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FABRICATION OF REDUCED GRAPHENE OXIDE-BASED PAPER USING L-ASCORBIC ACID

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Reduced graphene oxide (rGO) is a material with potentially interesting properties which leads to many applications. Paper-based rGO is effective in applications like bioelectrical electrodes, water purification and sensors. Fabrication of paper-based rGO begins with oxidizing graphite to graphene oxide (GO) and reducing paper-based GO using chemical or thermal reduction. In chemical reduction, hydrazine hydrate (H_6N_2O), sodium borohydride ($NaBH_4$), and hydroiodic acid (HI) are used, as they are strong reducing agents. However, their toxic nature has doubted the possibility of using paper-based rGO for bioelectric signal acquisition and water purification. Therefore, there is a necessity to fabricate paper-based rGO using green and non-toxic methods. This study presents a novel method of fabricating cellulose membrane (CM) filter paper-based rGO using L-ascorbic acid, a non-toxic reducing agent. The precursor, GO, was synthesized by the modified Hummer's method using Sri Lankan graphite. The vacuum filtration technique was used to deposit GO on the CM filter paper, and the CM filter paper-based GO reduced at 70 ºC using L-ascorbic acid. Fourier-transform infrared spectroscopy (FTIR) and Raman spectroscopy confirmed the deposition of GO and the reduction state of paper-based GO. Oxygen functional groups seen in the FTIR spectrum of CM filter paper-based GO confirmed the hydrophilic nature, which helps the proper bonding between GO and CM filter paper. Raman analysis revealed a significant increase in I_D/I_G ratio from 0.886 to 1.186 and I_{2D}/I_G ratio from 0.030 to 0.076 after reducing CM filter paper-based GO with the concentration of 500 mg l^{-1} at 70 ºC. This increase showed the reduction ability of L-ascorbic acid and the restoration of carbon-carbon bonds under sp^2 hybridization. Also, the I_{2D}/ I_G ratio increased as the GO concentration increased from 62.5 mg l^{-1} to 500 mg $l^{-1,}$ indicating that the optimized CM filter paper-based rGO may have high electrical properties.

Keywords: Cellulose membrane filter paper, L-ascorbic acid, Reduced graphene oxide, rGO paper, Vacuum filtration