

Thermodynamic and Morphological Analysis of Eutectic Formation of CBZ-L-Asp and L-PheOMe-HCl Mixtures

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Abstract

In enzymatic reactions, eutectic mixture technology has been used to prepare homogeneous substrate solutions with extremely high concentration levels.^{1,2)} Eutectic melting has been analyzed in respects to thermal, thermodynamic, and morphological properties.³⁾ However, the relationships between these properties have not been fully studied. In this study, the eutectic melting of a CBZ-L-Asp/L-PheOMe-HCl mixture was investigated from kinetic, thermal, thermodynamic, and morphological aspects. From TX-phase diagrams, the eutectic composition was determined to be 0.55 mole fraction of CBZ-L-Asp. The highest melting rate and the lowest apparent viscosity in the range of 55 ~ 75°C were obtained at the eutectic composition. Using Arrhenius plots of melting rates and apparent viscosities, minimum activation energies in the range of 60 ~ 80°C were obtained at the eutectic composition, whereas maximum values were attained below 60°C. At the eutectic composition, a maximum heat of fusion, the lowest excess free energy, and the highest excess entropy values were observed. A highly homogeneous morphology due to rearrangement of molecules was observed in the eutectic mixture via optical microscopy, scanning electron microscopy, and X-ray diffraction analysis. IR spectra revealed that hydrogen bonding in the mixture increases during eutectic melting.

References

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