



## Investigations on the effectiveness of the Saba banana peel for the treatment of fluoride contaminated water

Manisha Poudyal, Sandhya Babel\*

*School of Biochemical Engineering and Technology, Sirindhorn International Institute of Technology (SIIT), Thammasat University, Pathum Thani, Thailand, Tel. +662 986 9009 Ext. 2307; emails: sandhya@siit.tu.ac.th (S. Babel), poudyal.manisha@gmail.com (M. Poudyal)*

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### ABSTRACT

This study aims to evaluate the effectiveness of Saba banana peel powder, an agro-based adsorbent for the removal of excess fluoride from water. A series of batch adsorption experiments were carried out to determine the influence of adsorbent dose, pH, agitation speed, contact time, initial fluoride concentration and the effect of co-existing ions ( $F^-/Cl^-$  and  $F^-/SO_4^{2-}$ ). The adsorbent–fluoride interactions were more pronounced at neutral pH, and equilibrium was attained within 160 min, where 82% removal efficiency was recorded for 10 mg/L fluoride solution. FTIR results showed the presence of various functional groups ( $-OH$ ,  $-NH_2$ ,  $-COOH$ ), which played a major role in fluoride removal. The fluoride removal rate decreased at a higher concentration of sulfate ions, but was independent of the presence of chloride ions. The experimental data followed pseudo-second-order kinetics and fitted well with both Langmuir and Freundlich isotherms. This implied the predominance of chemisorption process on the heterogeneous surface of adsorbent. The linear relationships with high  $R^2$  values ( $>0.99$ ) for both isotherms proved that the experimental data were statistically significant. Despite having low surface area ( $1.87 \text{ m}^2/\text{g}$ ), this abundantly available horticultural waste showed remarkable fluoride adsorption capacity of  $5.9 \text{ mg/g}$ , and the residual fluoride concentration also met the WHO regulated standard.

*Keywords:* Fluoride; Saba banana peel; Batch adsorption; Isotherms; Kinetics

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\* Corresponding author.

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