L-半胱氨酸在二元溶剂体系中的溶解平衡研究及其结晶器设计

Solubility Equilibrium of L-Cysteine in Binary Solvent System and Its Crystallizer Design

摘　要

半胱氨酸，主要用于医药、食品、化妆、等方面。该物质有解毒作用，可用于缓一些特定物质的中毒。用于面包料中，可以促进发酵、出膜。用于天然果汁中可防止果汁变成褐色。化妆品方面主要用于美白方面，其中含有的巯基基团可调节细胞中黑色素的形成。因此，利用好它的特性，加大对半胱氨酸的生产技术和应用技术的开发力度，将生产出更多附加价值更高、性能更好的产品。

溶解度的数值是随着温度和溶剂组成而改变。大部分物质的溶解度会随着温度的升高而增大，但也有一些少部分物质温度变化的影响不明显，极少数物质的溶解度会随着温度的升高而减小。不同物质的溶解度的这些特性可以用来选择对其结晶的方式同时是设计其结晶器的重要参数。

本文采用静态称重法测定了 10℃～50℃温度范围内，水的摩尔分数在 0 %～100 %范围内，L-半胱氨酸在水-醇类二元混合溶剂体系中的溶解度，然后使用 Van't Hoff-J-A 和 Apelblat-Jouyban-Acree 对所得数据进行拟合，选用拟合结果最优的模型以预测 L-半胱氨酸在水-醇类二元混合溶剂中的溶解度，并进行误差分析，通过溶析法和降温结晶实验获得最大理论收率，以及最佳结晶条件，并对其结晶器进行设计。

关键词： L-半胱氨酸　静态称重法　溶解平衡　最佳结晶条件　结晶器

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Abstract

Cysteine is mainly used in medicine, cosmetics, biochemical research and so on. Used in breads to promote the formation of gluten and promote fermentation, mold release, and prevent aging. Used in natural juices to prevent oxidation of vitamin C and prevent juice from turning brown. This product has detoxification effect and can be used for acrylonitrile poisoning and aromatic acid poisoning. The product also has the effect of preventing radiation damage to the human body, and is also a drug for treating bronchitis, especially as a phlegm drug (usually used in the form of acetyl L-cysteine methyl esterate). Cosmetics are mainly used in beauty water, perm lotion, sun-proof skin cream and so on. Therefore, increasing the development of production technology and application technology of cysteine, and making better use of its characteristics, is conducive to the development of various products with higher added value and better performance.

Solubility is a function of temperature and solvent composition. The solubility of most substances increases with increasing temperature, but some of the solubility of some substances is not very obvious for temperature changes, and the solubility of very few substances decreases with increasing temperature. These characteristics of solubility play a decisive role in the way in which it is selected for crystallization.

In this paper, the static weighing method is used to determine the molar fraction of water in the range of 0% to 100% in the temperature range of 10 ° C to 50 ° C. The L-cysteine is in the water-alcohol and water-acetone binary mixed solvent system. In the solubility, the data were fitted using Van't Hoff-JA and Apelblat-Jouyban-Acree, and the model with the best fitting results was selected to predict L-cysteine in water-alcohol and water-acetone. The solubility in the binary mixed solvent, and error analysis, the maximum theoretical yield, and the best crystallization conditions were obtained by the dissolution and cooling crystallization experiments, and the crystallizer was designed.

Keywords:L-Cysteine, static weighing method, solid-liquid equilibrium, the best crystallization conditions, crystallizer

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