



ESTIMATION AND COMPARISON OF DEFLOURIDATION OF FLOURIDATED GROUND WATER USING FOUR NATURAL ADSORBENTS: MULTANI MITTI, CHALK POWDER, ORANGE PEEL POWDER AND RAGI POWDER

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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.

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.

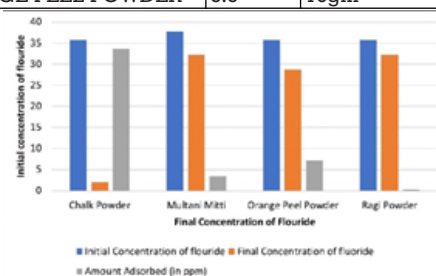
Understanding the implications of fluoride in drinking water is crucial, as water is vital for all physiological processes in humans, animals, and plants. However, the quality of surface and groundwater varies significantly, influenced by local geological conditions, including the presence of rocks and 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.



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

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.

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.

Adsorption 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 Detector Vario

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.

Table – 1 Materials Used, Their Inherent Ppm And Amount

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.

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