Characterization of MWCNT/PS/antibody membrane prepared by phase inversion method for biosensing applications

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Recent advances in nanoscience greatly influence in the field of electrochemical biosensors during the past years. This has carried an important development of new bio-compatible and highly conductive materials for biosensing applications.

The combination of multi-walled carbon nanotubes (MWCNT) as transducer with polysulfone (PSf) polymer offers unique properties for the easy incorporation of biological moieties providing a composite with high electrochemical response to corresponding analytes. The phase inversion method has been used in recent years for the immobilization of enzymes, proteins and antibodies into polymers [1]. Some of them have been used for their application in biosensors field.

For the design of bio-sensors, the crucial step is the immobilization of biological reagent into/onto the electrode surface, in this case the immuno-reagent. In the phase inversion technique, a thin film of polymer solution is deposited on an inert substrate and then immersed into a coagulant bath containing a non-solvent with respect to the polymer, rapid exchange of the solvent by non-solvent results in diffusion-induced phase separation and membrane formation [2,3]. With this method, biomolecules are easily incorporated and exhibit long-time resistance into the matrix.

Confocal Scanning Laser Microscopy (CSLM) is a rapidly advancing imaging technique which obtains high-resolution images of membranes at successive depths, therefore offers a three-dimensional view of membrane [4]. This technique allows working in two modes. In the reflective mode, CSLM has been mostly applied examine non-biological substrates and polymers and in the fluorescence mode CSLM has been used to analyze antibody localization using labeled antibodies.

In this work, we applied CSLM as a new nondestructive method to characterize the membrane and to study the immobilization of the antibodies in order to cast it onto screen-printed electrodes.

Other techniques as X-Ray Powder Diffraction, Scanning Electron Microscope (SEM) or Infrared Spectroscopy have completed the study of characterization of this composite membrane. Amperometric and voltammetric characterization is also made for the biosensing application.

References:

[1] Zhang,M., Gorski, W., J Am Chem Soc, **127** (2005) 2058-2059.
[2] Mulder,M., Kluwer Academia Publishers,(2000)
[3] Sánchez, S., Fàbregas, E., Biosens.Bioelectron., **22(6)** (2007) 965-972.
[4] Charcosset, C., Cherfi, A., Bernengo, J-C.,Chemical Engineering Science, **55** (2005) 5351-5358.

Figures:

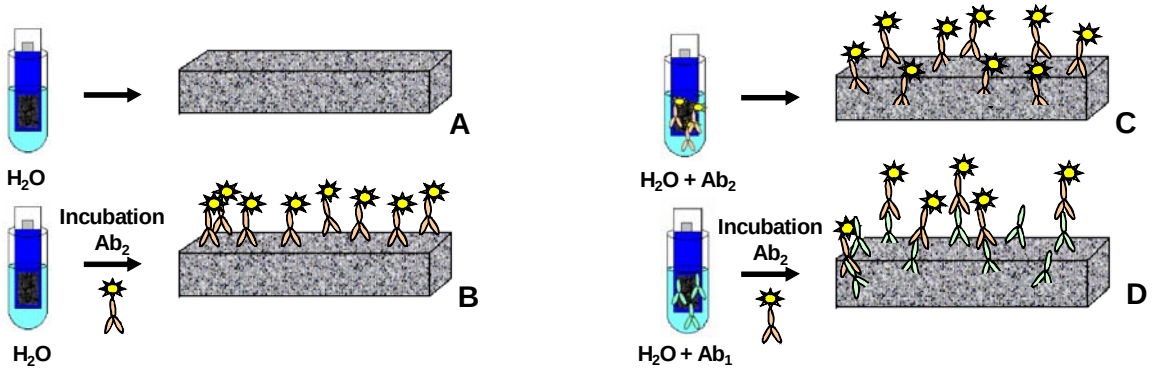

Fig.1 A) PSf/ CNT membrane prepared by phase inversion in H_2O. B) Sample of unspecific adsortion by incubation with AntiRIgG-Alexa568. C) AntiRIgG-Alexa568 introduced by phase inversion. D) RIgG introduced by phase inversion and incubated later with AntiRIgG-Alexa568

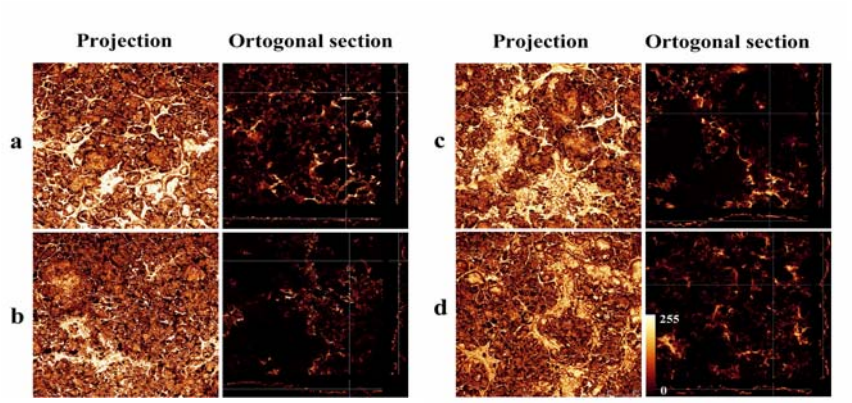

Fig.2 Membrane projection and ortogonal section of the different types of samples