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Immobilised lipase-catalysed resolution of (*R,S*)-1-phenylethanol in recirculated packed bed reactor

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Abstract

Six commercial immobilised lipases were screened for the resolution of *(R,S)*-1-phenylethanol in organic solvent. Among them, lipases from *Pseudomonas cepacia* (ChiroCLEC-PC) and *Candida antarctica* lipase B (Chirazyme L2, c.-f., C3, lyo) were used in the kinetic study of the resolution in batch stirred tank reactor (BSTR). Lauric acid was used as acyl donor in the acyl transfer reaction. This enzymatic resolution was carried out at 35 °C in isooctane. The enzyme activity as well as enantioselectivity was determined by varying substrates concentration from 25 to 250 mM, acyl length of fatty acid from C12 to C18, organic solvents with log *P* values from 1.4 to 4.5 and reaction temperature from 25 to 50 °C. An initial reaction velocity approach was used to determine the enzymes activities and a computer software, SELECTIVITY was used to calculate the enzyme enantioselectivity. The activity of ChiroCLEC-PC and Chirazyme L2, c.-f., C3, lyo are 1.4 kU/g and 1.0 U/g, respectively. The enzymes are highly selective toward the (*R*)-enantiomer of the chiral alcohol with the enantiomeric ratio, $E > 200$. A series of reaction progress curves was used to develop a kinetic model based on the principle of mass action law with steady-state assumption. The reaction follows a Ping–Pong Bi–Bi mechanism with substrate inhibition. The performance of Chirazyme L2, c.-f., C3, lyo in the resolution was also investigated in a recirculated packed bed reactor (RPBR). The enzyme performance in term of initial reaction rate was decreased 19% and the volumetric productivity was decreased 7% after 30 min of reaction time. The resolution was also required 350 min longer reaction time in order to achieve equilibrium. A comparable result could be obtained in a five-fold scaling up RPBR.

Keywords: Kinetic resolution; Immobilised lipase; Enantioselectivity; Recirculated packed bed reactor

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