ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT249

Estimation and Comparison of Deflouridation of Flouridated Ground Water Using Four Natural Adsorbents: Multani Mitti, Chalk Powder, Orange Peel Powder and Ragi Powder

First Author	Dr. Sushant Saini (MDS 3rd Yr)
Second Author	Dr. Kamal Kishor Gupta(Professor and Head of the Department)
Name of Corresponding Author	Dr. Kamal Kishor Gupta

Abstract:- This study highlights the global issue of fluoride contamination in drinking water, affecting approximately 260 million people in 30 countries, with India facing significant challenges as endemic fluorosis impacts around one million individuals across 17 states. The elevated fluoride levels are primarily attributed to fluoride-bearing minerals in local rocks and soils. The World Health Organization recommends maintaining fluoride concentrations near 1 mg/L to balance dental health benefits while preventing fluorosis. In response, various defluoridation methods—such as precipitation and adsorption—are implemented in India to adjust fluoride levels to optimal ranges. Given the essential role of water in physiological processes for humans, animals, and plants, understanding the variable quality of surface and groundwater is crucial. This variability is influenced by local geological factors and the presence of contaminants, necessitating effective management strategies for safe drinking water access.

Keywords:- Flouride, Deflouridation, Multani Mitti, Chalk Powder, Orange Peel Powder, Ragi Powder.

I. INTRODUCTION

Fluoride (F) is a mineral that plays a complex role in human health, acting as a double-edged sword. While adequate fluoride intake is associated with the prevention of dental caries, excessive exposure can lead to severe health issues, including dental, skeletal, and soft tissue fluorosis, conditions that currently have no cure. Toxicity occurs when fluoride levels in drinking water exceed the maximum permissible limit of 1.5 ppm. In Rajasthan, India, nearly all districts report alarming fluoride concentrations in their drinking and groundwater sources, with levels reaching as high as 18.0 ppm. This chronic exposure not only affects human populations but also poses risks to various domestic animal species, manifesting as osteo-dental fluorosis.

The interaction of fluoride with mineralized tissues such as bones and teeth is of particular clinical significance due to fluoride's high electronegativity, which attracts positively charged ions like calcium. This affinity leads to the formation of calcium–fluorapatite crystals, which can disrupt normal development and health of mineralized tissues.

Understanding the implications of fluoride in drinking water is crucial, as water is vital for all physiological processes in humans, animals, and plants. However, the quality of surface and groundwater varies significantly, influenced by local geological conditions, including the presence of rocks and ore deposits, as well as the dynamics of contaminants in lentic and lotic water systems. Addressing the challenges posed by fluoride contamination is essential for safeguarding public health and ensuring safe drinking water access.

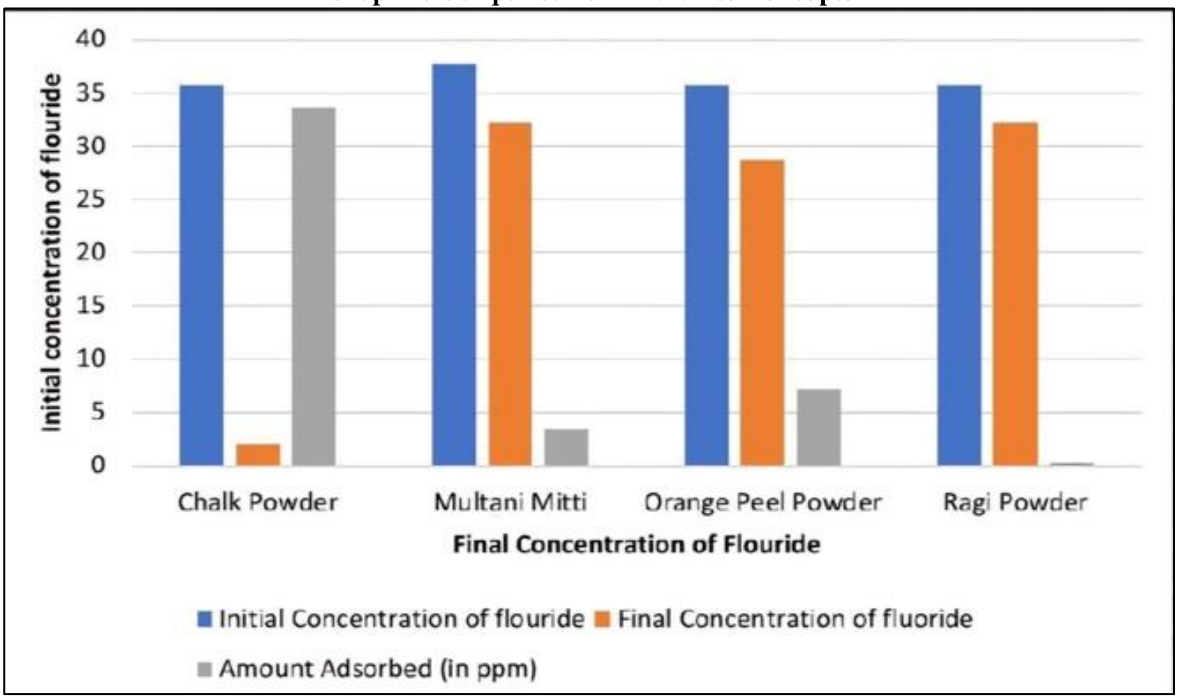
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT249

Fig 1: The Natural Low Costing Adsorbents Materials Selected For Deflouridation

Table – 1 Materials used, their inherent ppm and amount used.

TEST SOLUTION/ CONTROL	PPM	APPROX. AMOUNT USED (gm)
MULTANI MITTI	4.8	10gm
RAGI POWDER	7.60	10gm
CHALK POWDER	15	10gm
ORANGE PEEL POWDER	3.8	10gm

Graph 1: Comparison of All the Four Groups.



ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24OCT249

II. CASE STUDY

In this study, an attempt has been made to suggest certain low cost materials as effective adsorbents of fluoride. The adsorbents primarily screened were ragi powder, multani-mitti, chalk powder and orange peel powder. Initially, all the adsorbents were screened by adding 10 gm of each adsorbent to 100 ml of solution of fluoride.

Adsoprtion methods were adopted for removal of fluoride and these methods are suitable when fluoride element is present in low concentrations. For this purpose, an aqueous solution of 100 ml of fluoride of various concentrations were taken in 100 ml Stoppard bottles and 10 gm of adsorbent is added to the solutions. Batch adsorption experiments were carried out at room temperature, a contact time of 24 hrs was maintained. The initial and final concentrations of aqueous solution of fluoride were determined by 944 Professional UV/ VIS Dectector Vario

III. CONCLUSIONS

This study has summarized various methods for removing fluoride from drinking water, particularly in rural areas where high fluoride concentrations pose significant health risks. The effectiveness of different adsorbents has been examined, leading to several key conclusions. The ideal removal method should be simple, user-friendly, low-cost, and require minimal maintenance, while also being environmentally friendly.

Recent advancements in nano-adsorbents have shown promising results, demonstrating a higher capacity for fluoride uptake. Additionally, the potential to replace commercially available adsorbents with inexpensive alternatives highlights the feasibility of implementing these solutions at both domestic and community levels.

Overall, this study underscores the viability of utilizing various low-cost adsorbents for defluoridation efforts, which can be effectively integrated into local practices. However, further research is needed to deepen our understanding of low-cost adsorption processes and to demonstrate the technology's effectiveness in real-world applications.

REFERENCES

[1]. **Chidambaram S, Ramanathan AL, Vasudevan S**. Fluoride removal studies in water using natural materials. Water Sa. 2003;29(3):339-44.
[2]. **Vardhan CV, Karthikeyan J.** Removal of fluoride from water using low-cost materials. In Fifteenth International Water Technology Conference, IWTC-15 2011 Sep (pp. 1-14).
[3]. **Koteswara R, Mallikarjun M**. Effective low cost adsorbents for removal of fluoride from water: A study. International Journal of Science and Research. 2014;3:1-5.
[4]. **Gandhi N, Sirisha D, Shekar KC, Asthana S.** Removal of fluoride from water and waste water by using low cost adsorbents. International Journal of ChemTech Research. 2012 Oct;4(4):1646-53.
[5]. **World Health Organization**. Guidelines for drinking water quality, Geneva: World Health Organisation; 1984.
[6]. **Sompura K.** Study on prevalence and severity of chronic fluoride intoxication in relation to certain determinants of fluorosis. PhD Thesis, ML Sukhadia University, Udaipur (Rajasthan) 1998.
[7]. **Choubisa SL**. Endemic fluorosis in southern Rajasthan, India. Fluoride 2001;34(1):61-70.
[8]. **Choubisa SL**. Fluoride in drinking water and its toxicosis in tribals, Rajasthan, India. Proc Natl Acad Sci India Sect B Biol Sci 2012;82(2):325-30.
[9]. **Piddennavar Renuka, Krishnappa Pushpanjali**. Review on defluoridation techniques of water. The International Journal of Engineering and Science 2013; 2(3):86 -94
[10]. **Meenakshi, R.C Maheshwari.** Fluoride in drinking water and its removal. Journal of hazardous material 2006; 137(1):456-463.
[11]. **Davis SN, Deweist RJM.** Hydrogeology. New York, NY, USA: John Wiley and Sons; 1966. pp. 96-128.
[12]. **Sompura K**. Study on prevalence and severity of chronic fluoride intoxication in relation to certain determinants of fluorosis. PhD Thesis, ML Sukhadia University, Udaipur (Rajasthan) 1998
[13]. **Piddennavar Renuka, Krishnappa Pushpanjali**. Review on defluoridation techniques of water. The International Journal of Engineering and Science 2013; 2(3):86 -94.
[14]. **Ast DB, Smith DJ, Wachs B, Cantwell KT**. Newburgh-Kingston caries-nuorine study XIV. Combined clinical and roentgenographic dental findings after ten years of fluoride experience. The Journal of the American Dental Association. 1956 Mar 1;52(3):314-25.
[15]. **Bhargava DS, Killedar DJ**. Fluoride adsorption on fishbone charcoal through a moving media adsorber. Water Research. 1992 Jun 1;26(6):781-8.
[16]. **Saha S**. Treatment of aqueous effluent for fluoride removal. Water Research. 1993 Aug 1;27(8):1347-50.
[17]. **Saha S**. Treatment of aqueous effluent for fluoride removal. Water Research. 1993 Aug 1;27(8):1347-50.
[18]. **Piekos R, Paslawska S**. Fluoride uptake characteristics of fly ash. Fluoride. 1999 Feb 1;32:14-9.
[19]. **Sivasamy A, Singh KP, Mohan D, Maruthamuthu M**. Studies on defluoridation of water by coal-based sorbents. Journal of Chemical Technology & Biotechnology. 2001 Jul;76(7):717-22.
[20]. **Çengeloğlu Y, Kır E, Ersöz M**. Removal of fluoride from aqueous solution by using red mud. Separation and purification Technology. 2002 Jul 1;28(1):81-6.