Lypozyme 435 esterification activity improvement using short term treatments with ultrasounds

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The trend in industrial bioprocesses is to use clean, green, efficient catalysts. Biocatalysts are 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. The global market for industrial enzymes just in the United States is forecast to increase to $2.2 billion in 2019 [1].

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 [2]. Enzymes have quite low stability under severe conditions (pH, high temperatures and pressures), are expensive for commercial use, and for this reason there is a great concern in enhancing enzyme activity, stability, reusage capacity and enzymatic efficiency. Various chemical, physical and genetic methods are used to improve these limitations, ultrasounds being one of them [3].

Some experimental studies indicate that activation of enzymes with ultrasounds was predominantly caused by a structural modification of the enzyme molecules. In the reaction mixture, the mass transfer is intensified by the shear forces caused by mechanical effects of ultrasound, leading to the decrease of diffusion barrier [4]. Several research studies prove that ultrasound affects differently distinct enzymes, each having a specific tolerance and sensitivity to ultrasound.

In this paper we will focus on a novel approach of the ultrasound assisted enzymatic esterification reaction between acetic acid and i-amyl alcohol. We used a reactor designed in our previous work capable of enhancing enzymatic reactions. The highlights of this reactor is the minimizing cavitation activity with maximizing mass transfer [5]. The product of the reaction, isoamyl acetate is an ester widely used as flavor or aroma in food and cosmetic industries, also known as banana flavor. The main goal of this research is to use low intensity ultrasound for a determined period of time in order to improve enzymatic activity of Lipozyme 435 enzyme.

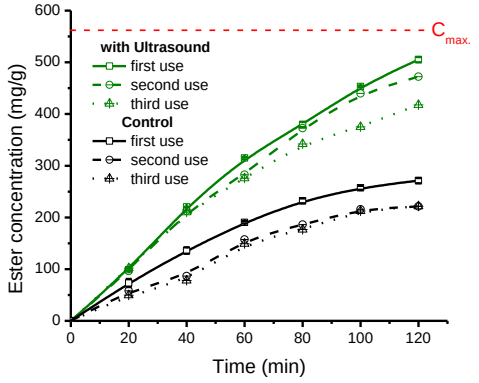

Fig. 4: The concentration of ester in time, for succesive uses, ultrasonic treatment (first 20 min) vs control

The authors acknowledge the financial support received from the Competitiveness Operational Programme 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

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