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Entitled

HYBRID ENZYME/NANO-SUPPORT BIOCATALYSTS FOR EFFICIENT WASTEWATER REMEDIATION

by

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Abstract

The existence of various bioactive organic pollutants in wastewater and municipal water sources has raised concerns regarding their potential effects on human health. As a result, different techniques are being explored to effectively break down these persistent organic pollutants. Peroxidases have recently emerged as a new approach to remediation that may have advantages over traditional methods. However, evaluating the effectiveness of different peroxidases in breaking down different emerging pollutants can be time-consuming and difficult. In this study, a quick and reliable method was developed to test the degradability of 21 emerging pollutants by five different peroxidases (soybean peroxidase, chloroperoxidase, lactoperoxidase, manganese peroxidase, and horseradish peroxidase) using an LC-MSMS approach. Additionally, the role of a redox mediator was examined in the enzymatic degradation tests. The findings revealed that some of the organic pollutants can be easily degraded by all five of the peroxidases, while others are only degraded by a specific peroxidase or in the presence of a redox mediator. Furthermore, two support materials (hybrid nanoflowers and metal organic framework) was synthesised for efficient, recyclable, and reusable for the degradation of these pollutants, we have created, characterized, and applied hybrid nanoflowers embedded with laccase enzymes and metal organic framework embedded with horseradish peroxidase. Both nanomaterials had a large surface area. Moreover, these materials were found that they could be reused for five cycles and stored for 21 days at 4 ◦C. Our findings indicate that enzyme-embedded hybrid nanoflowers/ metal organic framework is a powerful remediation tool for pollutants degradation. Additionally, the successful immobilization of enzymes on hybrid nanoflowers/ metal organic framework demonstrated in this study could enable the efficient recycling of enzymes for multiple degradation cycles, potentially leading to scaling up and the creation of a bioreactor.

Keywords:

Emerging pollutants, redox mediator, hybrid nanoflowers, metal organic framework Water remediation, water treatment