IMMOBILIZATION OF PSEUDOMONAS FLUORECENS LIPASE IN MESOPOROUS MATERIALS TO BIODIESEL PRODUCTION

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ABSTRACT

The aim of this work is to design a catalyst for biofuels production from renewable raw materials by means of the immobilization of an enzyme on nano-structured solid supports [1,2]. In fact, the main purpose is to immobilize the lipase of Pseudomonas fluorescens in the pure SBA-15 (Santa Barbara Amorphous) mesoporous material [3] and to compare their activity in the biodiesel production using vegetable oils, with that of the enzyme immobilized on materials SBA-15 modified with metals (Ca, Na, Fe, Cu, Al, K)[4]. The physicochemical properties of the synthesized mesoporous materials were determined by Small-angle X-ray scattering (SAXS), Transmission electron microscopy (TEM) and UV-visible. The enzyme was immobilized by physical adsorption, mixing each mesoporous material with an enzyme solution. The effective incorporation of the enzyme in the materials was confirmed determining the protein concentration in the soluble fraction after immobilization by the Bradford method. The optimal conditions of the biocatalyst activity were determined: oil / ethanol ratio, water percentage, amount of immobilized enzyme / mg of SBA-15 support, reaction time and activity of the biocatalyst respect to the metal impregnated in the solid used. Ca/SBA-15 material show the better activity as biocatalyst to biodiesel production using 400mg/g of lipase respect material, 1/4 oil/ethanol and 4 wt% of water respect oil.

The transesterification reaction of triglycerides with ethanol for the production of biodiesel catalyzed by the LPF / SBA-15 / Ca biocatalyst has high batch yields, does not produce soap, uses low temperatures of 37 ° C and allows to separate the catalyst easily from the mixture.

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References

[1] A. Salis, M.F. Casula, M.S. Bhattacharyya, M. Pinna, V. Solinas, M. Monduzzi, “Physical and Chemical Lipase Adsorption on SBA-15: Effect of Different Interactions on Enzyme Loading and Catalytic Performance”; Chem. Cat. Chem., Vol. 2 (2010), p. 322-329.

[2] A. Salis, M.S. Bhattacharyya, M. Monduzzi, V. Solinas, “Role of the support surface on the loading and the activity of Pseudomonas fluorescens lipase used for biodiesel synthesis”; J. Mol. Catal. B Enzym, Vol. 57 (2009), p 262-269.

[3] D. Zhao, Q. Huo, J. Feng, B.F. Chmelka, G.D. Stucky, “Nonionic Triblock and Star Diblock Copolymer and Oligomeric Surfactant Syntheses of Highly Ordered, Hydrothermally Stable, Mesoporous Silica Structures”; J. Am. Chem. Soc, Vol. 120 (1998), p 6024-6036.

[4] V.R. Elías, E.G. Vaschetto, K. Sapag, M.E. Crivello, S.G. Casuscelli, G.A. Eimer, “Synthesis and Photocatalytic Activity of Titania-Loaded Transition Metal-Modified MCM-41 Molecular Sieves”; Top. Catal., Vol. 54 (2011), p 277-286.