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Quartz Crystal Microbalance Based Hydrophobic Nanosensor for Lysozyme Detection

Authors : F. Yılmaz, Y. Saylan, A. Derazshamshir, S. Atay, A. Denizli

Abstract : Quartz crystal microbalance (QCM), high-resolution mass-sensing technique, measures changes in mass on oscillating quartz crystal surface by measuring changes in oscillation frequency of crystal in real time. Protein adsorption techniques via hydrophobic interaction between protein and solid support, called hydrophobic interaction chromatography (HIC), can be favorable in many cases. Some nanoparticles can be effectively applied for HIC. HIC takes advantage of the hydrophobicity of proteins by promoting its separation on the basis of hydrophobic interactions between immobilized hydrophobic ligands and nonpolar regions on the surface of the proteins. Lysozyme is found in a variety of vertebrate cells and secretions, such as spleen, milk, tears, and egg white. Its common applications are as a cell-disrupting agent for extraction of bacterial intracellular products, as an antibacterial agent in ophthalmologic preparations, as a food additive in milk products and as a drug for treatment of ulcers and infections. Lysozyme has also been used in cancer chemotherapy. The aim of this study is the synthesis of hydrophobic nanoparticles for Lysozyme detection. For this purpose, methacryoyl-L-phenylalanine was chosen as a hydrophobic matrix. The hydrophobic nanoparticles were synthesized by micro-emulsion polymerization method. Then, hydrophobic QCM nanosensor was characterized by Attenuated total reflection Fourier transform infrared (ATR-FTIR) spectroscopy, atomic force microscopy (AFM) and zeta size analysis. Hydrophobic QCM nanosensor was tested for real-time detection of Lysozyme from aqueous solution. The kinetic and affinity studies were determined by using Lysozyme solutions with different concentrations. The responses related to a mass (Δm) and frequency (Δf) shifts were used to evaluate adsorption properties.

Keywords : nanosensor, HIC, lysozyme, QCM
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