SYNTHESIS OF POROUS GRAPHENE FROM SRI LANKAN GRAPHITE FOR SUPERCAPACITOR APPLICATIONS

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Thesis submitted in partial fulfillment of the requirements for the degree
Master of Philosophy

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July 2022

DECLARATION

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ACKNOWLEDGEMENT

I would like to give my acknowledge and warmest thank to my research supervisor, Dr.(Mrs) H.S.Sitinamaluwa, not only for her guidance throughout my research but also for the knowledge and experience that she has shared with me. Her guidance and advice carried me through all the stages of this research she played a major role in my career development also. Next, I would also like to thank my other supervisor, Dr. Dilini Galpayage for her brilliant comments and suggestions.

The staff [Academic and Non-academic] at the Department of Materials Science and Engineering, especially all the research assistants who were there with me working together is a main part of the success of this research. I would like to give my heartiest gratitude to all of them for being with me. I would like to give my special thanks to all the academic and non-academic staff of the Department of Chemical and Process Engineering, who helped me to make this work possible.

Finally, I would like to acknowledge SRC grant of SRC/CAP/2019/01, which provided the financial assistance for this project.

ABSTRACT

A feasible process to synthesize porous graphene with ultra-high surface area is presented in this thesis. Graphene oxide (GO) was synthesized from Sri Lankan graphite via the modified hummers method. Then, GO was subjected to a chemical activation process to produce graphene with a mesoporous structure, where KOH was used as the activation agent. The influence of the critical activation process parameters on the specific surface area of graphene was studied. In this study, activation time at 60 min, activation temperature at 800 ℃ and KOH/GO mass ratio at 4 were identified as the optimum activation parameters for high surface area. As an alternative route to find the specific surface area (SSA), a dye adsorption based SSA calculation method was followed, and the methylene blue adsorption kinetics were studied for that. Second order kinetic model and Langmuir isotherms were the most suitable kinetic models for the methylene blue adsorption onto porous graphene which were produced from Sri Lankan vein graphite. A combined mathematical model of methylene blue number (MBN) and iodine number (IN) was used to calculate the SSA for high accuracy. The obtained optimum activated graphene sample showed a high specific surface area of 768.15 m^2/g as measured from the dye adsorption method and it was verified by BET analysis. Furthermore, methylene blue and Iodine adsorption methods are studied as a low-cost and feasible method for surface area determination of porous graphene. The high surface area of the obtained graphene would make it a promising material for supercapacitor applications. The present study mainly focuses on the value addition to Sri Lankan vein graphite trough the utilization of vein graphite as an electrode material in electrochemical double layer capacitor (EDLC).

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LIST OF ABBREVIATIONS

Abbreviation	Description
GO	Graphene Oxide
AGO	Activated Graphene Oxide
SSA	Specific Surface Area
BET	Brunauer, Emmett and Teller
XRD	X-Ray Diffraction
SEM	Scanning Electron Microscopy
FTIR	Fourier Transform Infrared
EDX	Dispersive X-Ray analysis
EDLC	Electrochemical Double Layer Capacitor
KOH	Potassium Hydroxide