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Entitled

DEVELOPMENT OF NOVEL PEROXIDASE-TiO_2/ZnO HYBRID CATALYSTS FOR THE DEGRADATION OF EMERGING POLLUTANTS

By

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Abstract

Water pollution by different organic compounds is one of the most important environmental issues that is attracting the attention of many scientists due to its direct potential bad effect on human health. These organic pollutants include pesticides, pharmaceuticals, industrial wastes and personal care products that are released in water bodies from domestic and industrial discharge. Various chemical, physical and biological approaches have been proposed to degrade these contaminants from the polluted water. In the present study, we immobilized versatile thermostable enzymes, Soybean peroxidase (SBP) and Horseradish peroxidase on a functionalized photocatalysts - TiO_2 and ZnO to create novel bio-composite catalysts (SBP-TiO_2, SBP-ZnO, HRP-TiO_2 and HRP-ZnO). These hybrid bio-catalysts appeared to have similar pH optima as 'free/un-immobilized" peroxidases, as well as similar thermal stabilities. Furthermore, we used the "combined enzyme-chemical oxidation" remediation strategy which combined a photocatalytic oxidation step with peroxidase activity to study the degradation of 21 different emerging organic pollutants, using LC-MSMS. Our results showed that immobilization of the enzymes onto solid photocatalytic supports not only allowed for the recycling of enzymes, but also created a potentially more potent hybrid catalyst as compared to free enzyme. Many emerging pollutants were degraded more efficiently using the hybrid biocatalysts rather than using the enzyme alone or the photocatalyst alone.

Keywords: Emerging pollutants, bioremediation, advanced oxidation process, enzymes, horseradish peroxidase, soybean peroxidase, photocatalysts, zinc oxide, titanium dioxide, and immobilization.