From Waste to Worth: Comparing Varying Cellulase Enzyme Concentrations on the Separation of Mixed Poly-Cotton Fibers

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The fashion industry generates substantial textile waste, contributing to environmental pollution and resource depletion. This study investigates the enzymatic separation of mixed poly-cotton fibers to enhance textile recycling efficiency. The research examines the impact of varying cellulase enzyme concentrations (0-10 FPU/mL) on the degradation of cotton fibers and the recovery of polyester in a 60/40 poly-cotton fabric blend. By measuring fabric weight loss and analyzing fiber structure through microscopy, the study determines the optimal enzyme concentration for fiber separation. Results indicate a positive correlation between increased cellulase concentration and cotton fiber degradation, with 10 FPU/mL achieving the highest mean weight loss. Statistical analysis (ANOVA, Tukey HSD) confirms significant differences between enzyme concentrations, reinforcing the effectiveness of enzymatic recycling. While enzymatic processing offers an eco-friendly alternative to mechanical and chemical methods, challenges such as fiber composition variability and process scalability remain. This research supports the development of sustainable textile recycling methods, promoting a circular economy in the fashion industry.

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