first Ganpati Vicersion point, Lake View Restaurant (Site S1), amount of fluoride before immersion was 1.36ppm with a standard deviation of 0.01562 and variance of 2.4398×10^{-4}, which is smaller than WHO (1.5ppm) and BIS (1.5ppm) values, 2.4ppm during immersion with standard deviation of 0.1549 and variance of 0.0239 (2.96ppm) after immersion with standard deviation and variance of 0.1004 and 0.010. During and after activities the concentrations of fluoride are higher than standard values. Site S1 is not as such contaminated with respect to fluoride concentration before immersion. Pre(1.36ppm)< During (2.4ppm)<Post(2.96ppm). Pre(1.36ppm)<WHO(1.5ppm) and BIS(1.5ppm). During (2.4ppm), Post(2.96ppm)> WHO(1.5ppm) and BIS(1.5ppm).

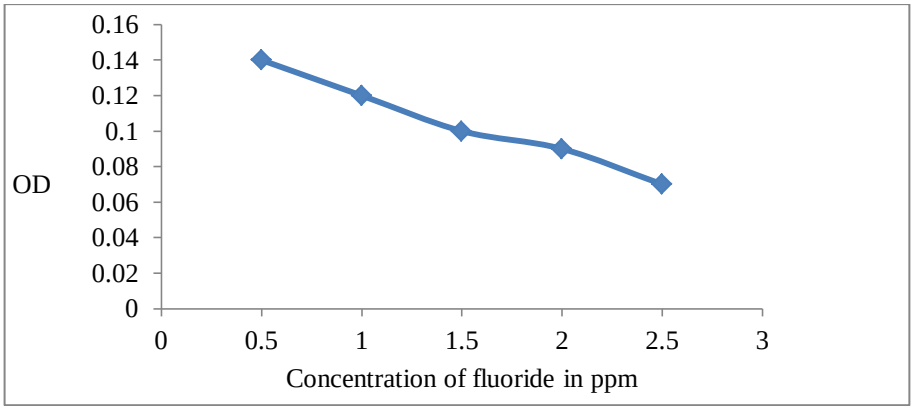

Figure-1: Graph of Optical Density Vs Concentration of Fluoride ion in ppm.

Table-1: Determination of Fluoride[17].

F^- Conc.(ppm)	Alizarin red S(cm^3)	Zirconyl itrate($cm^{3)}$
Blank	5.0	5.0
0.5	5.0	5.0
1.0	5.0	5.0
1.5	5.0	5.0
2.0	5.0	5.0
2.5	5.0	5.0

Table-2: Comparative Study of Amount of Fluoride.

Periods	Amount of Fluoride in µg/ml			WHO[18] µg/ml	BIS[19] µg/ml	USPH[20] µg/ml
	S1	S2	S3			
Before Immersion	1.36±0.01562 V=2.4398×10^{-4}	1.56±0.3645 V=0.1328	2.13±0.1528 V=0.0233	1.5	1.5	0.7
During Immersion	2.4±0.1549 V=0.0239	2.4±0.1549 V=0.0239	2.3±0.2008 V=0.0403			
Post Immersion	2.96±0.1004 V=0.010	2.63±1.5147 V=2.294	2.7±0.1732 V=0.0299			

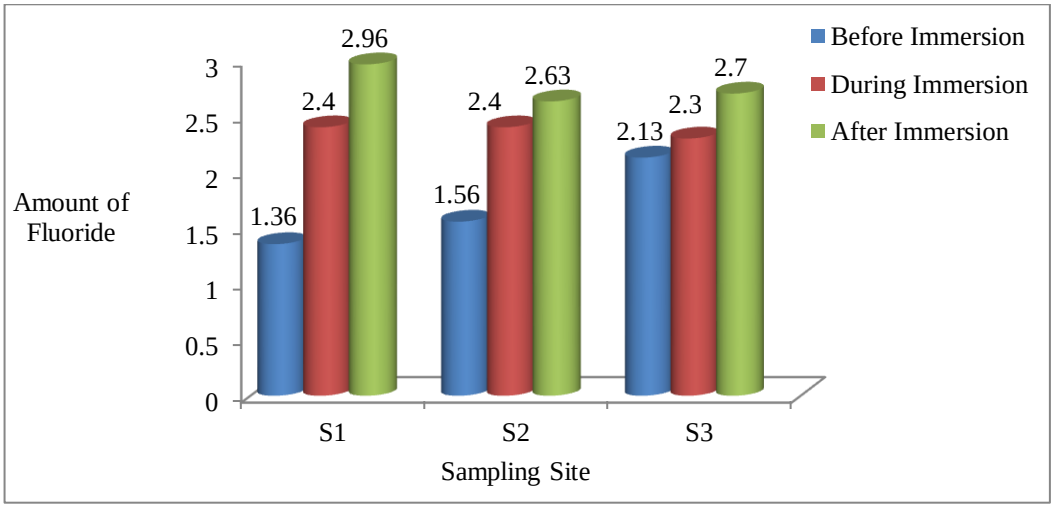

Figure-2: Graph of Amount of Fluoride (ppm) in Lake Water Vs Festival Periods.

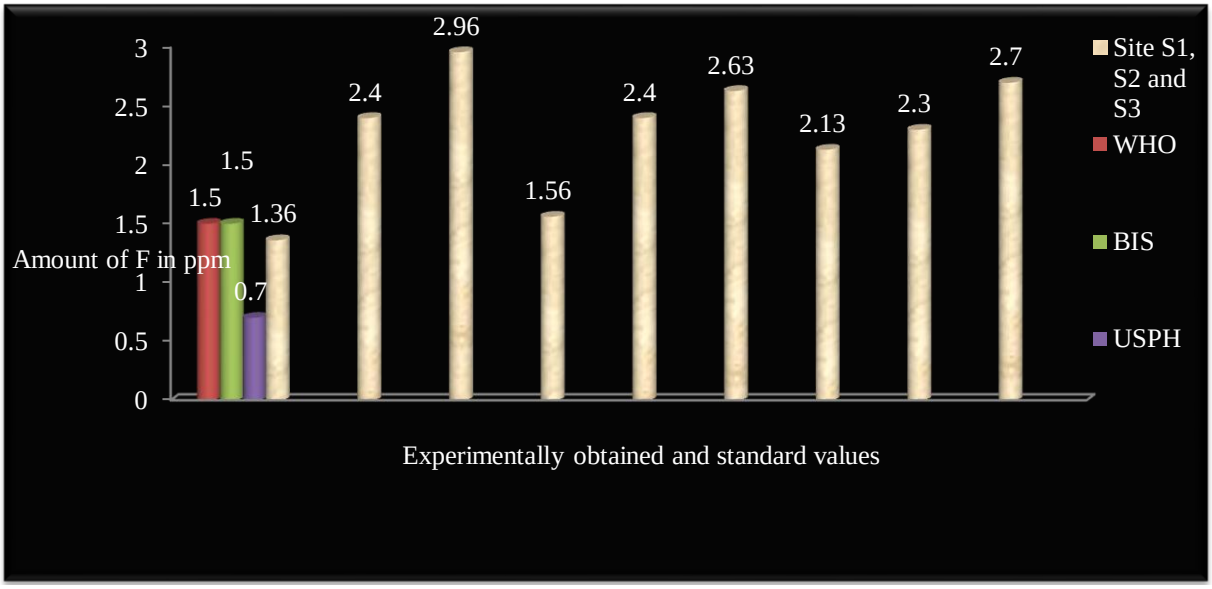

Figure-3: Comparative study of amount of fluoride (ppm) with standard values.

From second Ganpati Vicersion Ghat, Chandan Baug, Kamat Ghar Gaon, Near Peace Park (Site S2) amount of fluoride before immersion was 1.56ppm with standard deviation of 0.3645 and variance of 0.1328 which is little higher than WHO and BIS (1.5ppm), 2.4 ppm during immersion with standard deviation of 0.1549 and variance of 0.0239, 2.63 ppm after immersion with standard deviation (1.5147) and variance (2.294). Before, during and after activities the concentrations are higher than standard values. Site S2 contaminated to very less extent before immersion but during and after, level of fluoride get increases to that of WHO and BIS.

Pre (1.56ppm) < During (2.4ppm) < Post (2.63 ppm)
Pre (1.56ppm), During (2.4ppm), Post (2.63 ppm) > WHO (1.5ppm) and BIS (1.5ppm).

From third Ganpati Vicersion point, Phulegaon, Phenapada, (Site S3) fluoride concentration before immersion was 2.13ppm with standard deviation of 0.1528 and variance of 0.0233 which is comparatively smaller than the values obtained during and after immersion but higher than the WHO and BIS values as compared to site S1. Fluoride concentration of 2.3ppm with standard deviation (0.2008) and variance (0.0403) obtained during immersion. (2.7ppm) fluoride ion with standard deviation and variance of 0.1732, 0.0299 obtained post immersion activity. Site S3 shows the level of fluoride ions are higher with respect to all three periods of activities than Standard body.

Pre 2.13 ppm < During 2.3 ppm < Post 2.7ppm
Pre 2.13 ppm, During 2.3 ppm , Post 2.7ppm > WHO (1.5ppm) and BIS (1.5ppm).

The Fluoride concentration increased from 1.36µg/ml to 2.96µg/ml due to idol immersion activity.

According to USPH standard, the water is not safe with respect to fluoride concentration due to immersion activities as the amount of fluoride in water samples from all stations at three different periods of immersion activities, are more than the values prescribed by USPH standard. (Range of fluoride concentration) 1.36ppm to 2.96ppm > 0.7ppm (USPH standard)

Leaching and dissolution of fluorine in ground water due to circulation and weathering of water in soils and rocks are the feasible cause of elevated fluoride concentration in Indian water. Fluorosis diseases in humans are caused due to the high concentration of fluoride in water as this water is used for drinking purposes. In this research work the amount of fluoride were higher than the standard value prescribed by USPH[21].

Conclusion

Various aquatic animals depend on wetland for their survival and growth, as this lake is considered one of the significant wetland. Amount of fluoride is determined in the lake water of Bhiwandi during, before and post dipping of Idols activities. This anion is determined in lake water that will help us in understanding the risk of using this water for potable purposes. Ecosystem diversity get disturbed and destructed due to excess level of fluoride in the water which leads to various diseases in the human being, if that water reservoir provides the potable water. It also causes harmful effects on aquatic plants and animals[3,22].

In the present study concentration of fluoride get increased due to Idol immersion activity. The water has harm with respect to amount of fluoride on human health. We will also try to motivate people as far as possible to avoid using the lake as immersion site as it provides drinking water and source of food for the local population.

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