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Enzymatic ring-opening polymerization of macrolactones using new commercial enzymes

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Macrolactones are a class of cyclic esters which has been outstanding in the synthesis of polyesters via ring-opening polymerization, because they have good mechanical and biocompatibility properties. Among the macrolactones, ω-pentadecalactone and globalide have been dragging great attention from researchers. Immobilized enzymes have several advantages when used in biocatalytic processes, such as the ease of recovery and reuse, which is very important for industrial processes, as it results in cost savings. The main disadvantage of the industrial use of immobilized enzymes is the high cost of commercially available enzymes. Thus, preparations immobilized on cheaper supports favor new possibilities of applications. In view of this, aliphatic polyesters (from globalide and ω-pentadecalactone) were synthesized using a new commercial biocatalyst, the low-cost immobilized NS 88011 lipase (lipase B from Candida antarctica). Reactions conducted using NS 88011 as catalyst were compared with reactions conducted under the same conditions, but using the traditional biocatalyst Novozym 435. When NS 88011 was used, the reactions resulted in high yields, up to 90 wt% and molecular weights of 61,000 g mol-1 for poly(globalide) and 130,000 g mol-1 for poly(ω-pentadecalactone). These molecular weights are above those found when the enzyme Novozym 435 was used as catalyst. The concentration of enzyme in the polymerization reaction had a strong influence in the yields and molecular weights obtained. Finally, the thermal properties of the polymacrolactones synthesized are in accordance with literature data. An alternative and cheaper route for synthesizing novel polyesters was shown in this work using the NS88011 lipase.

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