

## 毛白杨环氧水解酶的异源表达及其在催化拆分手性环氧化物中的应用

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**摘要** 对已公布的全基因组进行检索发现, 杨树 (*Populus tomentosa*) 至少含有 24 个预测为可溶性环氧水解酶的基因. 从中选取了 7 个可能的环氧水解酶基因进行克隆, 通过扩增得到其中 5 个毛白杨 (*Populus tomentosa* Carr) 环氧水解酶基因. 序列分析显示, 它们与已克隆的巨大芽孢杆菌环氧水解酶的同源性仅为 24%~26%. 对该系列基因进行了在 *E. coli* 中的异源表达, 并将得到的 5 个环氧水解酶 (PTEH 1~5) 用于缩水甘油苯基醚和对硝基苯乙烯氧化物的酶促水解反应. 结果发现, 其中 3 个重组酶具有显著的环氧水解酶活性. 进一步研究表明, PTEH1 和 PTEH2 对于缩水甘油苯基醚显示了一定的反常规的 (R)-选择性, 而 PTEH5 则优先水解 (S)-构型的缩水甘油苯基醚. 因此, 毛白杨中环氧水解酶表现出多样性.

**关键词:** 毛白杨 环氧水解酶 异源表达 缩水甘油苯基醚 对硝基苯乙烯氧化物 催化拆分

**Abstract:** The genome of *Populus tomentosa* was the first to be reported in trees. Based on the mining results of the database, a gene pool encoding 24 potential soluble epoxide hydrolases was proposed. In which, 7 genes were selected in this study, and 5 genes were successfully cloned and sequenced. Sequence analysis showed that the cloned epoxide hydrolases had merely 24% - 26% similarity to the newly cloned *Bacillus megaterium* epoxide hydrolase. Then the 5 genes were heterogeneously expressed in *E. coli* and used for hydrolytic reactions of two model substrates, phenyl glycidyl ether and p-nitrostyrene oxide. Epoxide hydrolysis activity was detected in 3 recombinant epoxide hydrolases, in which PTEH1 and PTEH2 showed (R)-selectivity in hydrolysis of phenyl glycidyl ether, while PTEH5 preferred to hydrolyze (S)-phenyl glycidyl ether. This work proves the diversity of epoxide hydrolases from *P. tomentosa*.

**Keywords:** *Populus tomentosa*, epoxide hydrolase, heterogeneous expression, phenyl glycidyl ether, p-nitrostyrene oxide, catalytic resolution

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