11º COLAOB
11º Latin American Congress of Artificial Organs and Biomaterials
17th Congress of Lantin American Society of Artificial Organs, Biomaterials, and Tissue Engineering

L-LACTIDE DIMER: A MONOMER FOR POLY-L-LACTIC ACID PRODUCTION WITH POTENTIAL APPLICATION IN THE MEDICAL AREA

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ABSTRACT

Polylactic acid (PLA) is a polymer from natural sources (lactic acid – carbohydrates fermentation) that has great potential for application in the medical area, according to numerous publications. Such polymer is a biodegradable and biocompatible polyester, that presents excellent biological properties, besides mechanical strength as the monomer isomer used in its polymerization, which justifies its attractiveness in the health sector. PLA can be produced by two routes: direct polycondensation (DP) and ring-opening polymerization (ROP). The first one usually produces low molar mass PLA and uses lactic acid as the starting monomer in the reaction, resulting in a lower-cost route. The second one (ROP) occurs via l-lactide dimer opening, giving high molar mass PLLA. Therefore, ROP gives high molar mass PLLA, the high cost of the monomer (l-lactide) boosts the interest in direct polycondensation. However, depending on the configuration of the reactional system used in the DP, some l-lactide can be produced in this system pathway, which is interesting, since l-lactide is a high value-added monomer. To explore

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this hypothesis, the current work investigated the l-lactide obtaining process, since there is a lack of knowledge about this process and there are divergences for reaction parameters, besides the wide use of l-lactide in the synthesis of PLLA for medical applications. Thus, this work aimed to evaluate different experimental configurations for the l-lactide synthesis process, to obtain a monomer with high yield and purity, with the possibility to scale up this process. For this purpose, three experimental configurations at fixed parameters - temperature (185 °C), pressure (125 mmHg), and reaction time (4 hours); while the stannous octoate ($Sn(Oct)_2$) catalyst was added at 1% (v/v) in relation to lactic acid. Experimental results confirmed the formation of l-lactide in some points of the system (connector between the reactor and collecting flask, collecting flask, and condenser), whose properties were compatible with the standard l-lactide (PURASORB® L). The l-lactide produced had its thermal (differential scanning calorimetry – DSC), spectroscopic (infrared spectroscopy with Fourier transform - FTIR), and difratometric (X-ray diffraction - XRD) properties characterized.