



Experimental study of the application of date palm trunk fiber as biosorbent for removal cadmium using a fixed bed column: investigation of the influence of particle size

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ABSTRACT

The adsorption capacity of date palm trunk fiber (DPTF) as an economic agricultural waste adsorbent was studied for the removal of cadmium from wastewater using a fixed-bed column. The DPTF has been used directly as an adsorbent and only subjected to washing, drying and sieving, without any further preparation steps. Breakthrough curves were obtained for size cuts (250–355 μm) and (560–630 μm) under identical conditions (flow rate = 10 mL/min, initial pH = 6.05, Cd(II) concentration = 110 mg/L, mass of adsorbent = 4 g). Analysis of the experimental breakthrough curves using the Thomas model indicated that the smaller size adsorbent has a higher value of adsorption capacity to cadmium ions (20.9 mg/g) than the larger size adsorbent (19.4 mg/g). The 50% breakthrough time was estimated by applying Yoon–Nelson model. The 50% breakthrough time is 80.77 and 71.72 min for size cuts (250–355 μm) and (560–630 μm), respectively. This indicated that the smaller size adsorbent exhibits a better performance with larger service time. Wolborska's model is used to estimate the kinetic coefficient of the external mass transfer. The estimated values are 4.38 1/min for the adsorbent size (250–355 μm) and 1.98 1/min for the adsorbent size (560–630 μm).

Keywords: Adsorption; Breakthrough; Cadmium; Capacity; Date palm trunk fiber; Fixed bed column

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