

Response surface methodological study on lipase-catalyzed synthesis of amino acid surfactants

ABSTRACT

Lipozyme (Rhizomucor miehei lipase) was used to catalyze the acylation of the amino acid L-lysine (L) with the free fatty acids, palmitic (PA) and oleic (OA) acids, to synthesize N- -palmitoyllysine and N- -oleoyllysine, respectively. Response surface methodology (RSM) based on a five-level, five-variable design was employed, firstly, for studying the interactive effects of various parameters on the reactions, and secondly, for their optimization. Simultaneously increasing temperature and solvent hydrophobicity, fatty substrate concentration or enzyme amount improved yields in both reactions, as did increasing solvent hydrophobicity and substrate concentration or enzyme amount, and substrate concentration and enzyme amount together. Increasing desiccant amount in very non-polar solvents, at very high levels of enzyme, and in very concentrated substrate solutions led to higher yields in the PA reaction but compromised the OA reaction. The optimum conditions predicted for the two reactions were: temperature, 69.3 °C (PA) and 56.6 °C (OA); solvent log P = 3.46 (PA) and log P = 3.50 (OA); fatty substrate concentration, 98.0mM (PA) and 99.9mM (OA); enzyme amount, 186 mg (PA and OA); molecular sieves, 160 mg (PA) and 80 mg (OA). Reactions under optimized conditions yielded 16.1% of N- -palmitoyllysine and 33.1% of N- -oleoyllysine.

Keyword: Amino acid surfactants; Enzymatic synthesis; Lipase; Response surface methodology (RSM); Free fatty acids; L-Lysine