World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:9, No:03, 2015

Determination of Cyclic Citrullinated Peptide Antibodies on Quartz Crystal Microbalance Based Nanosensors

Authors : Y. Saylan, F. Yılmaz, A. Denizli

Abstract : Rheumatoid arthritis (RA) which is the most common autoimmune disorder of the body's own immune system attacking healthy cells. RA has both articular and systemic effects.Until now romatiod factor (RF) assay is used the most commonly diagnosed RA but it is not specific. Anti-cyclic citrullinated peptide (anti-CCP) antibodies are IgG autoantibodies which recognize citrullinated peptides and offer improved specificity in early diagnosis of RA compared to RF. Anti-CCP antibodies have specificity for the diagnosis of RA from 91 to 98% and the sensitivity rate of 41-68%. Molecularly imprinted polymers (MIP) are materials that are easy to prepare, less expensive, stable have a talent for molecular recognition and also can be manufactured in large quantities with good reproducibility. Molecular recognition-based adsorption techniques have received much attention in several fields because of their high selectivity for target molecules. Quartz crystal microbalance (QCM) is an effective, simple, inexpensive approach mass changes that can be converted into an electrical signal. The applications for specific determination of chemical substances or biomolecules, crystal electrodes, cover by the thin films for bind or adsorption of molecules. In this study, we have focused our attention on combining of molecular imprinting into nanofilms and QCM nanosensor approaches and producing QCM nanosensor for anti-CCP, chosen as a model protein, using anti-CCP imprinted nanofilms. For this aim, anti-CCP imprinted QCM nanosensor was characterized by Fourier transform infrared spectroscopy, atomic force microscopy, contact angle measurements and ellipsometry. The non-imprinted nanosensor was also prepared to evaluate the selectivity of the imprinted nanosensor. Anti-CCP imprinted QCM nanosensor was tested for real-time detection of anti-CCP from aqueous solution. The kinetic and affinity studies were determined by using anti-CCP solutions with different concentrations. The responses related with mass shifts (Δm) and frequency shifts (Δf) were used to evaluate adsorption properties and to calculate binding (Ka) and dissociation (Kd) constants. To show the selectivity of the anti-CCP imprinted QCM nanosensor, competitive adsorption of anti-CCP and IgM was investigated.The results indicate that anti-CCP imprinted QCM nanosensor has a higher adsorption capabilities for anti-CCP than for IgM, due to selective cavities in the polymer structure.

Keywords : anti-CCP, molecular imprinting, nanosensor, rheumatoid arthritis, QCM
Conference Title : ICNN 2015 : International Conference on Nanoscience and Nanotechnology
Conference Location : London, United Kingdom
Conference Dates : March 14-15, 2015