

Lipase NS81006 immobilized on Fe₃O₄ magnetic nanoparticles for biodiesel production

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Abstract. Lipase-catalyzed biodiesel production is being the object of extensive research due to the demerits of chemical based catalytic system. Lipase immobilized on Fe₃O₄ magnetic nanoparticles has the integrated advantages of traditional immobilized lipase and free lipase for its rather fast reaction rate and easy separation. It has been demonstrated that free lipase NS81006 has potential in catalyzing the alcoholysis of renewable oils for biodiesel preparation. In this study, Fe₃O₄ magnetic nanoparticles functionalized with organosilane compounds like (3-aminopropyl)triethoxysilane (APTES) and (3-mercaptopropyl)trimethoxysilane (MPTMS) were used as carriers for lipase immobilization. Lipase NS81006 was covalently bound to the organosilane-functionalized magnetic nanoparticles by using glutaraldehyde cross-linking reagent. A biodiesel yield of 89% and 81% could be achieved by lipase immobilized on APTES-Fe₃O₄ and MPTMS-Fe₃O₄ magnetic nanoparticles respectively under optimized conditions of oil to methanol molar ratio 1:3 with three step addition of methanol, reaction temperature 45°C and reaction time duration 12 h. The lipases immobilized on magnetic nanoparticles could be recovered easily by external magnetic field for further use.

Keywords: Fe₃O₄ magnetic nanoparticles, functionalization, immobilized lipase, biocatalysts, transesterification, biodiesel.

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