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The Amine Functionalized Sugarcane Bagasse Biocomposites as Magnetically Adsorbent for Contaminants Removal in Aqueous Solution

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Abstract: The method of solvothermal by one-step operation has been performed to synthesize of magnetic amine-functionalized sugarcane bagasse biocomposites (SB-MH). The obtained SB-MH contains 62.34% of Fe, 17.8 mmol/g of amine, and a magnetic property of 19.46 emu/g. The biocomposite surface area increased significantly from 1.617 to 25.789 m^2/g after amine functionalization. The optimum condition of SB-MH used for Pb(II) ion removal was achieved at pH 5 for 360 min with adsorption capacity of 203.522 mg/g. The pseudo 2nd order was well-fitted to the model of Pb(II) ion adsorption. Meanwhile, other contaminant parameters number of Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), and dye in wastewater were also remarkably reduced by about 74.4%, 88.0%, and 96.7%, respectively. The reusability of SB-MH with 4th repetitions showed only a slight decrease in performance of 5%. Therefore, the proposed magnetic amine-functionalized sugarcane bagasse biocomposites lead to a very potential adsorbent implemented in high scale due to high surface area, easy separation, stable materials and capability to adsorb contaminants from aqueous solution.

Keywords: biocomposites; magnetic; Pb(II) ion; solvothermal; sugarcane bagasse

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1. Introduction

Recently, the utilization of bio-source materials recovered from biomass has been increasing for research interest. The proper treatment of lignocellulosic materials could produce value-added products such as building block chemicals, sugar, specific polymer, fuel and adsorbent [1,2]. The biomass consisting cellulose, hemicelluloses, and lignin has the capability to adsorb heavy metal ions; and even it can be used as a harmless adsorbent. Furthermore, pre-treatment of biomass with acid solution (nitric acid, sulphuric acid, hydrochloric acid, citric acid) and/or base solution (calcium hydroxide, sodium carbonate, sodium hydroxide) mineral effaces soluble biotic compounds and even may intensify the metal adsorption efficiency [3]. A low-cost farming biomass is sugarcane bagasse. It is a solid part excessed from sugarcane industry. Researchers have applied the cellulose bagasse for biocomposite matrices such as cardanol–formaldehyde composites [4], polyester matrix [5], composite bioplastic [6], and pesticides [7]. The modified sugarcane baggase is also used as adsorbent for dyes removal [8], CO_2 adsorption [9], and metal ion adsorption [10]. There are many contaminants in waste water, and one of the dangerous ions is Pb(II); it is known as a poisonous substance in water. The elevated Pb(II) ion concentration in drinking water will damage human health, causing things such as mental retardation, kidney failure, physiological flaw, and anemia [11]. Heavy metal removal from