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Title: Evaluating the biocatalytic potential of fruit peel-derived eco-enzymes for sustainable textile wastewater treatment

Abstract:

The innovative utilization of compostable waste for synthesizing eco-enzymes presents a novel approach to textile wastewater treatment. In this study, we synthesized eco-enzymes from banana, pineapple, and orange fruit peels and characterized their biocatalytic and antimicrobial attributes. The eco-enzymes possess noteworthy protease, lipase, and amylase activity conducive to wastewater treatment. The one-way analysis of variance (ANOVA), revealed significant differences among eco-enzymes derived from different fruit peels ($p < 0.05$). Although all eco-enzymes demonstrated antimicrobial attributes, orange peel-derived eco-enzymes exhibited the most potent activity against both gram-positive and gram-negative bacterial strains. Besides, when subjected to eco-enzymes, the textile wastewater showed an 80–85% decrease in biological oxygen demand (BOD), an 81–85% reduction in chemical oxygen demand (COD), a 35–37% decrease in total dissolved solids (TDS), a 55–60% reduction in total suspended solids (TSS), substantial reduction in pH, and enhancement in dissolved oxygen (DO) content after 100 h of treatment. Additionally, ANOVA analysis on the efficacy of treating textile wastewater by eco-enzymes revealed significant differences from the conventional treatment method ($p < 0.05$). These findings underscore the potential of eco-enzyme treatment to produce distinctive and environmentally beneficial results in textile wastewater treatment.

Keywords: Eco-enzyme, Sustainability, Fermentation, Recycled fruit waste, Textile wastewater

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