Development of Carbon Nanotube-Based Electrochemical Biocatalyst by One-Step as Platform for Biosensing

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Fabrication of biocatalysts for biosensing and/or bio fuel-cells for energy generation implies the development of a proper enzymatic immobilization process. This means that the process be cheap, fast, scalable and controllable, allowing the stability of the bioelement and preserving its catalytic activity. Even though, manual procedures and encapsulation in sol-gel matrix or chitosan gels, have been widely employed to confine different enzymes, working conditions, use of cross-linking agents and lack of control in the thickness layer, reduce both the enzyme activity and the reproducibility of the biosensors. In this sense, electrochemical entrapment of bioreceptor, employing electroactive polymers has been an attractive alternative for development of reproducible procedures. In this work, a bioelectrocatalyst has been developed, using carbon nanotubes electrochemically modified with N and P functionalities and glucose dehydrogenase-PQQ dependent, as model enzyme. Electrochemical functionalization of the carbon nanotubes using 4-Aminophenyl phosphonic acid (4-APPA) in presence of the enzyme, promotes both the surface functionalization of the carbon material and the enzyme entrapment. Interestingly, this methodology improves the biosensor performance and allows us manufacturing a biocatalyst by-one-step. The potential applied during electrochemical modification presents an important effect in the amount of N and P incorporated and in the amount of the enzyme entrapped, improving the electrocatalytic towards the glucose oxidation.