

Research Article

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Enhanced adsorption of Cu(II) from wastewater using potassium humate-modified coconut husk biochar

Supplementary material

S1 Cost analysis

Cost-effectiveness is one of the important indicators for evaluating the potential of biochar application. The main processes include raw material costs, modification costs. the cost estimation for preparing 1 t CMB was calculated in U.S. dollars as follows:

- I. Coconut husk biochar was purchased from Zhiyuan Chemical Reagent Co., Ltd. (China) at a market price of approximately \$101/t.
- II. To produce 1 ton of modified biochar, approximately 0.25 tons of potassium humate is required, corresponding to a cost of around \$372 based on the current market price.
- III. The price of the tap water is \$ 0.55/t. The cost of tap water used to prepare the solution and to wash the biochar (the price of tap water per ton water consumption for 1t BBC) = \$ 0.55=\$ 11.
- IV. Since no high-power equipment was used during the modification process, the electricity cost was considered negligible.

Above all, the overall cost for CMB production is at least: \$ 101 + 372 + 11=\$ 484/t

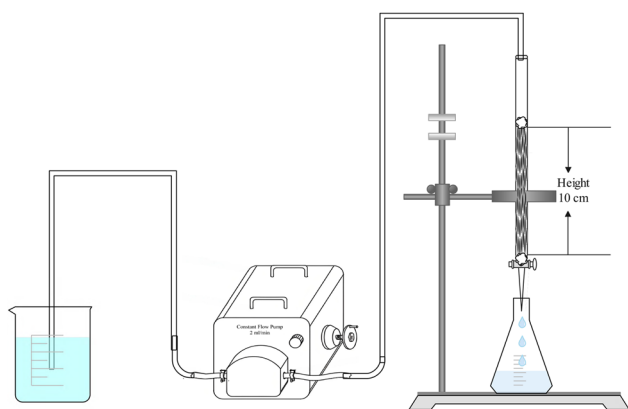


Figure S1: Fixed bed setup.

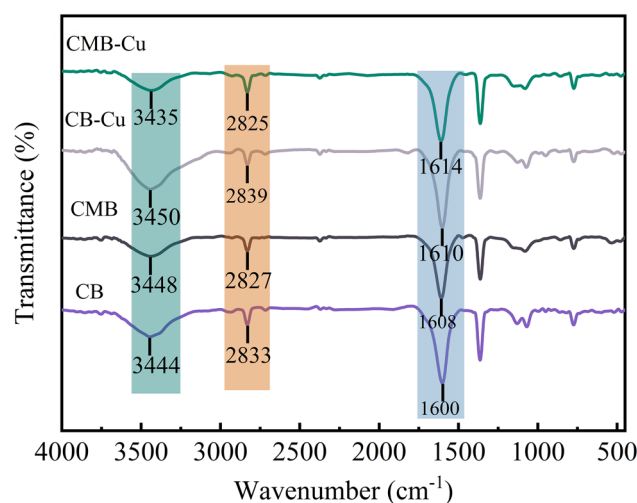


Figure S2: FTIR spectra of CB and CMB before and after adsorption.

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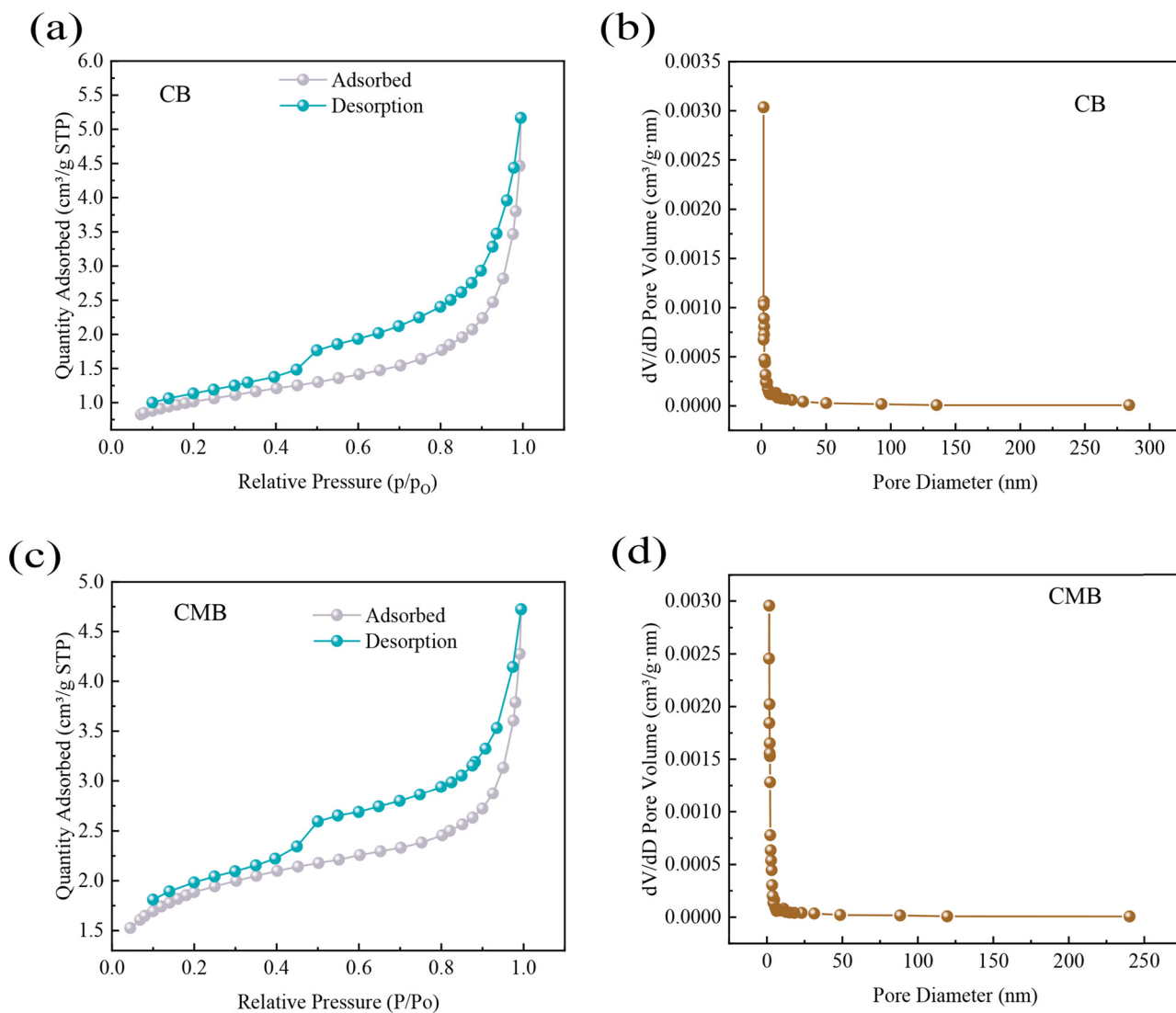


Figure S3: N₂ adsorption-desorption isotherms and pore size distribution diagrams of CB and CMB: (a) and (c) Isotherms of CB (a) and CMB (c), (b) and (d) pore size distributions of CB (b) and CMB (d).