Low cost and green approach in the reduction of graphene oxide (GO) using palm oil leaves extract for potential in industrial applications

ABSTRACT

Graphene is an exceptional and versatile new material which having worldwide reputation due to its unique properties such as having extremely good electrical conductor, tunable energy band gap, and offers high mechanical strength. The process to derived graphitized carbon into the reduced graphene oxide (rGO) is facing a huge obstacle and the chemical method is proven to be the best choice in order to synthesis rGO in the big scale short amount of time. However, the current chemical method involved the usage of hazardous, toxic and corrosive chemical as reducing agent namely hydrazine to form the sheet layer of graphene. Thus, this will limit the various applications of graphene due to environmental impact and safety issues. As an alternative current research proposed the usage of palm oil leaves extract to replace the hazardous and toxic chemical used as reducing agent. In our project, graphite was used as starting material and was oxidized using modified Hummer's method. The palm oil leaves extract with the mixture of graphene oxide (GO) solution was refluxed to produce rGO. The as-synthesized green approach rGO material were then characterized using X-ray diffraction (XRD), energy dispersive X-ray (EDX), transmission electron microscopy (TEM), and Raman spectroscopy. The results revealed that the interspace distance between plane increased proportionally as graphite was oxidized, increasing from 0.33 nm to 0.84 nm. The reduction process of GO using palm oil leave extract showed the successful in removing the hydroxyl group and amorphization of sp2 carbon structures. The reduction process found to be increased in C/O ratios from 1:1 to 3:1. Raman spectroscopy revealed that the G band position was restored comparable to graphite as the reduction process successful achieved. TEM images and selected area electron diffraction (SAED) patterns illustrated the confirmation of the successfully synthesized of the monolayer of graphene sheet. Electrochemical studies carried out for both GO and rGO have positively differentiated and concluded a better voltage-current response of rGO in comparison to GO. The as synthesized rGO in the current project holds various potential for further investigation and industrial applications not limited to just supercapacitor and photocatalyst.

Keyword: Biomass; Electrochemical; Graphene oxide; Palm oil; Reduced graphene oxide