# PREPARATION OF ACTIVATED CARBON DERIVED FROM TEA DUST FOR SUPERCAPACITOR APPLICATION

**NURUL ANIS NABILAH BINTI ZULKARNAIN**

**Final Year Project Report Submitted in**

**Partial Fulfilment of the Requirements for the**

**Degree of Bachelor of Science (Hons.) Physics**

**in the Faculty of Applied Sciences**

**Universiti Teknologi MARA**

**JULY 2025**

This Final Year Project Report entitle "**Preparation of Activated Carbon Derived from Tea Dust for Supercapacitor Application**" was submitted by Nurul Anis Nabilah Binti Zulkarnain in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by

Norna Binti Abdul Hadi
Supervisor
B. Sc. (Hons.) Physics
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau, Perlis

Dr. Siti Zulaikha Binti Mohd Yusof
Project Coordinator
B. Sc. (Hons.) Physics
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau, Perlis

Dr. Rosyaini Binti Afindi Zaman
Programme Coordinator
B. Sc. (Hons.) Physics
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau, Perlis

JULY 2025

# ABSTRACT

## PREPARATION OF ACTIVATED CARBON DERIVED FROM TEA DUST FOR SUPERCAPACITOR APPLICATION

In the modern era, the need for sustainable energy storage systems has greater in response to global concerns about climate change grow. Supercapacitors, with their quick charging and discharging capabilities, emerge as promising alternatives. The difficult part is in optimizing synthesis parameters to applications. The activated carbon that has been used in these studies is tea dust. The main objectives of this research are to synthesize activated carbon from tea dust for application in supercapacitor electrodes and to evaluate the resultant specific capacitance and an energy density of these tea dust derived supercapacitors. This study therefore concentrated on the unique synthesis of activated carbon from tea dust, employing a streamlined process involving pre-treatment, carbonization and chemical activation with Potassium Hydroxide (KOH) as the activating agent and electrolyte of the supercapacitor. In this study, the best result was AC-2 (2 hours) at 300°C which exhibited the highest performance, achieving a capacitance of 3.8 F, a specific capacitance of 152 F/g and an energy density of 21.11 Wh/g. The capacitance value of AC-3(3 hours) and AC-4(4 hours) at 300°C which are 2.4 F and 3.2 F, for specific capacitance which 120 F/g and 91 F/g and an energy density of 16.67 Wh/g and 12,64 Wh/g were showed the lower values, suggesting that the synthesis conditions for AC-2 were more optimal. The outcomes of this study include determining the charge-discharge cycle and energy density of supercapacitors based on tea dust.

**TABLE OF CONTENTS**