



Synthesis of Molecularly Imprinting Polymers for the Removal of Xylenol Orange from Water

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ABSTRACT

The molecularly imprinted polymers (MIPs) were prepared by using the non-covalent approach. In the polymerization process, xylene orange was used as a template (T), acrylic acid as a functional monomer (M), divinylbenzene as a cross-linker (CL) and 2,2'-azobisisobutyronitrile (AIBN) as an initiator and microemulsion as a solvent. The synthesized polymers were characterized by using FTIR and SEM micrograph. The batch binding analysis was used to evaluate the rebinding efficiency of imprinted polymers. The highest rebinding efficiency was obtained from the MIP-R2 (0.1:0.6:2, T:M:CL). The selected MIP-R2 was used for the removal of xylene orange from the water sample and have shown removal efficiency of about 80%.

INTRODUCTION

The molecularly imprinting technology was first introduced by Wulff & Sarhan (1972) and was expanded by Mosbach and coworkers in 1980s (Andersson et al. 1984). This technology enables us to synthesize the materials with highly specific receptor sites towards the target molecules. MIPs are categorized as highly cross-linked polymers and can bind target compounds with high specificity. They are synthesized in the presence of the target molecule which acts as a template (Lok & Son 2009). MIPs have been attributed several advantages such as high selectivity and affinity, high stability and the ease of preparation (Piletsky et al. 2006). They can also be used repeatedly without loss of activity with high mechanical strength and are durable to harsh chemical media, heat and pressure as compared to biological receptors (Lavignac et al. 2004). Svenson and Nicholas (Svenson & Nicholls 2001), have proved that polymers are thermally resilient and can retain their chemical affinity.

The most important condition to produce MIP network with high potential recognition sites is that there must be a good interaction between monomer and template. Based on the nature of pre-polymerization interactions between the template and monomer, there are two strategies employed for MIP technology. Self-assembling approach (Arshady & Mosbach 1981), similar to the biological recognition

systems where non-covalent forces like hydrogen bonds, Van der Waals forces, ion or hydrophobic interaction and metal coordination were used. The most frequent approach for the preparation of MIPs is self-assembling. This is due to the simplicity of complex formation and dissociation and the flexibility where available functional monomers can interact with almost any type of templates.

MIPs have been successfully applied in various fields such as in chiral separation, solid-phase extraction, biomimetic sensor, and controlled release devices of several drugs (Caro et al. 2006). It has been used widely for the detection and treatment of water pollutants even at very low concentrations (Schreibera et al. 2009). Molecularly imprinted materials can also be used in combination with the catalyst to form novel composite adsorbent or catalyst systems.

Xylenol orange, [3,3-bis-N, N, bis-(carboxymethyl) aminomethyl-o-cresolsulfonephthalain] is used for the determination of many metal ions because it is an excellent complexometric indicator and potentiometric reagent. The effluents discharged from xylene orange manufacturing industries and laboratories pollute water bodies. In this way, the presence of xylene orange in the water bodies further attracts heavy metals and causes various health problems to both humans and aquatic animals. Therefore, removal of xylene orange from the water is very important to safe-