

## OPTIMIZATION OF BIOTECHNOLOGICAL INTERESTERIFICATION PROCESS FOR FAT SYSTEMS

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Enzymatic interesterification enables a global transformation of the oil and fat industry by replacing conventional hydrogenation methods. This technology is promising for producing specialty fats used in confectionery, bakery, dairy, and other food industries. Lipases exhibit both hydrolytic and interesterification catalytic properties, making them actively researched enzymes. Utilizing lipases with different specificity types allows for targeted interesterification. This method is safe, environmentally friendly, prevents trans-isomer formation, and is nearly waste-free. However, challenges arise due to process specifics, particularly the biphasic reaction system where substrate and product are in a water-immiscible liquid phase, while the enzyme acts at the phase interface. Technological hurdles include significant enzyme consumption due to insufficient process rationalization and leveraging hydrolytic enzymes to catalyze reverse reactions.

Enhancing enzymatic activity and reducing enzyme costs are critical tasks, achievable through modeling and optimizing biotechnological interesterification to improve catalytic activity and thermostability. Process refinement will minimize waste, rationalize processing regimes, and optimize material resource use. Thus, improving biotechnological interesterification is essential for producing safe, high-value fats with regulated composition while addressing industry demands for specialty fats. The physicochemical parameters (acid, peroxide, and anisidine values; phosphorus content; moisture; melting point) and fatty acid composition of raw materials (palm stearin, coconut oil, soybean oil) were determined, complying with DSTU 4439, DSTU 4562, and DSTU 4534 standards. Modeling and optimization of biotechnological interesterification using immobilized Lipozyme TL IM established that pre-humidification of the enzyme and pH adjustment of the aqueous solution reduce process duration by ~30 %. Optimal parameters include: 3 – 4 % sodium bicarbonate solution (by enzyme mass); pH 7.4 – 7.7. The interesterified fat produced via this improved method meets DSTU 4336 requirements, with: acid value: 0.26 mg KOH/g; peroxide value: 0.60 mmol  $\frac{1}{2}$  O/kg; anisidine value: 1.70 AU; moisture: 0.04 %; melting point: 33.2 °C [1]. These results demonstrate the efficacy of optimized biotechnological interesterification in producing high-quality fats with reduced processing time and resource consumption, supporting its industrial adoption for sustainable fat modification.

### References:

1. Belinska, A., Bliznjuk, O., Shcherbak, O., Masalitina, N., Myronenko, L., Varankina, O., Samoilenko, S., Borovkova, V., Kibenko, N., & Timchenko, V. (2022). Improvement of fatty systems biotechnological interesterification with immobilized enzyme preparation usage. *Eastern-European Journal of Enterprise Technologies*, 6(6 (120), 6–13.