Nanostructured biosensor for fumonisin B1 based on paramagnetic beads and a monoclonal antibody

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Fumonisin B1 (FB1) is a mycotoxin produced by several Fusarium fungi, classified as a possible human carcinogen agent by the IARC (International Agency for Research on Cancer) in Group 2B (2002). In animals, this mycotoxin causes diseases such as equine leukoencephalomalacia (ELEM) in horses and pulmonary oedema (PE) in pigs. Other toxic effects include carcinogenicity, hepatotoxicity, nephrotoxicity and effects on the immune system. In humans, ingestion of these toxins is linked to high rate of esophageal cancer in areas of South Africa and China. Therefore the European Commission suggests that the maximum tolerable intake of fumonisin is 2 µg kg^{-1} body weight.

A nanostructured amperometric immunosensor with disposable screen-printed carbon electrodes (SPCEs) is a valuable analytical tool that can be used in a portable system for in situ determination of this mycotoxin, with a sensitivity and selectivity comparable or superior to that obtained by traditional ELISA methods but with a much lower reagent consumption and a decrease in the time necessary of the determination.

This work has been initiated to study the bioaffinity reaction between a monoclonal antibody to FB1 and this mycotoxin by ELISA. The development of different schemes for obtaining a direct competitive immunosensor for FB1 has been also studied, using a specific monoclonal antibody and magnetic nanoparticles functionalized with tosyl group.

This study will allow the design of various schemes of the immunoassay in solution and a good electrochemical detection on the SPCEs surface, avoiding problems of nonspecific adsorption or electroactive interferences. Finally, we discuss the advantages of using Surface Plasmon Resonance (SPR) for detection of biorecognition signal between monoclonal antibody and FB1.

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