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Evaluation of *Garcinia quaesita* fruit rinds as a sustainable biosorbent for effective cadmium removal

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The presence of toxic heavy metals such as cadmium in water sources, particularly those used for consumption, cause a significant threat to human health. The use of contaminated water in food preparation can lead to the accumulation of toxic metals in food items and then finally in human body. Therefore, exploring biosorbents that are effective and suitable for culinary applications has become an important need. The present study examines the adsorption capability of *Garcinia quaesita* (commonly known as Goraka) and its potential as a sustainable biosorbent. *G. quaesita* fruit rinds collected from Panadura district, Sri Lanka, were washed, dried, and pulverized to <1 mm size. Batch adsorption experiments were conducted to assess the influence of initial cadmium concentration, pH of the medium, adsorbent dose and contact time. Subsequently, equilibrium isotherm and kinetic studies were performed using prior optimized conditions. The initial and final concentrations of each adsorption were accurately determined using Inductively Coupled Plasma-Mass Spectrometry. For better accuracy, three replicates were conducted. Optimal cadmium removal observed at an initial concentration of 0.80 mg/L, achieving 50.63% efficiency. A pH of 7 resulted in the highest efficiency at 30.75%. The most effective biosorbent dose was 0.05 g (33.00%). The optimum contact time was 140 minutes, corresponding to 62.75% removal. Based on equilibrium data, this biosorption process was best fitted with the Freundlich model having a higher regression coefficient (R^2 = 0.9033), confirming a multilayer coverage on the adsorbent. Adsorption capacity of *G. quaesita* fruit rind is determined to be 1.02 mg/g. Furthermore, kinetic studies show adherence to pseudo- second order kinetics (R^2 = 0.9976), suggesting chemisorption as the rate limiting step. This study highlights that *G. quaesita* can work well as an environmentally friendly material to remove toxic cadmium from aqueous solutions. However, more research is needed to explore how it could also be applied in food-related applications.

Keywords:
Garcinia quaesita; biosorbent; Cadmium removal; adsorption kinetics