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Converting Dates Branch into Activated Carbon Via Microwave Assisted – H₃PO₄ Activated for Cation Dye Removal

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Structured Abstract

Background: The biggest environmental problem of our time is water pollution, which has grown into a bigger problem around the world. A lot of different pollutants are polluting different types of water, like rivers, lakes, the ocean, and groundwater. This harms water quality, aquatic life, habitats, and human health with dangerous things like heavy metals, solvents, oils, and toxic trash are dumped into waterways by industries. This increases the chance of ecological disruption and biodiversity loss. The goal of this study is to investigate the method activated carbon is by using microwaves assist with phosphoric acid to activate crystal violet dye.

Methods: The weighing balance was needed for 100g DB. Materials were crushed with a lab mixer. After that, 200 grams of phosphoric acid (H₃PO₄) were measured and impregnated into the sample at 1:2. DB and (H₃PO₄) solution were heated at 110 degrees Celsius for 24 hours. The dry mixture of DB and (H₃PO₄) was transferred from microwave to a quartz glass reactor to activate the carbon. This technique takes 15 minutes in a 600-watt microwave with two litres of nitrogen gas per minute. The carbonized DB is repeatedly cleaned with boiling water until neutral pH is reached. A 24-hour oven drying at 100 degrees Celsius followed. After sieving to a consistent particle size of 250 µm, the material was stored in an airtight container.

Results: The adsorption of crystal violet (CV), an organic pigment, from aqueous solutions has been thoroughly investigated. The adsorption properties were assessed using the Box-Behnken statistical approach, considering the following factors which is DBAC dosage ranging from 0.02 to 0.1 g,pH values ranging from 4 to 10, and duration ranging from 10 to 130 minutes. The percentage of DBAC dye removal was determined to be 77.44%.

Conclusion: This study shows that agricultural waste, especially date branches (DB), may be used to make activated carbon (DBAC) utilizing pyrolysis with H₃PO₄ activation. DBAC material has great industrial potential for eliminating heavy metal ions, cationic dyes, and pharmaceuticals in water-based systems which is a promising application. Its massive surface area, porosity, and water wettability make it effective for treating contaminated water.

Keywords: Date Branch, Activated Carbon, Crystal Violet

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