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Synthesis and characterization of molecular imprinting polymer for the removal of 2-phenylphenol from spiked blood serum and river water

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Abstract

Background: The 2-phenylphenol is used as an agricultural fungicide. It is generally applied for the post-harvest treatment of fruits and vegetables to protect against microbial damage. It is also used for waxing of citrus fruits and for disinfection of seed boxes. It has been reported that 2-phenylphenol has some toxic effects human beings due to its disposal in the environment. Therefore, preparation of selective materials for the extraction of 2-phenylphenol is important. For this purpose, molecular imprinting polymer (MIP) were prepared by precipitation polymerization using 2-phenylphenol as the template molecule, styrene as the functional monomer, and divinyl benzene as the cross-linker with a non-covalent approach.

Results: The polymers were characterized by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), Fourier transform infra red spectroscopy (FT-IR), and Brunauer–Emmett–Teller (BET). The results obtained from SEM depicted that the shape of polymer particles is spherical with uniform size in micrometers. The BET results also showed better surface area ($131.44 \text{ m}^2 \text{ g}^{-1}$), pore size (7.9587 \AA), and pore volume (5.23 cc g^{-1}) of MIP as compared to NIP. The batch adsorption test was conducted to select a most specific polymer in terms of affinity towards the template. A series of parameters such as initial concentration, polymer dosage, effect of pH, and selectivity with structural analog were conducted. The selectivity of MIP towards the 2pp was very appreciable as compared to its structural analog biphenyl with a good adsorption capacity. Moreover, the MIP as an extractant was successfully applied for extraction of 2-phenylphenol from the spiked blood serum (93%) and river water sample (88%).

Conclusion: Molecular imprinting polymer has been successfully synthesized for the selective extraction of 2-phenylphenol from biological and environmental samples. The synthesized material has been applied for the extraction of 2-phenylphenol from blood serum and river water.

Keywords: Molecularly imprinted polymer, Precipitation polymerization, 2-Phenylphenol, Blood serum, River water

Introduction

2-Phenylphenol is a white-colored, flaky crystalline solid used as a biocide in food preservative. 2-Phenylphenol (orthophenylphenol), and its sodium salt sodium o-phenylphenate (SOPP), were evaluated as broad-spectrum fungicides and disinfectants with widespread

agricultural, industrial, and domestic usage [1]. 2pp has historically been among the most widely used home and garden pesticides. 2pp is a waxy substance used as a coating agent to protect a variety of crops from storage diseases [1]. 2pp is a typical compound commonly mixed with other phenolic compounds, and the mixtures can be very irritating at sufficiently higher concentrations [2]. Due to the widespread use of especially 2pp and SOPP, the potential for consumer exposure and some “critical” findings the toxicological database is quite extensive and

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