SPECIMEN FORMAT FOR THESES OF MONTH

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Department	**:**	Chemistry
Branch/ Area:	**:**	Chemistry
Sub Subject Heading:	**:**	Advanced Material chemistry
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Title of the thesis	**:**	Investigation of Biomass Derived Functional Carbon Electrodes from Leaves of *Spathodea campanulata* and *Tecoma capensis* for Supercapacitor applications
(i) In Roman Script		-
(ii) In roman Script		-
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Name of Supervisor	**:**	Dr.A. Prithiba
Designation of Supervisor	**:**	Assistant Professor
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Abstract within 300 words:

This dissertation explores the process of synthesis, characterization and application of the relative biomass carbonaceous materials obtained from the '*Spathodea campanulata* and *Tecoma capensis*' plants; more specifically, the effect of nitrogen doping particularly in improving its properties for use in supercapacitor applications is outlined in details.

The choice to use biomass-based carbon materials is increasing due to the fact that such materials are sustainable and environment friendly. For this research, leaves of *Spathodea campanulata* and *Tecoma capensis* were selected as biomass precursors due to the fact that they are readily available. The preparation method included pyrolysis of the biomass and nitrogen doping with urea as the nitrogen source. All obtained Carbon / nitrogen-doped carbon materials were subjected to physicochemical characterizations includes FT-IR, XRD, Raman, BET, FESEM, EDAX, TEM to determine their structural and morphological properties

The electrochemical performance of the carbon materials/ nitrogen-doped carbons has been analyzed. It was observed that nitrogen doping has enhanced capacitive behavior of the carbon materials. The nitrogen-doped carbons derived from *Spathodea campanulata* and *Tecoma capensis* exhibited high specific capacitance indicating their suitability as supercapacitor electrodes.

This study highlights the potential of utilizing abundant biomass sources for developing high-performance supercapacitor materials through nitrogen doping, offering a sustainable approach to energy storage that aligns with green chemistry and renewable energy principle.

i) Major objectives:

The key objectives of the study are outlined as follows:

1. To synthesize biocarbon materials from leaves of *Spathodea campanulata* and *Tecoma capensis* using direct pyrolysis technique

2. To synthesize nitrogen doped material from prepared biomass carbon material

3. To characterize the synthesized biocarbon and doped biocarbon material by structural characterization (FT-IR, XRD, and Raman spectroscopy), morphological characterization (FESEM, HRTEM, and BET analysis)

4. To Derive Carbon Electrodes from the prepared carbon and to assess the electrochemical performance of the bio-carbon electrodes in supercapacitor using Electrochemical characterization

through cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS) for energy storage applications.

ii) Hypothesis:

Harness Carbon from natural sources for utilizing as electrode for supercapacitor applications

iii) Methodology:

The work plan for the present investigation is structured into three phases:

Phase I: Synthesis of carbon materials (SPL/TCL) and nitrogen doped carbon from *Spathodea campanulata* and *Tecoma capensis* (SN/TN) Leaves

Phase II: Physiochemical and Morphological characterization of synthesized carbon materials-SPL/TCL/SN/TN

Phase III: Electrochemical characterization of SPL/TCL/SN/TN derived carbon materials for utilization of synthesized carbon materials in supercapacitor electrode applications

By systematically carrying out these three phases, the research aims to gain insight into the synthesis, physicochemical properties, electrochemical behavior, and practical application of carbon materials derived from SPL and TCL leaves for supercapacitor technology.

iv) Findings:

Functionalized carbon materials, namely SPL- 700, SPL- 800, SPL- 900, TCL- 700, TCL- 800, TCL- 900, SN- 700, SN- 800, SN- 900, TN- 700, TN- 800 and TN- 900 were successfully synthesized from dried *Spathodea campanulata* (SPL)and *Tecoma capensis* (TCL) leaves using direct pyrolysis techniques. Based on the results provided, it can be concluded that the prepared functional carbon electrode material (TN-900) exhibited superior ionic transport, high specific capacitance (Csp), increased energy (E) and power density (P) and good cyclic stability. This suggests that these materials possess favorable properties for applications in energy storage devices such as supercapacitors or batteries. Characterization of all synthesized carbon materials indicate that the selected precursors, *Spathodea campanulata* (SPL)and *Tecoma capensis* (TCL) leaves exhibit favorable properties for supercapacitor electrodes. Thus, it can be inferred that these selected precursors hold promise for imparting supercapacitive characteristics to the synthesized carbon electrode materials, making them suitable candidates for application in supercapacitors.

Examiners

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