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Preconcentration Techniques

OPTIMIZATION OF THE TEMPERATURE FOR THE EXTRACTION OF PHARMACEUTICALS FROM WASTEWATER BY A HOLLOW FIBER SILICONE MEMBRANE

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The influence of temperature on the extraction and selectivity of naproxen, ibuprofen, and triclosan by a thin-walled hollow fiber silicone rubber membrane was investigated. Determination of the diffusion coefficients and flux values at 25, 40, and 60 degrees Celsius was undertaken. The diffusion coefficient and flux were found to increase with temperature. It was also observed that at higher temperatures, mass transfer was influenced by the amount extracted in the acceptor phase. However, diffusion from the bulk donor phase through the hollow fiber silicone rubber membrane was shown to control the transport of analytes at lower temperatures. When applied to wastewater, the hollow fiber silicone rubber showed remarkable selectivity toward the analytes. However, at high temperatures, the amount of matrix components extracted also increased slightly. The amount extracted nearly doubled when extraction was performed at 40 degrees Celsius compared to 25 degrees Celsius, indicating that temperature increased the efficiency of the hollow fiber silicone rubber membrane. The application of the technique to municipal wastewater showed remarkable selectivity and reproducibility. The concentrations of these compounds were from 18.4 (1.37 percent) micrograms per liter for triclosan to 1.1 (0.16 percent) micrograms per liter for naproxen in the influent and 2.7 (0.29 percent) micrograms per liter for triclosan to 0.4 (0.01 percent) micrograms per liter for naproxen in the effluent.

Keywords: High-performance liquid chromatography; Hollow fiber silicone; Pharmaceuticals; Wastewater

INTRODUCTION

Currently, there is a move toward using greener sample preparation techniques. These are extraction techniques that use no organic solvents, minimal organic solvents, and/or environmental friendly solvents typically in microliter volumes (Thordarson et al. 1996; Pedersen-Bjergaard and Rasmussen 1999; Chimuka

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