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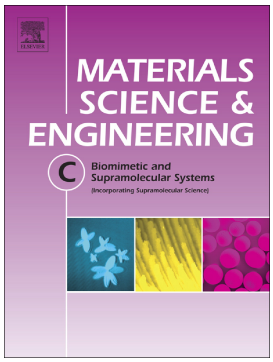

Electrochemical immunosensor based on magnetite nanoparticles incorporated into electrospun polyacrylonitrile nanofibers for vitamin-D3 detection

Deepika Chauhan, Pramod K. Gupta, Pratima R. Solanki

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Electrochemical immunosensor based on Magnetite Nanoparticles Incorporated into Electrospun Polyacrylonitrile Nanofibers for Vitamin-D_3 detection

Deepika Chauhan, Pramod K. Gupta, Pratima R. Solanki*

Special centre for Nanoscience, Jawaharlal Nehru University, New Delhi- 110067

Abstract

In the present study, magnetite nanoparticles (Fe_3O_4 NPs) incorporated polyacrylonitrile nanofibers (PANnFs) having diameter of 350-500 nm, were electrospun and directly collected onto indium tin oxide (ITO) coated glass substrate. X-ray diffraction pattern of Fe_3O_4-PANnFs conFsirmed the existence of Fe_3O_4 NPs within the PANnFs. Nafion was used to make Fe_3O_4-PANnFs more adhesive to the ITO surface. Partial hydrolyzation of Fe_3O_4-PANnFs/ITO electrode was done using NaOH solution for the partial conversion of nitrile group (C≡N) into carboxyl and amine groups that was conFsirmed by Fourier transform inFsra-red spectroscopy study. The hydrolyzed Fe_3O_4-PANnFs/ITO electrode was used as an immobilization matrix for monoclonal antibody specific to Vitamin-D_3 (Anti-VD) *via* 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide and N-Hydroxysuccinimide chemistry. Bovine serum albumin was used as a blocking agent to block the non-specific sites onto Anti-VD/Fe_3O_4-PANnFs/ITO electrode surface. Fabricated BSA/Anti-VD/Fe_3O_4-PANnFs/ITO immunoelectrode showed improved biosensing parameters for Vitamin-D_3 detection such as sensitivity of 0.90 μA ng^{-1} mL cm^{-2}, limit of detection of 0.12 ng $mL^{-1}$and detection range of 10 - 100 ng mL^{-1}. The association and dissociation constants were obtained as 74.62 ng mL^{-1}, 4.6 ng mL^{-1}, respectively.

Keyword: Electrospinning; magnetite NPs; PAN nanofibers; Immunosensor; Vitamin-D_3

*Corresponding author: (PRS) pratimarsolanki@gmail.com; partima@mail.jnu.ac.in. Phone -91-11-26704740.