SYNTHESIS OF BIOABSORBABLE POLYMERS USING NON-COMMERCIAL BIOCATALYST

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Introduction. Interest in biocatalyzed synthesis of polymers is growing due to its many advantages: it can prevent byproducts generation by using efficient catalytic processes with high stereo- and region-selectivity and prevent or limit the use of hazardous reagents (1). The objective of this work was to evaluate the performances of non-commercial immobilized lipases from yeasts *Yarrowia lipolytica* (YLL2), *Candida utilis* (LCU) and a partially purified latex from the plant *Carica papaya* (CPL) in the polymerization of diacids and polyols. This kind of polymers has applications as bioabsorbable nano-carriers of drugs and genes (2).

Methods. CPL was collected directly from the unripe fruits (variety "Maradol") and purified according to (3). LCU and YLL2 were produced according to (4) and immobilized according to (5). Enzymatic polymerizations of adipic acid (AdA) with glycerol (GL) or octane-1,8-diol (OD) were carried out according to (5). Varian HPLC, Bruker MicroTOF-QII and RMN were used for characterization of polymers.

Results. Conversion and initial velocities are shown in Table 1. For polymerization with GL, the best performance was obtained using CPL. This auto-immobilized lipase showed also good performances in polymerization of ε-caprolactone (4). LCU and YLL2 had similar performances for this reaction. For the reactions with OD, lower conversions were obtained, but in this case LCU had the highest conversion.
When GL was used, both linear polymers and ramified oligomers were obtained (Fig. 1A), while for OD, only linear polymers were observed (Fig. 1B).
Regarding the molecular mass of the products synthesized, LCU gave the products with the highest MW, up to 2760 Da for GL substrate (Fig. 2) and 1050 Da for OD. More studies are required using this biocatalysts as there are only a few reports about LCU and no previous reports of its application on polymerization reactions were found in the literature.

Table 1. Initial rate (Vo) and conversion obtained for polymerization of AdA and GL or OD using immobilized lipases.

Biocatalyst	v_0 (µmol/min·U)		Max. conversion, time	
	GL	OD	GL	OD
CPL	15.7	3.0	85%, 5d	50%, 5d
LCU	11.3	4.8	80%, 6d	35%, 1d
YLL2	8.6	9.7	75%, 6d	35%, 1d

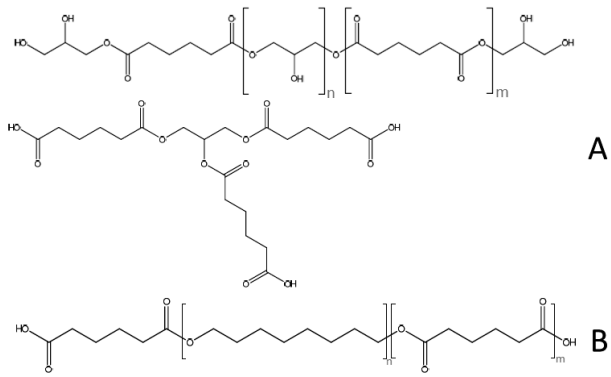

Fig.1 Structures of the polymers of AdA and GL (A) or OD (B).

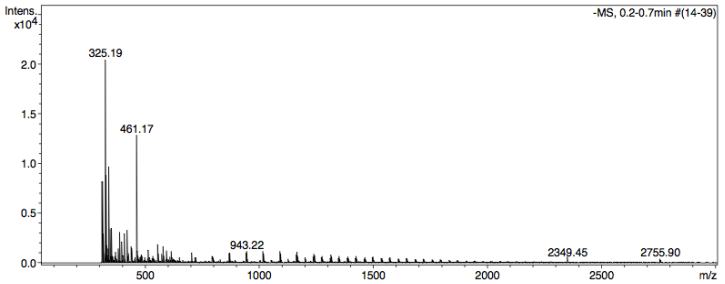

Fig.2 Mass spectra of the products synthesized by LCU using AdA+GL.

Conclusions. As LCU gave the highest Mw for the studied reactions, further studies will be performed with this lipase. Besides, CPL performed well and becomes interesting because of its low cost, as the latex is a self-immobilized form of the enzyme, which requires low processing to be used as biocatalyst.

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