Abstract

Polyethylene terephthalate (PET) waste poses a major environmental concern due its durability and widespread use in packaging. Enzymatic degradation using cutinase enzymes such as TfCut2 offers an environmentally friendly method for breaking down PET into its monomers. However, the efficiency of this process is limited by weak hydrophobic interactions and electrostatic repulsion between the enzyme and the PET surface, reducing the adsorption and activity of enzyme. To address these challenges, this study aims to enhance the adsorption of enzyme on PET surface by using N-terminal modifying reagents named 1*H*-1,2,3-triazole-4-carbaldehyde (TA4C), synthesized with varying alkyl chain lengths to act as surfactants. Variations in enzyme activity were measured by quantifying the concentration of terephthalic acid (TPA), a PET hydrolysis product, via HPLC. Among them, the C_{12}-TA4C reagent significantly enhanced the activity of the enzyme on both high-crystalline PET (hcPET) powder and amorphous PET (A-PET) film. Moreover, the enzyme adsorption of A-PET film treated with C_{12}-TA4C reagent was qualitatively confirmed by SDS-PAGE, and is found to exhibit a thicker band, indicating higher enzyme adsorption. Additionally, weight loss analysis showed a 12.8 times increase in degradation for the C_{12}-TA4C reagent treated A-PET film compared to the control. These findings demonstrate that TA4C-derived N-terminal modifying reagents, particularly C_{12}-TA4C, significantly improve activity of the enzymatic PET degradation by enhancing adsorption to PET surface.

Keywords: *enzymatic PET degradation, surfactant, TA4C-derived reagent, N-terminal modifying reagent*