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The Potential of Hybrid Polymer in Treating Textile Wastewater: Optimization of pH and Dosage Using Response Surface Methodology

Abstract

The study aimed to evaluate the effectiveness of hybrid polymer ZOPAT compared to single polymers in treating textile wastewater. The research analyzed reduction of color, chemical oxygen demand (COD), turbidity, and suspended solids using jar testing. Response Surface Methodology (RSM) was employed to optimize the treatment, analyze variance, and create pertur-bation and desirability plots for multiple responses. The storage conditions of the hybrid polymer were also investigated. The results showed that ZOPAT was highly effective in reducing color, with a 93% reduction compared to other treatments. Additionally, turbidity and suspended solids were reduced by 100%, and COD was reduced by up to 80%. The RSM multi-response outcome showed a desirability plot of 0.592. The hybrid polymer required only 17.5 min for coagulation treatment, while the other treatments re-quired more than 40 min to achieve maximum effectiveness. The validation test showed that the optimization model's error rate was less than 1%. The study recommended that hybrid polymer solutions be stored in a cold room for up to 20 days to maintain consistency. The findings suggest that hybrid polymer is a highly effective coagulant for treating textile wastewater, with significant reductions in color, turbidity, and suspended solids. The use of RSM allowed for the optimization of the treatment, and the storage conditions were determined to ensure consistent results over time. Overall, the study's results have significant implications for the water treatment industry, with potential applications in treating wastewater in other industries.

Keywords

Desirability plot; Hybrid polymer; Perturbation plot; Response Surface Methodology; Storage conditions