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The Characterization and Optimization of Bio-Graphene Derived From Oil Palm Shell Through Slow Pyrolysis Environment and Its Electrical Conductivity and Capacitance Performance as Electrodes Materials in Fast Charging Supercapacitor Application

Authors : Nurhafizah Md. Disa, Nurhayati Binti Abdullah, Muhammad Rabie Bin Omar

Abstract : This research intends to identify the existing knowledge gap because of the lack of substantial studies to fabricate and characterize bio-graphene created from Oil Palm Shell (OPS) through the means of pre-treatment and slow pyrolysis. By fabricating bio-graphene through OPS, a novel material can be found to procure and used for graphene-based research. The characterization of produced bio-graphene is intended to possess a unique hexagonal graphene pattern and graphene properties in comparison to other previously fabricated graphene. The OPS will be fabricated by pre-treatment of zinc chloride ($ZnCl_2$) and iron (III) chloride (FeCl3), which then induced the bio-graphene thermally by slow pyrolysis. The pyrolizer's final temperature and resident time will be set at 550 °C, 5/min, and 1 hour respectively. Finally, the charred product will be washed with hydrochloric acid (HCL) to remove metal residue. The obtained bio-graphene will undergo different analyses to investigate the physicochemical properties of the two-dimensional layer of carbon atoms with sp2 hybridization hexagonal lattice structure. The analysis that will be taking place is Raman Spectroscopy (RAMAN), UV-visible spectroscopy (UV-VIS), Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), and X-Ray Diffraction (XRD). In retrospect, RAMAN is used to analyze three key peaks found in graphene, namely D, G, and 2D peaks, which will evaluate the quality of the bio-graphene structure and the number of layers generated. To compare and strengthen graphene layer resolves, UV-VIS may be used to establish similar results of graphene layer from last layer analysis and also characterize the types of graphene procured. A clear physical image of graphene can be obtained by analyzation of TEM in order to study structural quality and layers condition and SEM in order to study the surface quality and repeating porosity pattern. Lastly, establishing the crystallinity of the produced bio-graphene, simultaneously as an oxygen contamination factor and thus pristineness of the graphene can be done by XRD. In the conclusion of this paper, this study is able to obtain bio-graphene through OPS as a novel material in pre-treatment by chloride $ZnCl_2$ and FeCl3 and slow pyrolization to provide a characterization analysis related to bio-graphene that will be beneficial for future graphene-related applications. The characterization should yield similar findings to previous papers as to confirm graphene quality.

Keywords : oil palm shell, bio-graphene, pre-treatment, slow pyrolysis
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