World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:18, No:12, 2024

# Electrochemical Impedance Spectroscopy Based Label-Free Detection of TSG101 by Electric Field Lysis of Immobilized Exosomes from Human Serum

**Authors :** Nusrat Praween, Krishna Thej Pammi Guru, Palash Kumar Basu

**Abstract :** Designing non-invasive biosensors for cancer diagnosis is essential for developing an affordable and specific tool to measure cancer-related exosome biomarkers. Exosomes, released by healthy as well as cancer cells, contain valuable information about the biomarkers of various diseases, including cancer. Despite the availability of various isolation techniques, ultracentrifugation is the standard technique that is being employed. Post isolation, exosomes are traditionally exposed to detergents for extracting their proteins, which can often lead to protein degradation. Further to this, it is very essential to develop a sensing platform for the quantification of clinically relevant proteins in a wider range to ensure practicality. In this study, exosomes were immobilized on the Au Screen Printed Electrode (SPE) using EDC/NHS chemistry to facilitate binding. After immobilizing the exosomes on the screen-printed electrode (SPE), we investigated the impact of the electric field by applying various voltages to induce exosome lysis and release their contents. The lysed solution was used for sensing TSG101, a crucial biomarker associated with various cancers, using both faradaic and non-faradaic electrochemical impedance spectroscopy (EIS) methods. The results of non-faradaic and faradaic EIS were comparable and showed good consistency, indicating that non-faradaic sensing can be a reliable alternative. Hence, the non-faradaic sensing technique was used for label-free quantification of the TSG101 biomarker. The results were validated using ELISA. Our electrochemical immunosensor demonstrated a consistent response of TSG101 from 125 pg/mL to 8000 pg/mL, with a detection limit of 0.125 pg/mL at room temperature. Additionally, since non-faradic sensing is label-free, the ease of usage and cost of the final sensor developed can be reduced. The proposed immunosensor is capable of detecting the TSG101 protein at low levels in healthy serum with good sensitivity and specificity, making it a promising platform for biomarker detection.

**Keywords :** biosensor, exosomes isolation on SPE, electric field lysis of exosome, EIS sensing of TSG101
**Conference Title :** ICBB 2024 : International Conference on Biosensors and Bioelectronics
**Conference Location :** Goa, India
**Conference Dates :** December 09-10, 2024