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亲水性环氧聚合物磁性微球的制备及其固定化青霉素酰化酶

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摘要

通过设计反相悬浮聚合体系，制备了聚甲基丙烯酸缩水甘油酯（GMA）-甲基丙烯酸羟乙酯（HEMA）- *N,N′* -亚甲基双丙烯酰胺（MBAA）亲水性磁性聚合物GHM微球。球中的Fe_3O_4微晶呈倒立尖晶石结构，在微球表面存在着大量环氧基和亲水性的羟基及酰胺等基团，这些功能性基团为青霉素酰化酶（PGA）的固定化提供了适宜的微环境;同时，GHM微球具有的大孔结构和较高的比表面积，使其制备的固定化酶的载酶量高，这些有利因素使得固定化酶PGA/GHM在37℃下水解青霉素G钾合成6-氨基青霉烷酸的表观活性达748 IU·g^{-1} 。 PGA/GHM经15次重复使用，其催化活性未出现明显的衰减，在使用中，固定化酶在磁场的作用下能够快速沉降与产物分离。

关键词

亲水性环氧聚合物 磁性微球 固定化青霉素酰化酶 催化活性

分类号

Preparation of hydrophilic epoxy polymer magnetic beads and their immobilization for penicillin G acylase

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Abstract

The hydrophilic epoxy polymer GHM magnetic beads, copolymerizing glycidyl methacrylate (GMA) - 2-hydroxyethyl methacrylate (HEMA) - N,N′-methylene bisacrylamide (MBAA) in the presence of magnetic Fe3O4 powder, were prepared by designing a novel inverse suspension polymerization system, and were used as the support for immobilization of penicillin G acylase (PGA).The magnetic Fe3O4 in GHM beads had inversed cubic spinel structure and paramagnetic characteristics.A number of epoxy groups, hydrophilic hydroxyl and amido groups exist on the surface of the GHM beads and provide a micro-environment suitable for the immobilization of PGA, and the enzyme molecules can be immobilized covalently on the surface of GHM beads by the reaction between the amido groups of PGA and the active epoxy groups of the support.The GHM beads possessed a large pore size (mainly ranging from 15 nm to 55 nm) and a large specific surface area so that the immobilized enzyme (PGA/GHM) had high enzyme loading.As a result, the apparent activity of PGA/GHM reached 748 IU·g^{-1} for hydrolyzing penicillin G potassium into 6-aminopenicillanic acid at 37 oC, and its activity had not changed obviously after 15 recycles.The PGA loaded beads can settle quickly in the magnetic field and be separated easily from the product in applications.

Key words

hydrophilic epoxy polymer magnetic beads immobilized penicillin G acylase catalytic activity

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