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Efficiency of a Molecularly Imprinted Polymer for Selective Removal of Chlorpyrifos from Water Samples

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Abstract : Chlorpyrifos is an organophosphorus pesticide which can be found in environmental water samples. The efficiency and reuse of a molecularly imprinted polymer (chlorpyrifos - MIP) were investigated for the selective removal of chlorpyrifos residues. MIP was prepared with UV curing thiol-ene polymerization technology by using multifunctional thiol and ene monomers. The thiol-ene curing reaction is a radical induced process, however unlike other photoinitiated polymerization processes, this polymerization process is a free-radical reaction that proceeds by a step-growth mechanism, involving two main steps; a free-radical addition followed by a chain transfer reaction. It assures a very rapidly formation of a uniform crosslinked network with low shrinkage, reduced oxygen inhibition during curing and excellent adhesion. In this study, thiol-ene based UV-curable polymeric materials were prepared by mixing pentaerythritol tetrakis(3-mercaptopropionate), glyoxal bis diallyl acetal, polyethylene glycol diacrylate (PEGDA) and photoinitiator. Chlorpyrifos was added at a definite ratio to the prepared formulation. Chemical structure and thermal properties were characterized by FTIR and thermogravimetric analysis (TGA), respectively. The pesticide analysis was performed by gas chromatography-mass spectrometry (GC-MS). The influences of some analytical parameters such as pH, sample volume, amounts of analyte concentration were studied for the quantitative recoveries of the analyte. The proposed MIP method was applied to the determination of chlorpyrifos in river and tap water samples. The use of the MIP provided a selective and easy solution for removing chlorpyrifos from the water.

Keywords : molecularly imprinted polymers, selective removal, thilol-ene, uv-curable polymer
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