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STUDY OF 4-CHLOROPHENOXYACETIC ACIDADSORPTION ON COCONUT SHELL BIOCHAR

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ABSTRACT

The adsorption of 4-chlorophenoxyacetic acid (4-CPA) by coconut shell biochar (CSB) was investigated. The effect of sample solution pH was studied. The optimum solution pH value was1. This suggested that the strong interaction of 4-CPA with the CSB.Therefore, CSB, as a green, environmental-friendly adsorbent, can be applied to the adsorption of contaminants in environment.

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INTRODUCTION

In recent years, the circular economy concept is becoming an integralpart of industrial green technological processes. In this regard, biomass contains product, byproducts, residues and waste fromagriculture, forestry and industrial processesare undertaking efforts for the utilization of sorbents for various contaminants (Kim*et al.*2020).Coconut shell biochar (CSB) can also be used as an excellent adsorbent for removal of dyes, heavy metals and pollutants (Lin*et al.*2018).In this study,CSBwas applied to adsorb4-CPA. Effect of sample solution pH on adsorption was investigated.

Experimental

Chemicals and Materials: 4-CPAwas purchased from Sigma-Aldrich (Steinheim, Germany), high performance liquid chromatography-grade methanol (MeOH) and acetonitrile (ACN) were provided by J&K Chemical (Beijing, China). NaH_2PO_4, H_3PO_4, NaOH, and other affiliated chemicals were all obtained from Sinopharm Chemical Reagent Co. Ltd. (Shanghai, China). All solvents and chemicals were of analytical grade and used without further purification unless otherwise specified.HPLC-grade water was obtained by purifying demineralized water in a Milli-Q system (Millipore, Bedford, MA, USA), and was used throughout the work.

Apparatus and software: Hitachi U-2910 UV-Vis spectrometer was provided by Hitachi Instrument Inc. (Hitachi, Japan). All the samples were passed through microporous nylon filters of 0.45 μm pore sizes in diameter (Pall Corporation, USA). An Ion 510 pH meter (Ayer Rajah Crescent, Singapore) was used to monitor pH adjustment. A centrifuge (Xiangyi, Hunan, China) was used for sample preparation.

Preparation of standard: Standard stock solution containing 1000μg/mL of 4-CPAwas prepared by dissolving the required amounts of the standard in MeOH. It was stored in a refrigerator at 4 °C. Working solutions were prepared from the stock solutions by dilution with appropriate amounts of Milli-Q water.

Adsorptive performance experiment: All the adsorption experiments were performed according to our previous work (Niu*et al.* 2022). The impact of initial solution pH on 4-CPA adsorption efficiency were conducted by adding 100 mg CSBinto each 4-CPA solution (80 μg/mL, 5 mL) with ultrasonic bath assisting for 0.5 h. The pH value was adjusted by NaOH or H_3PO_4 solution (0.1 M) ranged from 1.0 to 5.0.

RESULTS AND DISCUSSION

Effect of pH: Solution pH is a major influencing factor in adsorption process since it can alter the surface charge of adsorbents and the

speciation distribution of the analytes in solution. Figure 1 illustrates the effect of initial pH on 4-CPA uptake by CSB with pH ranging from 1.0 to 5.0. It could be found that *Q*of 4-CPA was above 0 during the range of 1.0 to 3.0, thendecreased as pH value increased from 4 to 5; however, the *Q*value was biggest when pH value was 1 for 4-CPA. These phenomena may be resultant from the surface charge of CSB and the speciation of 4-CPAat different pH values. When solution pH was 1, the surface charge of CSB was positive, and the 4-CPA was neutral. Therefore, there were other interaction between CSB and 4-CPA.

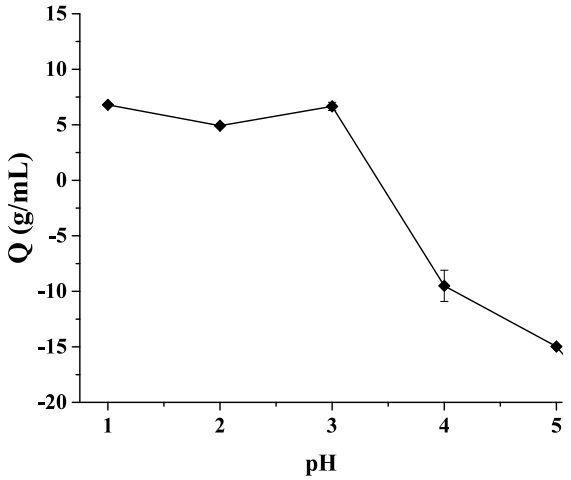

Figure 1. Effect of sample solution pH on adsorption

CONCLUSIONS

In conclusion, a green, environmental-friendly adsorbent was supplied to the 4-CPA adsorption. The solution pH had a great effect on the adsorption efficiency. The data showed that when sample solution pH value was 1, the adsorption is strong. As a highly efficient adsorbent for 4-CPA, CSB could be a candidate to adsorb contaminants in environment in the future.

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