Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

Available online at www.jcbsc.org

Section A: Chemical Sciences

Research Article

De-escalation of Concentration of Fluorides by Clayware with Alum Salts in Potable Water

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Received: 30th December 2011; Revised: 08 January 2012; Accepted: 10 January 2012

ABSTRACT

For de-escalation of fluorides in the potable water, we have enumerable de fluoride techniques of which flocculation, Coagulation, Electro Coagulation, Adsorption, Absorption, have been taken a vital path. This research where it has been successfully adopted by the researchers took place at highlands around 3000 ft from the sea level in Ethiopia Country. We identified various concentrations of fluoride in the ground water around Aksum town of Ethiopia. Aluminum Ammonium Sulphate clayware is the one of the vital methods in the community at economical sustainability for de-escalation of the fluorides in the potable waters. The villages which are surrounded by the Aksum city of Ethiopia have been identified as fluoride contaminated areas and the people of these places (woredas) have been excruciating for the last 25-30 years vigorously with the Fluorosis. Here we concentrate predominantly Longmuir studies to carry this Proposal.

Keywords: Fluorosis, Defluoridation agent, Clayware, Adsorption and Aksum-Ethiopia.

INTRODUCTION

The fluorine is one of the most hazardous halogen elements which cause chronic disease through Fluorosis in the human metabolism. Nearly 25-30 countries have been bearing this Fluorosis for the last 35years drastically. Ethiopia is one of the developing countries in Africa continental. Total country covered by full of highlands and lowlands. This Research work has been taken place around the Northern part of the Ethiopia-Aksum. Half of the people of the Aksum have been bearing the dental Fluorosis[1] for the last 20 years. As per the instructions of the W.H.O.[2], fluorine contamination exceeds in water more than 1.5ppm may cause Fluorosis[3] either in dental or skeletal. Usually elevated lands contain huge minerals and raw materials of which NaF, $NaSiF_6$, CaF_2, $CaSiF_6$, MgF_2, ZnF_2, AlF_3, and CuF_2 generate the concentrations of fluorides in drinking water and usage waters. In fact the AlF_3 and CaF_2 create very less toxic when comparatively other complex compounds. All the chemical elements of the Earth crust occur in widely differing ubiquitous concentrations, due to their various nuclear chemical formations and geochemical history. However, as a result of natural, geological and environmental processes, element abundances in natural materials can vary by several orders of magnitude within short distance. People living under different environmental conditions prevailing in rural and urban areas are constantly exposed to varied types of environment pollutants of which fluorine contamination is the vital part in causing chronic diseases to the human beings.

EXPERIMENTAL

Black brownish color Soil[4]: geometric mean size 0.15mm, density: 2.1g/cm^3, Al 0.1ppm, Cu 0.12ppm,F 10.25ppm, P^H 7-7.5, Biological carbon 0.2% Zn 0.11ppm.

Standard Fluoride solution[5]: Sodium Fluoride solution 10ppm in 1000 ML (1 ppm in 100 ML solution).

Aluminium Ammonium Sulphate[6]: 1.0 gm/pot, 2.0 gm/pot, 3.0 gm/pot, 4gm/pot, and 5.0 gm/pot are used while preparing clayware.

Fluoride ion meter: Orion 720A meter[7] is used for identifying the various concentrations fluorides in clayware. The soft black brownish color exquisitely soil was collected from Wokro village which is situated 9 km from Aksum-Ethiopia and chemically analyzed in the laboratory for preparing clayware. Each clayware was being made by incorporation (amalgamated[8]) of Aluminium Ammonium Sulphate 1.0 gm/kg, 2.0 gm/kg, 3.0 gm/kg, 4.0 gm/kg and 5.0 gm/kg at unique ratios. The soil was dried at 100-110^{o}C by hot air oven, crushed into smooth substance and finally used it for clayware preparation. Subsequently the Alums which have been mixed in the clayware waters at unique ratio of 1.0 gm, 2.0 gm, 3.0 gm, 4.0 gm and 5.0 gm respectively in clayware no.1,2,3,4, and 5. Our observations mainly focused on adsorption of the fluoride at time intervals from clayware[9] potable waters. Hence the results of the de-escalation of the concentrations of the fluorides in the clayware have been notified in the following progressively. Once water is stored in the pots, we can observe the concentrations at tumbled in way by the various timing intervals. Subsequently we can remove the rest of the ions from potable waters by different filtrations.

RESULTS AND DISCUSSION

This experiment has been carried out at 20-25 ^{0}C under 7-7.5 P^H in the laboratory. The entire result **(Table no.1 and 2)** shows that clayware pot No 4 has got tremendous de-escalation of fluoride ion concentration by adsorption[11] at 24Hrs time period where as the rest of the clayware have been showed discrete quantity of fluoride diminution. Clayware pot no1 has been amalgamated with 1gm of Alum salt which showed 5.05 mg/lit out of 10mg/lit at 24Hrs**(Graph-1).** Clayware pot no2 mixed with 2gm of Alum and it has been showed 5.15mg/lit of fluoride at 24Hrs. clayware pot no3 contaminated with 3mg of Alum and it has been showed successive rate of de-escalations of fluorides 3.10 mg/lit at 24Hrs. clayware pot no5 has got the similar result of pot no4 which leads to successive rate of de-escalations of fluorides. When the fluoride ions react with Alums to yield AlF_3 which is insoluble and it is easy to get adsorption. The main reaction [10] of this adsorption is as follows.

$$Al_2(NH_4)_3SO_4 \longrightarrow 3Al^{3+} + NH_4^+ + SO_4^{2-}$$

$$Al^{3+} + 3\overline{F} \longrightarrow AF_3 \text{ (adsorption and insoluble fluoride)}$$

$$Al^{3+} + 3OH^- \longrightarrow Al(OH)_3 \text{ aluminium hydroxide}$$

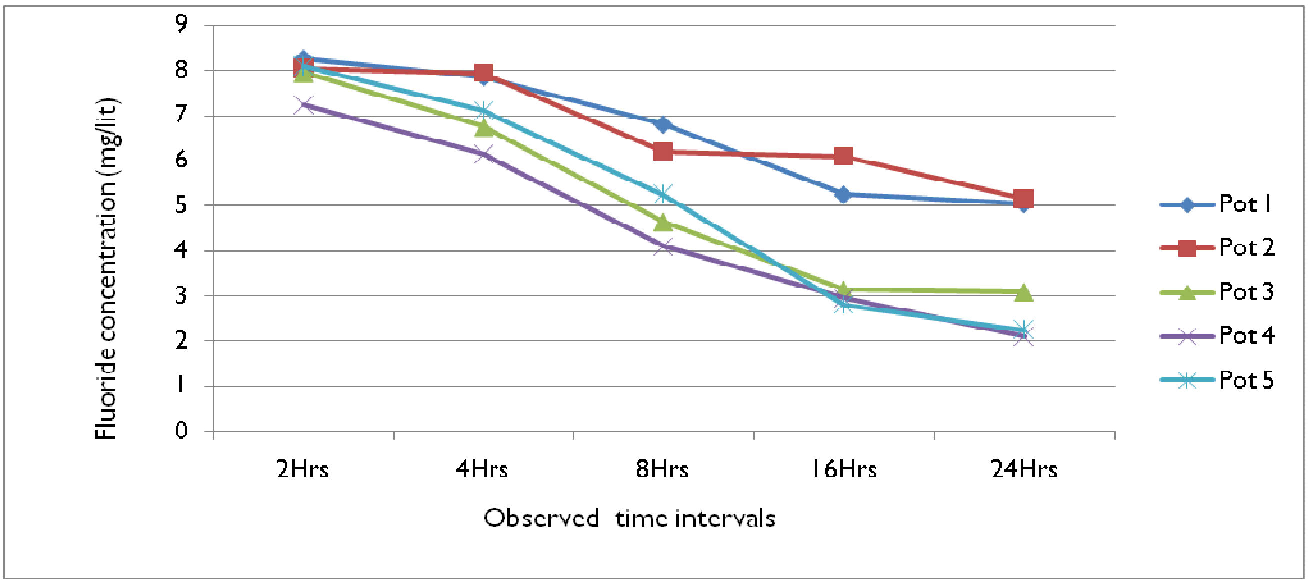
Table-1: Adsorption of the Fluorides in all Potteries.

S.No.	**Aluminium Ammonium Sulphate added in the clayware** (gm/kg)	**Concentration of fluoride in different time period (mg/lit)**				
		2Hrs	4Hrs	8Hrs	16Hrs	24Hrs
1	Clayware pot 1	8.25	7.85	6.80	5.25	5.05
2	Clayware pot 2	8.05	7.95	6.20	6.10	5.15
3	Clayware pot 3	7.95	6.75	4.65	3.15	3.10
4	Clayware pot 4	7.25	6.15	4.10	2.95	2.10
5	Clayware pot 5	8.10	7.10	5.25	2.80	2.25

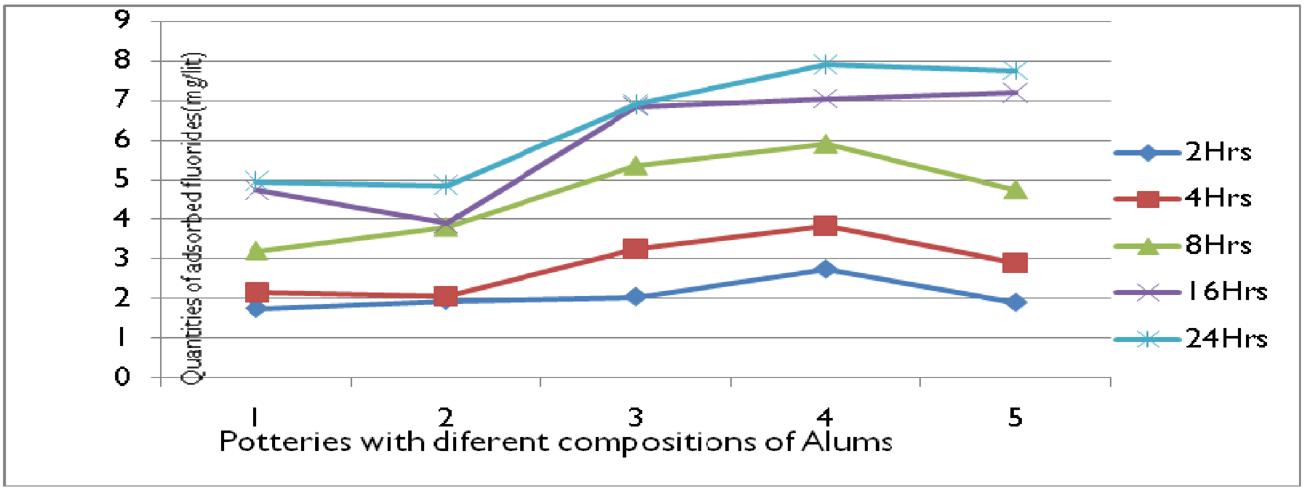
Table-2: The Adsorbed quantities of fluorides at time intervals.

Clayware material	Total adsorbed fluoride ions on various time periods				
	2Hrs	4Hrs	8Hrs	16Hrs	24Hrs
Pot No 1	1.75	2.15	3.20	4.75	4.95
Pot No 2	1.95	2.05	3.80	3.90	4.85
Pot No 3	2.05	3.25	5.35	6.85	6.90
Pot No 4	2.75	3.85	5.90	7.05	7.90
Pot No 5	1.90	2.90	4.75	7.20	7.75

Graph-1: De-escalation of fluorides comparatively in all potteries.



Graph-2: Total Adsorbed fluorides in the different pots at time intervals



ACKNOWLEDGEMENT

The Authors are profusely grateful to the Management of the Aksum University, especially to Dr. Mebrahtom Mesfin, President of the University, Tewodros Aregai, Dean, College of Natural and Computational Sciences, who gave abundant support in terms of Chemicals and sophisticated laboratories to do all the needful and also thankful to Dr.Ravindranath.K, Professor of Chemistry-Bapatla Engineering College-India, for his continuous encouragement for completion of this Research work.

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