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Rotating bed reactor packed with heterofunctional structured silica-supported lipase

Publication date:	01.01.2021
Publication title:	Rotating bed reactor packed with heterofunctional structured silica-supported lipase
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Journal information:	Microporous and Mesoporous Materials

Production of specialty chemicals increasingly makes use of the enzyme catalysts in organic solvents, and Novozym 435 (N435) is among most often applied. However, its polymeric skeleton is unstable in many solvents. In this context we report the results of a more systematic study of the biocatalysts, fabricated using highly porous siliceous pellets/enzyme carriers (MH, 4 cm3 g−1 total pore volume, 310 m2 g−1 surface area), grafted with octyl (-O), amino (-A) and octyl and amino (-OA) groups, to attach the enzyme - CALB lipase. The catalysts were deployed in a rotating bed reactor (RBR) and tested in hydrolysis of p-nitrophenyl acetate, and esterification of levulinic acid. Performance of the system was compared with the same RBR filled with N435. N435 appeared the most active in both reactions, when activity was related to bulk mass of the catalysts, mainly owing to very large enzyme load. But its pore structure degraded in many typical solvents already after 24 h of soaking, whereas no significant change in MH-O and MH-OA activity was detected. Irrespective of the solvent and reaction, the highest specific activity of the enzyme featured MH-O. However, a significant enzyme leaching from MH-O observed in a hydrolytic reaction, in stark contrast to MH-OA which came second in specific activity, point to MH-OA as the catalyst of choice for hydrolytic reactions. In esterification reaction the MH-O lipase was not only most active but it was also quite stable. Therefore, MH-O appears the most suitable production system for the reactions carried out in organic solvents.

Metryczka

Published by:	Marek Tańczyk
Published at:	08.05.2026 14:53
Last edited by:	Marek Tańczyk
Last edited at:	08.05.2026 14:55
Number of views:	9