Biosensors & Bioelectronics-2013

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Biosensors & Bioelectronics

June 17-19, 2013 Hilton Chicago/Northbrook, USA

Intriguing application of nanoporous graphene oxide composite membrane in electrochemical nanobiosensing

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Abstract

Pore structure is an important feature of membranes and depends on the process of preparation along with several other factors including mechanical strength. Graphene, a single layer of graphite, is not only the thinnest material, but also the stiffest and strongest material in the world. A graphene-based membrane represents the thinnest membrane possible and has revolutionary applications in devices that could displace the relatively thick membranes currently in commercial use due to its thinnest barrier and smallest pore sizes attainability. These membranes may offer a combination of thickness, controlled pore-size ranges, and pore density that surpass even state-of-the-art track-etched membranes. Recently nanopores have been employed in immunoassay. Here we demonstrate a novel method of self-assembly of nanoporous GO/polycarbonate membrabe/air interface approach to prepare macroscopic composite GO membrane through vacuum filtration method. The GO was synthesized from natural graphite powder by a modified Hummers method. The GO/PCTE composite nanoporous membrane was subjected to electron beam to create porosity in transmembrane composite. The characterization of membranes was done by, Fourier Transform Infrared spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDX/EDS) and Thermo gravimetric Analyzer (TGA). The nanopore was functionalized by EDC/NHS through carboxylic group of GO to attach mesothelin antibodies, and the whole setup of electrochemical Nanobiosensor was used for the detection of mesothelin cancer line in human sera. The detection limit and specificity tests were also performed to advocate the superiority of developed system over conventional systems, QCM and SPR.

Biography

Dr. Krishna P. Singh has completed his Ph.D in 1997 from Aligarh Muslim University and joined J.V.C. of C.C.S. University in 1998. He has been visiting faculty at various university and institutions in United Kingdom, Slovakia, USA and Croatia. Currently he is an Associate Professor of Biophysics and Nanotechnology at G. B. Pant University of Agriculture and Technology, Pantnagar, India. He is also the Coordinator of Biophysics and officer in-charge of Bio-Nanotechnology and Nanobiosensor Research laboratories at CBSH, Pantnagar. He has published more than 100 research papers in reputed journals/conferences/seminar/workshop and serving as an editorial board member of reputed journals.

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