

Optimization of palm-based wax esters production using statistical experimental designs

ABSTRACT

Wax esters, one of the important ingredients in cosmetic industry, are long-chain esters that exhibit wetting behavior with non-greasy feeling. Wax esters derived from long chain fatty acids and long chain alcohols with chain lengths of 12 carbons or more. These compounds have many potential applications in cosmetics, pharmaceutical and food industries. The present work focuses on the scale-up synthesis of wax esters by alcoholysis of palm oil (PO) with oleyl alcohol (OA) using Lipozyme in a bioreactor. Response surface methodology (RSM) and a 5-level-5-factor central composite rotatable design were adopted to evaluate the effects of synthesis parameters, such as temperature (40-60°C), amount of enzyme (14-22% by weight of PO), amount of palm oil (80-240 mmol), amount of oleyl alcohol (240-720 mmol) and impeller speed (100-400 rpm) on the percentage yield of palm-based wax esters. Based on Design Expert Software (version 6.0.4), optimum alcoholysis conditions were: temperature, 50.4°C, amount of enzyme, 16.0% by weight of palm oil, amount of palm oil, 200.0 mmol, amount of oleyl alcohol, 600.0 mmol, palm oil/oleyl alcohol ratio, 3:1 and impeller speed, 242.1 rpm. The corresponding predicted value of percentage yield and productivity was 91.5% and 106.4 mmol/h respectively compared to the actual experimental value 92.3% yields and 110.8 mmol/h productivity.

Keyword: Wax ester; Palm oil; Lipozyme; Scale-up; Alcoholysis; Response surface methodology