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A Case Study on Removal of Fluoride from Water Using Fly Ash and Rice Husk

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ABSTRACT:A fluoride concentration over the World Health Organization (WHO) guideline estimation of 1.5 mg/L in sanitary water is globally sanctioned as a health concern. Added than 200 million people in the world depend on water sources of groundwater for drinking constancies. The co-existence of fluoride with arsenic in groundwater is lethal to human beings. Groundwater infection with fluoride has influenced over 300 million people worldwide. In India, around 17 (seventeen) states have been recognized as a pestilence for fluorosis and Rajasthan is one of them. Drinking of fluoride-infected water for an elongated period or at high concentration causes drastic health effects. Haphazard intake of fluoride leads to dental and skeletal fluorosis and bone disfigurements. Estimating the capacity of industrial-based adsorbents to exclude fluoride from drinking water has global consequences due to their ease and extensive availability. The modern study aimed to appraise selected agricultural and industrial scrap materials (rice husk and fly ash) for the removal of fluoride from drinking water to find cost-effective adsorbents.

KEYWORDS: Fluoride, Rice Husk, Water Treatment

I. INTRODUCTION

1. Endemic Fluorosis moreover severe health-related quandaries in India effects of high fluoride levels in groundwater Difficulties among the unusual Fluoride concentration in the groundwater resources ought to fit an essential health-related geological matter in the numerous parts of India wherever nearly 3 million people are inscribed to devour excess fluoride-containing water. Overhead the WHO recommended a supreme limit of 1.5 mg/L. In some parts of Rajasthan in India, fluoride concentration touches up to 18 ppm prompting severe diseases, i.e. skeletal and dental fluorosis in the two human beings and animals. Health problems are numerous severe in rural areas where harmful defluoridation techniques before-mentioned as ion- exchange, reverse osmosis, nano-filtration, electrodialysis, and Donna dialysis cannot be chosen due to higher prices. In contemporary years, notice has been paid to improve low-cost techniques for the removal of fluoride from sanitary water. Low-cost supplies like bone charcoal, cement past, brick powder, various clays, plaster of Paris fly-ash, etc. have been considered as adsorption catalysts toward the defoliation of fluoride fortified water. A large portion of solid waste -ash is generated when the oxidization of coal in Kota Super Thermal Power Plant, Kota Rajasthan. Extra solid waste in the form of Kota stone (Lime) slurry/sludge is also offered in huge quantity from the Kota stone industries and dumped immediately on open land and contaminates the environment.The plentiful availability concerning ash and lime slurry motivated us to exhibit low-cost, powerful adsorbent material for the elimination of fluoride from drinking water, which is largely groundwater in a healthy portion of pastoral areas in Rajasthan, the most critically affected one by prolonged fluoride-related health diseases. Through the present study, a generous adsorbent material is being improved by impregnating limestone slurry onto F type-ash with silica and Alumina>70%. The amalgamated adsorbent material is identified for its fundamental, mineralogical, morphological, and physic-chemicalcharacteristics. Batch adsorption investigations are carried out systematically in courses of process parameters before-mentioned as fundamental concentration, pH, and adsorbent dose. Several kinetic figures are examined to determine out the proper one to represent fluoride removal kinetics above limestone impregnated fly-ash.

II. RELATED WORK

The diverse approaches so considerably undertaken for the extraction of excess fluoride from h2O can be broadly organized into four sections. a) adsorptive techniques, b) ion-exchange systems, c) precipitation systems, miscellaneous

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purposes. Some defluoridation procedures elaborated to examine fluoride in water are reversed osmosis, adsorption method applying sunflower plant, bagasse ash, burnt bone powder, etc. as adsorbents. Though, due to tremendous value, lower productivity, or non-applicability on a mass scale, these methods are not enough in use. The existing paper deals with the study of removal efficiency of fluoride by activated rice husk as an adsorbent.

One of the most successful methods for defluoridation that is practiced in India is the Nalgonda system. In this technique, estimated amounts of alum, lime, and bleaching powder are associated with water obeyed by flocculation, sedimentation, filtration, and disinfection. The existing article summarizes the system and extraction performance of several low-cost bio- adsorbents like coconut shell carbon, corn cob, groundnut shell, tamarind seeds, and drum stick seed pulp. These elements are prepared in tremendous significances, frequently biodegradable are economical, and environmentally beneficial disposable. An adsorbent is brewed by flashing a Coconut shell at 4000C in a furnace with a controlled oxygen supply. The collected charcoal was stimulated with 25% NaOH, 25% CaCl2, 2M H2SO4, and 2M HNO3 severally for 12 hours. The charcoal was then soaked completely with deionized water, oven-dried, and powder to prepare granular activation. Carbon was lastly sieved at 4.75mm, 2.36mm, 1.18mm, 600µ, 300µ, and 150µ sieve sizes to satisfy various particle dimensions. The fluoride removal performance of sulphuric acid activated carbon was 58.4%, 14.2% for NaOH activated carbons, 23.8% for Nitric acid activated carbons, 18.7% for calcium chloride activated carbons and 3.33% for business purchased activated carbon. An adsorbent was made by heating the coconut fibre in a muffle stove at 423 K for a whole and half hours. The ash was cleaned with compressed water, dried in daylight, and then concentrated in an oven at 353 K overnight. It was sieved into a mesh size of 150 mm and saved in a plastic air-tied vessel for further use. This matter is held coconut fibre ash (CFA). The aluminium impregnation is prepared by using 100 g CFA, 500 mL of0.6 M aluminium sulphate solution combined and mixed at 180–200 rpm with 1.0 M sodium hydroxide solution till pH equals 5-7. In this method, the summation of sodium hydroxide is very essential and it was tested by individual checking of the pH of the mixture. The desorption study with AICFA revealed that the fluoride removal effectiveness is 98% at pH 12. Moreover, the coexisting anions had a meaningful effect on fluoride adsorption. The comparative performance of fluoride removal in the presence of anions increased in the order PO4 < SO4 < Cl < NO3. An adsorbent Zirconium anion inseminated coconut fibre carbon (ZICFC) was achieved by mixing 5% ZrOCl2 extract (pH 1.6) including coconut fibre carbon (CFC) at room heat (298 K) for 5 days. The saturated adsorbent was consequently drained, cleaned, and concentrated in an oven at 333 K. ZICFC has its fluoride extraction performance at 99.2% and 97.4% at pH 4 and 7 sequentially. An adsorbent was developed by deseeding the maize cobs including draining them for 48 h in daylight. Next, the corn cobs were obtained powdered in an electric blender to a net size of 30-60. 5.0 g of the particles were stained with 100 mL distilled h2O to eliminate exterior adhered shreds, which were next stored in association with 100 mL liquid containing 1.0 g of AlCl3 for 24 h. The solution was separated and the hard rock collected was cleaned with 200-250 mL distilled water. The resultant explosive was concentrated repeatedly at 900 -100°C in the oven. Another adsorbent practicing the foregoing system was served by handling with calcium chloride alternately of AlCl3.1.0 g of the particles was determined to grasp 0.193 g of Al and 0.35 g of Ca in the event of AlCl3 and CaCl2 individually. The preserved powder was applied in additional tests. The IR spectra of corn cobs particles showed the presence of hydroxyl and carbonyl groups. Fluoride consumption performance of aluminium-managed corn cob is up to 88% for 120 minutes and that of Calcium used corn cob is up to 95%.

III. METHODOLOGY

The National Environment Engineering Research Institute in Nagpur, India (NEERI) has emerged an economical and manageable method of defluoridation, which is linked to essentially the Nalgonda technique.UNICEF has served closely with the Government and additional partners in defluoridation details in India, where unreasonable fluoride has been known for many years to survive in much of the nation's groundwater. In the 1980s, UNICEF supported the Government's Technology Mission in the effort to identify and address the fluoride problem: the Government consequently launched an extensive program, still underway, to render fluoride-safe water in all the areas affected. The elimination of fluoride from sanitary water is not adequate when the initial concentration of fluoride in the water is very high and the pH of the untreated water is alkaline.

The rice husk moreover fly ash signify an effective adsorbent concerning fluoride. The Resultant fly ash is an operative and useful adsorbent of the composition of fluoride. In the following procedure, we have utilized the fly ash which was generated from chula. With the sudden increment in the Physio-Chemical parameters,while working on the research, it was identified that pre-treated fly ash can create some issues and problems without hindering the elements of fluoride and its efficient removal. Therefore, fly ash is pre-treated first, and then defluroidation is taken place.

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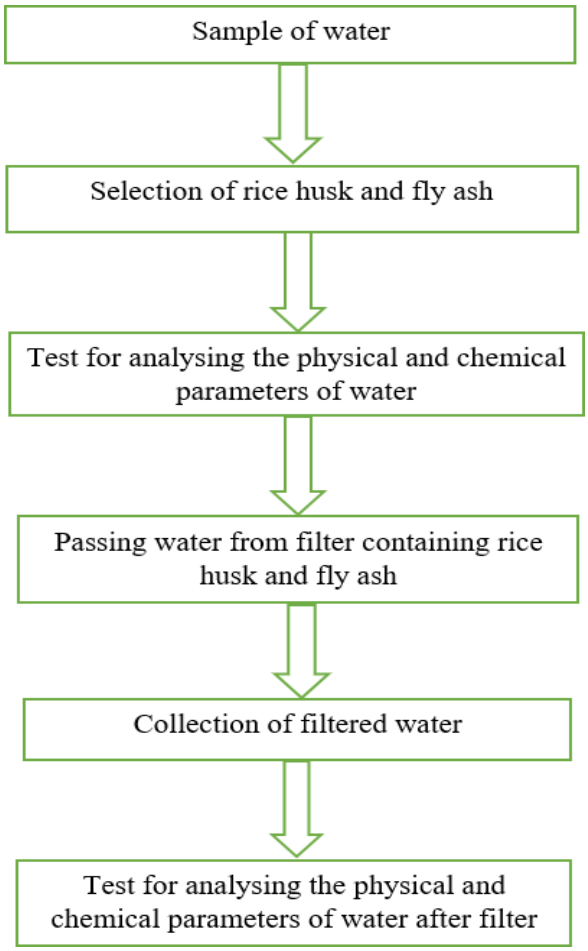
| Volume 4, Issue 6, June 2021 |

For the process of pre-treatment of fly ash, the composition is washed with potable water. For instance, 100 grams of fly ash is washed in 1 liter of water, and the procedure needs to be done twice for better results.
For this method, we have used an ordinary filter paper, funnel, and beaker. Dried, crushed, and powered fly ash is used before the treatment of fluoride treatment.
After the procedure of pre-treatment of fly ash, we will use a glass cylinder that consists of different layers of absorbent. The initial and lower part will contain gravels, the next part includes coarse sand, and above that, the layer will be of fine sand, and these layers will be covered by rice husk and fly ash used for the process of absorption of fluoride from the water. The water is poured into a glass vessel and has to be kept undisturbed for few hours. After that, the sample is collected and the test is processed.
while Working on the research,the consequent methodology was accommodated to exclude fluoride from deferent drinking water samples as shown in fig. 3.1.



IV. EXPERIMENTAL RESULTS AND CONCLUSION

Experimental results:

The experiments toward a separate sample of water intimate that there is a significant decrease in the amount of fluoride meanwhile it is reached through the tower collected with fly ash and rice husk

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V. CONCLUSION

The natural element is readily obtainable, low cost, and none no additional investment with this program. The conclusions show that the specimens have fluoride content higher than the desirable destinations, so it is prepared to decrease fluoride content. Acceptance of fly ash and rice husk efficiently degraded fluoride content; from the natural low-cost adsorbent can be utilized fruitfully for the elimination of fluoride over an extensive variety of absorptions. These low-cost adsorbents have an enormous role in emerging nations like India, despite, this method is moderate but adequate. This method has a significant part as fluorosis has a modern principal problem of tooth decay and in arid intelligence like in Rajasthan. So, this removal of fluoride is essential. In the rural and village areas, this method can easily take place as people of that area cook their food on Chulhasand the ash which is left is considered to be a waste form. This procedure is also helpful in showcasing the reuse of fly ash. This technique is the cheapest and requires less amount of capital for the accepting defluoridation process. It has been summarised from the above that potable and pure form of water is considered to be most essential medicine for the worldwide. The excess usage of fluoride in the potable water leads to the contamination of water and can give serious health issues. The measurement of use of fluozzride can be detected and observed by the defluoridation of drinking water. There are some measures to provide fluoride free water to the people

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