Ph.D. Finding Details:

March 10, 2014

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Title of Ph.D. Thesis	**Development of Nucleic Acid Biosensors for the Detection of Pathogen**

FINDINGS:

Cholera continues to pose a serious public health problem worldwide due to no access to adequate water and sanitation resources. The causative agent *V. cholerae* is responsible for cholera and acute diarrhoeal infection. The pathogenesis of cholera is associated with the production of an exotoxin, which is called cholera toxin (CT). Cholera is a very serious infectious disease and it can lead to death if untreated in earlier stage. The objective was to develop DNA based biosensor for such pathogen detection.

Tin oxide quantum dots (SnO_2-QDs), nanostructured magnesium oxide (nMgO) and their composite with biopolymer chitosan (CH) and conducting carbon-nanotubes (CNTs) were used as matrices for the biosensor. SnO_2-QDs (~ 1-5 nm) and nMgO (size < 10 nm) were synthesized via pulsed laser ablation (PLA) and sol-gel methods respectively. Films were deposited using electrophoretic deposition (EPD) technique on indium-tin-oxide (ITO) coated glass substrates. For the fabrication of nMgO nanocoposite based matrices (i) nMgO surface was modified with chitosan and (ii) nMgO was used for grafting with multi walled carbon nanotubes (MWCNTs) surface. CH is an excellent contender due to its film forming ability, better adhesion property, biocompatibility, and presence of amines/hydroxyl group for functionalization of biomolecules. Carboxyl functionalized MWCNTs (cMWCNTs) surface is suitable for grafting of MgO nanoparticles and provides better conduction path, which may result in increased electron transportation as well as high mechanical strength. The cell cytotoxicity (MTT) assay of synthesized MgO nanoparticles has been investigated using human intestinal cell lines (INT 407) and cervical cancer (SiHa).

The 23 bases single stranded DNA (ssDNA) probe specific to *V. cholerae* has been functionalized onto fabricated electrode surface via different immobilization techniques. The structural and morphological characterizations of fabricated electrodes and bioelectrodes have been performed using UV-vis, FT-IR, XRD, SEM, TEM, contact angle, Raman and XPS characterization techniques. CV, DPV and EIS techniques have been utilized to reveal the electrochemical behaviour of the fabricated electrodes and bioelectrodes.

These unique properties of CH-nMgO and nMgO-cMWCNTs nanocomposites offer excellent prospects for interfacing biological recognition events with electronic signal transduction for fabrication of biosensing device. It is found that nanostructured metal oxide based electrochemical DNA biosensors offer great advantages for rapid, sensitive and selective detection of infectious agents. The nMgO and nanocomposite based electrochemical DNA biosensor provide better sensitivity and fast response time as compared to the other reported methods. Therefore, the suggested method can be studied in details to develop a commercially viable metal oxide based DNA biosensor for rapid detection of *V. cholerae*.