Electrochemical portable biosensor of graphene derivatives to detection human nasopharyngeal secretion samples and RNA samples extracted from SARS-CoV-2

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Graphene-based materials exhibit high surface area and can present various structural defects or heteroatoms, depending on the fabrication method. These properties facilitate the interaction of graphene with biomolecules, resulting in high electrochemical activity. In this context, we synthesized a high-quality dispersed reduced graphene oxide using lysozyme as a dispersant (Ly-RGO) with different concentrations of hydrazine (N_2H_4 = 1.5 mL, 2.5 mL, 4 mL, and 4.9 mL) to obtain four types of Ly-RGO electrochemical biosensors. Thus, in this work, we investigated the oxidation-reduction mechanisms of graphene in the four types of Ly-RGO using X-ray Photoelectron Spectroscopy, X-ray Diffraction, and Raman Spectroscopy. Four working electrodes were fabricated in an electrochemical cell, and the voltammograms show significant transduction of electrical signals for each of the fabricated biosensors. Finally, cyclic voltammetry and chronoamperometry measurements were performed with human nasopharyngeal secretion samples and RNA samples extracted from SARS-CoV-2 to calibrate our biosensors. The results indicate that the developed Ly-RGO is an excellent candidate for portable electrochemical biosensor platforms for 50s detection of SARS-CoV-2 positive and negative samples, and has potential applications for other viruses.

Keywords: portable, biosensor, electrochemical, graphene derivatives, SARS-CoV-2