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Abstract

Selective Removal of Direct Green-6 from Textile Wastewater Using Molecularly Imprinted Polymers †

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The textile industry is one of the main sectors contributing to water pollution, with dyes being among the most significant pollutants in wastewater. In this study, molecularly imprinted polymers (MIPs) were used for the removal of Direct Green-6 (DG-6), a dye commonly found in textile wastewater. MIPs are artificially synthesized polymers that contain specific binding sites for target molecules. Due to this property, they stand out as an effective method for the selective removal of environmental pollutants.

In this study, DG-6-specific MIPs were synthesized using the bulk polymerization method and optimized with different ratios of MAA (methacrylic acid), EGDMA (ethylene glycol dimethacrylate), and the initiator AIBN (azobisisobutyronitrile). After polymerization, DG-6 was removed from the polymers through washing steps using various methanol/acetic acid solutions. The efficiency of template molecule removal was evaluated using spectrophotometric methods, and the obtained MIP and NIP (non-imprinted polymer) samples were characterized using FT-IR spectroscopy.

According to the results of adsorption studies, the most efficient removal was achieved by the polymer synthesized at a 1:50:150 ratio, referred to as "β MIP." This polymer achieved 46% dye removal after 20 h of adsorption. The results indicate that MIPs can effectively recognize and remove complex pollutants such as DG-6 dye.

This study demonstrates that molecularly imprinted polymers offer a cost-effective, selective, and environmentally friendly alternative for dye removal from textile wastewater and lays the groundwork for their use in advanced treatment processes.

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