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RESEARCH ARTICLE

STUDY OF 2,4-DICHLOROPHENOXYACETIC ACID ADSORPTION ON COCONUT SHELL BIOCHAR

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ABSTRACT

The adsorption of 2,4-dichlorophenoxyacetic acid (2,4-D) by coconut shell biochar (CSB) was investigated. The effect of initial concentration of 2,4-Dwas studied. The optimum concentration was30 μg/mL. This suggested the strong interaction of 2,4-D with 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 integral part of industrial green technological processes. Coconut shell biochar (CSB), which made from the byproducts of coconut shell, can also be used as an excellent adsorbent for removal of dyes, heavy metals and pollutants (Lin *et al.*2018).In this study, CSB was applied to adsorb2,4-D. Effect of initial concentration of 2,4-D on adsorption was investigated.

EXPERIMENTAL

Chemicals and Materials: 2,4-Dwas purchased from Sigma-Aldrich (Steinheim, Germany), 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.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 2,4-Dwas 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 concentration of2,4-D adsorption efficiency was conducted by adding 100 mg CSBinto each 2,4-D solution (pH=1, 5 mL) with ultrasonic bath assisting for 0.5 h. The initial concentration of 2,4-Dwas between 10 μg/mL and 50 μg/mL and prepared by appropriately diluting the stock solution with 10 mmol/L NaH_2PO_4.

RESULTS AND DISCUSSION

Effect of initial concentration of 2,4-D: The initial concentration of analytes is crucial in understanding how the 2,4-D distribute on the CBS when the adsorption process reaches an equilibrium state. Figure 1 illustrates the effect of initial concentration of 2,4-D uptake by CSB ranging from 10 to 50 μg/mL. It could be found that *Q* of 2,4-Dincreased during the range of 10 to 30μg/mL, then *Q* value reached an equilibrium as the concentration increasing from 30 to 50 μg/mL. These phenomena may be because the surface of CSB was saturated when the initial concentration of 2,4-D was 30 μg/mL and could not provide more adsorption sites for more 2,4-D.

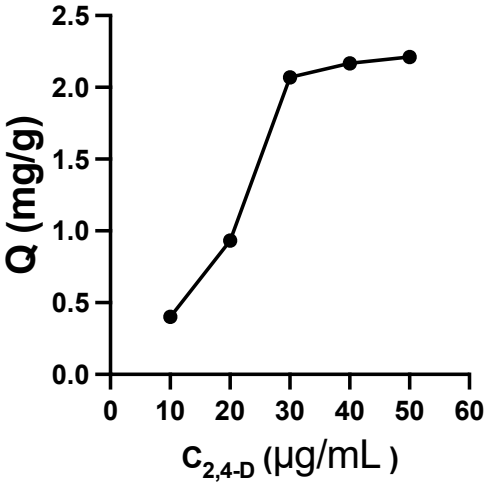

Figure 1. Effect of sample solution initial concentration of 2,4-Don adsorption

CONCLUSION

In conclusion, a green, environmental-friendly adsorbent was supplied to the 2,4-D adsorption. The data showed that when initial concentration of 2,4-Dwas 30 μg/mL, the adsorption reached an equilibrium. As a highly efficient adsorbent for 2,4-D, CSB could be a candidate to adsorb contaminants in environment in the future.

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