Synthesis and characterization of carbon material obtained from coconut coir dust by hydrothermal and pyrolytic processes

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Abstrak

Since 2004, graphene has risen in popularity owing to its superior properties. However, limits to the scale of production methods have rendered graphene a costly material. Moreover, existing production methods require chemicals that are detrimental to the environment. This study uses Coconut Coir Dust (CCD) as a carbon precursor and an intermediate product in the manufacturing of graphene. Firstly, CCD sieved into a 100 mesh was carbonized using a hydrothermal method at temperatures of 235oC, 250oC, and 265oC, for 4 hours. Following this, the resulting solid residue was pyrolyzed at 1000oC for 2 hours under the protection of nitrogen (N2). The hydrothermal solid residue was labelled CHT (hydrothermal temperature) and the pyrolysis product was named as SP (hydrothermal temperature). Both samples were characterized using SEM, XRD and EDS. In addition, Raman characterization was conducted for SP samples. At the end of the process (SP), the XRD pattern showed two broad peaks centered around 2? ~24o and 44o corresponding to a (002) and (100) graphite plane. This pattern is similar to that of reduced-graphene oxide. SEM images showed a sheet-like microstructure is caused by undegraded lignin. A perforated and corrugated sheet formed after pyrolysis, which subsequently confirms the formation of reduced-graphene oxide. Furthermore, the Raman result indicates that higher hydrothermal temperatures lead to an increasing integrated ID/IG ratio. The ratios were 1.62, 1.71 and 1.77, for SP 235, SP 250, and SP 265, respectively. Research results conclude that the carbonaceous material formed through hydrothermal and pyrolytic processes contained a mixture of an amorphous-carbon form and a graphene-like cluster. Results additionally show a similar structure with reduced-graphene oxide.