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Design and development of an electroanalytical genosensor based on Cu-PTCA/rGO nanocomposites for the detection of cervical cancer

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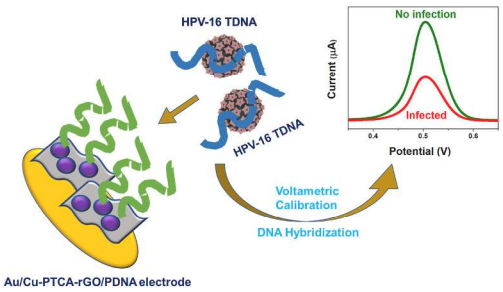
HIGHLIGHTS

- Cu-PTCA/rGO Nanocomposite as a robust Nano transduction platform for the detection of cervical cancer.
- High degree of linearity and enhanced limit of detection exhibited by developed biosensor.
- High degree of selectivity observed towards detection of HPV-16 in spiked serum samples.
- Huge potential exhibited by developed sensor in point of care scenario.

GRAPHICAL ABSTRACT



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ABSTRACT

Cervical cancer is one of the most ordinary fatalities that occurs between middle-aged and older women. When left undiagnosed and untreated, this disease leads to life-threatening events among the female populace and has been placing a huge burden on available healthcare resources. Considering numerous limitations (high cost, time consuming, bulky equipment etc.) of conventional techniques for diagnosing this highly malignant cancer, it becomes imperative to develop miniaturized bio sensing platforms which can aid in early detection of cervical cancer for enhanced patient outcomes. We made our way on the design and development of an electrochemical biosensor based on the novel Nano-composites of Perylene Tetra carboxylic acid functionalized copper nanoparticles and reduced graphene oxide (Cu-PTCA/rGO) for DNA-based detection of Human Papilloma Virus 16 (HPV 16) – the key biomarker for cervical cancer. Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS) were used to classify the developed sensor, with the latter providing insights into the electrode kinetics. The sensor optimizations and analytical performance were assessed using Square Wave Voltammetry (SWV), eventually exhibiting sensitivity and limit of detection of 0.052 μA/μM/mm^2 and 2.15 fM respectively. The genosensor was found to be selective solely to HPV 16 target DNA and exhibited a shelf life of

Abbreviations: HPV, Human Papillomavirus; Cu-PTCA/rGO, Copper-Perylene Tetracarboxylic Acid-reduced Graphene Oxide; CV, Cyclic Voltammetry; SWV, Square Wave Voltammetry; EIS, Electrochemical Impedance Spectroscopy; LoD, Limit of Detection.

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