

Accepted Manuscript

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PII: S0141-8130(17)34378-7
DOI: <https://doi.org/10.1016/j.ijbiomac.2017.12.122>
Reference: BIOMAC 8784



To appear in: *International Journal of Biological Macromolecules*

Received date: 7-11-2017
Revised date: 21-11-2017
Accepted date: 20-12-2017

Please cite this article as: Tamal Sarkar, H.B.Bohidar, Pratima R.Solanki, Carbon Dots-modified Chitosan based electrochemical biosensing Platform for Detection of Vitamin D, International Journal of Biological Macromolecules <https://doi.org/10.1016/j.ijbiomac.2017.12.122>

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Carbon Dots-modified Chitosan based electrochemical biosensing Platform for Detection of Vitamin D

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Abstract

Here in, a carbon dots (CDs)-modified chitosan (CH) based sensor platform was fabricated for vitamin D₂ detection. Carbon dots were synthesized through microwave pyrolysis method, and characterized with transmission electron microscopy, Raman spectroscopy, Fourier transform infrared spectroscopy, and UV/VIS spectroscopy. Chitosan (1%) solution was prepared in acetic acid (1%) solution and followed by the addition of CDs to prepare the carbon dots-chitosan (CD-CH) composite. A thin film of film of CD-CH composite was prepared onto ITO glass substrate (CD-CH/ITO) by drop casting method. Surface of the composite film was characterized by atomic force microscopy, static contact angle measurement and cyclic voltammetry. CD-CH/ITO surface was further modified with immobilization of vitamin D₂ antibody (Ab-VD₂) and bovine serum albumin (BSA) to prepare BSA/Ab-VD₂/CD-CH/ITO bioelectrode. Electrochemical response of the bioelectrode towards vitamin D₂ antigen (Ag-VD₂) was carried out by differential pulse voltammetry. The biosensing electrode showed linearity within the range 10-50 ng mL⁻¹ of Ag-VD₂ concentration. The sensitivity was found to be 0.2 $\mu\text{A ng}^{-1}\text{mL cm}^{-2}$, LOD was 1.35 ng mL⁻¹, had a shelf-life of about 25 days.

Keywords: Chitosan; Carbon dots, Citric acid, Vitamin D₂, Electrochemical, Immunosensor.

Introduction

Carbon dots (CDs) are the new addition to the carbon nanomaterial family. CDs were accidentally discovered in 2004 while purifying and separating single-walled carbon nanotubes (SWCNT). Since its discovery CDs have attracted tremendous attention due to their electronic, biochemical, and optical properties [1] i.e., high solubility [2-3], green synthetic routes [2, 4-6], stable fluorescence, easy functionalization, low toxicity [5], high electrochemical response, [7-8]

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