

Achievement of High L-Cysteine Yield from Enzymatic Conversion Using Eutectic Mixtures of the Substrate ATC

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Abstract : L-Cysteine, a sulfur-containing amino acid, has been often used in the pharmaceutical, cosmetic, food, and feed additive industries. This amino acid has been usually produced by acid-hydrolysis of human hair and poultry feathers. There are many problems, such as avoidance for use of animal hair, low yields, and formation of harmful waste material. As an alternative, the enzymatic conversion of D, L-2-amino- Δ^2 -thiazoline-4-carboxylic acid (ATC) to L-cysteine has been developed as an environmental-friendly method. However, the substrate solubility was too low to be used in industry. In this study, high concentrations of eutectic substrate solutions were prepared to solve the problem. Eutectic melting occurred at 39°C after mixing ATC and malonic acid at a molar ratio of 1:1. The characteristics of eutectic mixtures were analyzed by FE-SEM, EDS mapping, and XPS. However, since sorbitol, MnSO₄, and NaOH should be added as supplements to the substrate mixture for the activation and stabilization of the enzyme, strategies for sequential addition of total five compounds, ATC, malonic acid, sorbitol, MnSO₄, and NaOH were established. As a result, eutectic substrate mixtures of 670 mM ATC were successfully formulated. After 6 h of enzymatic reaction, 550 mM L-cysteine was made.

Keywords : D, L-2-amino- Δ^2 -thiazoline-4-carboxylic acid, enzymatic conversion, eutectic solution, l-cysteine

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