

生物化学工程、制药、食品和天然产物加工

海因酶法制备D-苯丙氨酸的酶催化过程动力学

韦萍, 姚忠, 李家璜, 欧阳平凯

南京工业大学制药与生命科学学院, 江苏 南京 210009

收稿日期 2002-12-17 修回日期 2003-8-1 网络版发布日期 2008-9-1 接受日期

摘要 采用自行筛选的兼有海因酶和N-氨甲酰氨基酸水解酶活性的*Burkholderia cepacia* 1003菌种, 利用海因酶法大规模制备D-苯丙氨酸, 对其中涉及各过程的动力学参数进行了测定. 结果表明:L-苯基海因的消旋速率常数为 $3.975 \times 10^{-3} \text{min}^{-1}$; 海因酶的米氏常数为 $16.7894 \text{mmol} \cdot \text{L}^{-1}$, 最大反应速率为 $0.6127 \text{mmol} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$; N-氨甲酰氨基酸水解酶的米氏常数为 $0.82688 \text{mmol} \cdot \text{L}^{-1}$, 最大反应速率为 $4.828 \times 10^{-4} \text{mmol} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$. 对DL-5-苯基海因的溶解、L-苯基海因的消旋、D-海因的水解开环及其中间产物(N-氨甲酰苯丙氨酸)的水解脱酰氨过程建立了动力学模型, 并在此基础上进行了动力学参数显著性分析和优化. 结果表明: 对于这一级联酶转化反应, D-海因酶的水解反应是快速反应, 而N-氨甲酰氨基酸脱氨甲酰的反应速率极小, 是该过程的控制步骤. 提高氨甲酰水解酶的活力将有助于提高总体的转化速率, 而L-海因的消旋速率则是影响外消旋苯基海因转化率的主要因素.

关键词 [海因酶](#) [D-苯丙氨酸](#) [酶催化](#) [动力学](#)

分类号

ENZYMATIC CATALYSIS DYNAMICS OF PREPARATION OF D-PHENYLALANINE

WEI Ping, YAO Zhong, LI Jiahuang, OUYANG Pingkai

Abstract

The *Burkholderia cepacia* 1003 screened by the authors' laboratory, which contains hydantoinase and N-carbamoylase activities, was used to prepare D-phenylalanine on a large scale. The dynamic parameters of the whole bioconversion process were measured, and the results showed that k_r was $3.975 \times 10^{-3} \text{min}^{-1}$, K_m and r_m of hydantoinase and N-carbamoylase were $16.7894 \text{mmol} \cdot \text{L}^{-1}$, $0.82688 \text{mmol} \cdot \text{L}^{-1}$, $0.6127 \text{mmol} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$ and $4.828 \times 10^{-4} \text{mmol} \cdot \text{L}^{-1} \cdot \text{min}^{-1}$, respectively. Simulation was made including processes of dissolution, racemization, hydrolysis of D-BH and hydrolysis of N-carbamyl phenylalanine. The significance of parameters in this model was investigated and these parameters were optimized. The result showed that the reaction rate of D-BH hydrolysis was higher than that of N-carbamyl phenylalanine hydrolysis, the latter was the limiting step of the whole process. Promotion of N-carbamoylase activity was helpful to D-phenylalanine production. Another result was that the rate of L-BH racemization was the main factor, which influenced the conversion of racemic BH.

Key words [hydantoinase](#) [D-phenylalanine](#) [enzymatic catalysis](#) [dynamics](#)

DOI:

通讯作者 姚忠 yaozh09@263.net

扩展功能

本文信息

▶ [Supporting info](#)

▶ [PDF\(856KB\)](#)

▶ [\[HTML全文\]\(0KB\)](#)

▶ [参考文献](#)

服务与反馈

▶ [把本文推荐给朋友](#)

▶ [加入我的书架](#)

▶ [加入引用管理器](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

相关信息

▶ [本刊中 包含“海因酶”的相关文章](#)

▶ 本文作者相关文章

· [韦萍](#)

· [姚忠](#)

· [李家璜](#)

· [欧阳平凯](#)