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Effects of TiO_2 on the laccase enzyme immobilization and the bisphenol-A removal of the ceramic membranes

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ABSTRACT

This research investigates the effects of titanium dioxide (TiO_2) on the laccase enzyme immobilization and the BPA removal performance of the ceramic membranes. There were four types of experimental ceramic membranes: the ceramic membrane, TiO_2-coated membrane, laccase-immobilized membrane, and laccase-immobilized TiO_2-coated membrane. The laccase concentrations were varied between 0, 500, 2500 and 5000 U L^{-1}. The experimental results revealed that TiO_2 improved the laccase immobilization as TiO_2 increased the membrane surface area, formed the mesoporous structure and induced the stronger binding between the membrane surface and the enzyme. Moreover, the laccase-immobilized TiO_2-coated membrane with 5000 U L^{-1} laccase concentration achieved the highest BPA removal efficiency of 93%. The TiO_2-coated membrane could achieve a higher BPA removal efficiency (31%) than the ceramic membrane (9%) and the 500 U L^{-1} laccase-immobilized membrane (20%). The finding was attributable to the improved degradation of organic pollutants as a result of higher photocatalytic performance under visible light and the enhanced organic-pollutants adsorption capacity of the TiO_2-coated membrane.

Keywords: Ceramic membranes; TiO_2; Laccase enzyme; Bisphenol-A removal

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