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ORIGINAL ARTICLE

# Reactivity of sugar cane bagasse as a natural solid phase extractor for selective removal of Fe(III) and heavy-metal ions from natural water samples

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**Abstract** This work introduces the feasibility of using sugar cane bagasse (SCB) – a sugar cane industry waste – as a selective solid phase extractor for Fe(III). The order of metal uptake capacities in μmol $g^{-1}$ for the extraction of six tested metal ions from aqueous solution using static technique is Fe(III) > Cu(II) > Pb(II) > Zn(II) > Cd(II) > Co(II). Since SCB exhibits remarkable binding characteristics for Fe(III), special interest was devoted for optimizing its uptake and studying its selectivity properties under static and dynamic conditions. In this respect, batch experiments were carried out at the pH range 1.0–4.0, initial concentration of metal ion (10–100 μmol), weight of phase (25, 50, 75, 100, 125 and 150 mg) and shaking time (10, 30, 45, 60, 90, 120 and 150 min). FT-IR spectra of SCB before and after uptake of Fe(III) were recorded to explore the nature of the functional groups responsible for binding of Fe(III) onto the studied natural biosorbent. The equilibrium data were better fitted with Langmuir model ($r^2$ = 0.985) than Freundlich model ($r^2$ = 0.934). Moreover, Fe(III) sorption was fast and completed within 60 min. The adsorption kinetics data were best fitted with the pseudo-second-order type. As a view to find a suitable application of SCB based on its unique property as a benign sorbent, it was found that, Fe(III) spiked natural water samples such as doubly distilled water (DDW), drinking tap water (DTW), natural drinking water (NDW), ground water (GW) and Nile River water (NRW) was quantitatively recovered (>95.0%) using batch and column experiments, with no matrix interferences.


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## 1. Introduction

In recent years, research interest has increased in terms of the use of natural and/or agricultural adsorbents to overcome the environmental pollution (Nagh and Hanafiah, 2008; Mohan and Pittman, 2006). Increasing attention has also been focused on the separation, preconcentration and/or determination of trace heavy-metal ions in the environment using these sorbents