Protein depletion with bacterial cellulose nanofibers

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Protein Depletion with Bacterial Cellulose Nanofibers

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Abstract

In this study, we have reported a novel fabrication technique for human serum albumin (HSA) imprinted composite bacterial cellulose nanofibers (MIP-cBCNFs) used for the depletion of HSA selectively from artificial blood plasma for proteomic applications. Molecular imprinting was achieved by using metal ion coordination interactions with N-methacryloyl-(L)-histidinemethylester (MAH) and Cu(II) ions. MAH-Cu(II)-HSA complex was polymerized with bacterial cellulose nanofibers (BCNFs) under constant stirring at room temperature. The characterization of the MIP-cBCNFs were carried out by FTIR-ATR, SEM, contact angle measurements and surface area measurements. The adsorption experiments of HSA onto the MIP-BCNFs and NIP-BCNFs from aqueous HSA solutions were investigated in a batch system. The selectivity of the MIP-cBCNFs was investigated by using non-template human transferrin (HTR), and myoglobin (Myo). The relative selectivity coefficients of the MIP-cBCNFs were calculated as 4.73 and 3.02 for HSA/HTR and HSA/Myo molecules, respectively. In addition, the depletion of HSA from artificial human plasma was confirmed by SDS-PAGE and 2-D gel electrophoresis. As a result, it has been shown that metal ion coordination interactions contribute to specific binding of template when preparing MIP-cBCNFs for the depletion of HSA with a high adsorption capacity, significant selectivity and reusability.

Key words: Bacterial cellulose nanofibers, metal-ion coordination, molecular imprinted polymers, protein recognition, proteomics.

Introduction

Biochemically, cellulose is a polysaccharide formed by condensation polymerization of long chain anhydroglucose units linked by β-1,4 glycosidic bonds. Although the plants are the primary cellulose producers, the cellulose synthesized from bacteria has a high degree of polymerization, high crystallinity, high water retention capacity, high elasticity, high mechanical stability and high purity [1-2]. Bacterial cellulose nanofibers (BCNFs) is a nanomaterial synthesized naturally, and an increasing number of publications show that many researchers