BIOMASS-DERIVED POROUS ACTIVATED CARBON FROM COCONUT HUSK FOR HIGH-ENERGY DENSITY SYMMETRIC SUPERCAPACITORS

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In the name of Allah, the most Beneficent, the most Merciful.

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ABSTRACT

Biomass-derived porous activated carbon materials are readily available, renewable, sustainable, and capable of producing great results without costing a lot of money, thus they have received great deal of interest in energy-storage devices, particularly supercapacitors. This research describes the preparation of activated carbon electrodes from coconut husks through chemical activation method at impregnation ratios of 1:1 and 1:3. Potassium hydroxide (KOH) is used as an activator during chemical activation. This research aims to observe the effects of mixing activating agents at different impregnation ratios on the yielding percentage of activated carbon in the samples obtained during the research. Chemical assessments of the final product, as well as the percentage of carbon yield and ash content, are assessed utilising a mathematical formula method at the end of this research.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

The concept of supercapacitors, also known as ultracapacitors, has sparked great interest since their inception, owing to the technology's exceptionally high capacitance and nearly infinite charge or discharge cycle life. The ability to store electrical energy at an interface between an electrolyte and a solid compound has been known since the nineteenth century. However, developing a reliable application for the technology has been difficult. Since its inception, the supercapacitor has come a long way, and new technologies have undoubtedly found useful applications for the age-old electrical design (Ghosh et al., 2019).

Activated carbons (AC) are a highly porous form of solid carbon made from carbonaceous raw materials through chemical or physical activation. They've been employed in a variety of industrial applications during the previous few decades, including gas purification, organic pollutant removal from water, as a catalyst in catalytic processes, and also as electrode materials in electrochemical tools. The use of activated carbon in adsorption processes is heavily influenced by the surface chemistry and pore structure of porous carbons (Nguyen et al., 2021; Ideta et al., 2021; Escobar et al., 2021; Fang & Yang, 2021).

To produce activated carbon from carbonaceous materials, there are two types of activation processes: chemical and physical activation processes. Physical activation starts with carbonisation and concludes with activation utilizing oxygen, steam or carbon dioxide as an activating agent (Azeta et al., 2021). However, in the chemical activation procedure, carbonisation and activation occur in a single stage, with chemicals such as potassium hydroxide (KOH), sodium hydroxide (NaOH), and zinc chloride ($ZnCl_2$) acting as activating agents (Surya & Michael, 2021).

As environmental pollution becomes more of a big threat, global demand for activated carbon is escalating due to its vast applications, such as in industries and other human assistance. But some of the raw resources used in the process are non-renewable. As a result, every possible source should be investigated. The effectiveness of lignocellulosic agricultural wastes with high carbon content but low levels of inorganic compounds as precursors for the synthesis of activated carbons has been studied and documented (Ghosh et al., 2019; Low & Yee, 2021; Perea-Moreno et al., 2019). All carbon-containing raw materials, whether sourced