Highly Efficient Electrochemical Biosensing Platform by Employing Conductive Nanocomposite Entrapping Magnetic Nanoparticles and Oxidase in Mesoporous Carbon Foam

김문일, 예영진[1], 원병연, 신수정, 이진우[1], 박현규*
KAIST; [1]POSTECH
(hgpark@kaist.ac.kr*)

A conductive multi-catalyst system consisting of Fe_3O_4 magnetic nanoparticles (MNPs) and oxidative enzyme co-entrapped in the pores of mesoporous carbon is developed as an efficient and robust electrochemical biosensing platform. The construction of the nanocomposite begins with the incorporation of MNPs by impregnating $Fe(NO_3)_3$ on a wall of mesoporous carbon followed by heat treatment under an inert atmosphere, which results in the formation of magnetic mesoporous carbon (MMC). Glucose oxidase (GOx) is subsequently immobilized in the remaining pore spaces of the MMC by using glutaraldehyde crosslinking to prevent enzyme leaching from the matrix. H_2O_2 generated by the catalytic action of GOx in proportion to the amount of target glucose is subsequently reduced into H_2O by the peroxidase mimetic activity of MNPs with the generated cathodic current, which can be detected through the conductive carbon matrix.