Activation with ultrasounds of Lipozyme 435 for esterification and transesterification reactions

A. Vartolomei[1], I. Calinescu[1], A.I. Gavrila[1], M. Vinatoru[1]

1. Faculty of Applied Chemistry and Material Science, Bioresources and Polimers Department University "Politehnica" of Bucharest, 1-7 Gh. Polizu, Bucharest, 011061, Romania

Enzymes are capable biocatalysts, used more and more to replace chemical catalysts, especially due to their high specificity, regio- and stereo-selectivity in mild conditions, leading to a sustainable chemical process. Immobilized enzymes are preferred over free enzymes due to the easiness of recovery and purification of products and separation of biocatalysts from the process stream. The employment of immobilized enzymes is still challenging due to their costs and storage problems . Ultrasound can cause inactivation of many enzymes, attributed to the mechanical and chemical effects of cavitation. Not all lipases are denatured by ultrasound, the effect being dependent on the chemical structure of the protein and using ultrasound at optimum frequencies and intensity levels can lead to an increase of enzyme activity by enhancing the mass transfer due to micro mixing and changing enzyme conformation giving better access to the enzymatic sites [1]. In the present paper a systematic study on the effects of ultrasounds on immobilized lipase Lipozyme 435 was carried out. We studied two ultrasound assisted enzymatic reactions: the esterification of i-amyl alcohol with acetic acid and the transesterification of sunflower oil with ethanol. The equipment used for the ultrasound assisted processes in this study consists of a Vibracell 750 processor. We identify the optimum sonication conditions to improve Lipozyme 435 activity, stability and reusability. The results show a favorable perspective to improve the esterification and transesterification efficiency and reduce the reaction time, using ultrasounds for short periods of time.

The authors acknowledge the financial support received from the Competitiveness Operational Program 2014–2020, Action 1.1.4: Attracting high-level personnel from abroad in order to enhance the RD capacity, project: P_37_471, „Ultrasonic/Microwave Nonconventional Techniques as new tools for nonchemical and chemical processes", financed by contract: 47/05.09.2016

[1] S. Datta, L.R. Christena, Y.R. Rajaram, Enzyme immobilization: an overview on techniques and support materials, 3 Biotech, 3 (2013) 1-9.