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Synthesis of porous molecularly imprinted polymers for selective adsorption of glutathione

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Abstract

An effective approach overcome the classical deficiencies of biomolecules molecularly imprinted polymers (MIPs), that is, low binding capacity and slow mass transfer rate, is proposed. With glutathione (GSH) as target molecule, porous imprinted layers were fabricated according to our newly developed method the introduction of a mixture of acetontrile and dimethylsulfoxide as porogen in surface-initiated polymerization systems. The resultant MIPs particles exhibited a large surface area could remarkably improve the imprinting effect in relation to a significantly increased imprinting factor and mass transfer rate, compared to the MIPs prepared by using aqueous solution as solvent. The batch static binding tests were carried out to evaluate the adsorption kinetics, adsorption isotherms and selective recognition of the MIPs particles. The binding behavior followed the pseudo-second order kinetic model, revealing that the process was chemically carried out. Two binding isotherm models were applied to analyze equilibrium data, obtaining the best description by Langmuir isotherm model. In addition, the selective of separation and extraction of GSH from a mixture of GSH and its structural analogs could be achieved on the MIPs solid-phase extraction cartridge, indicating that the possibility for the separation and enrichment of the template from complicated matrices.

Keywords: Porous molecularly imprinted polymer; Solid-phase extraction; Porogen; Glutathione.

1. Introduction

Glutathione (GSH, 5-L-Glutamyl-L-cysteinylglycine) is a tripeptide with three amino acid residues [1-3]. Many approaches, including spectrofluorometry [4], capillary electrophoresis [5] and chromatography [6], have been proposed to analyze GSH in biological matrices. Although these methods can offer more sensitive approaches to GSH analysis, relatvely expersive intruments, which are not yet available in all laboratories, are reuired. Theremore, most of the reported determination methods have difficulty in direct separation and enrichment of GSH from complex matrcices through sample pretreatment [7]. Generally, GSH is present in complex samples at low concentrations, thus, developing a simple and novel determination method appropriate for GSH is necessary.

Molecular imprinting is a technique to generate artificial receptors with specific binding sites, which are tailor-made *in situ* by copolymerization functional monomers and cross-linkers in the presence of a target template and suitable porogen [8-9]. As compared with natural recognition materials, e.g. antibodies and enzymes, molecularly imprinted polymers (MIPs) offer several advantages, such as favorable mechanical,

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