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PRODUCTION OF POLY(L-co-D,L LACTIC ACID) POROUS FIBERS BY ELECTROSPINNING

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Scientists around the world are widely interested in the fabrication of nanofibers scaffolds. Among the possible structures, porous fibers arouse interest for mimicking the extracellular matrix and for its high surface area, that favors cell attachment and proliferation over the scaffold. Several methods allow porous nanostructures production, such as electrospinning, electrospraying, and nanoimprinting, among others. Electrospinning has an appeal for being a robust and versatile technique. Changing the solution properties and the processing variables influences the morphology of the nanofibers assembled. This research aimed to produce porous fibers to biomedical applications through conventional electrospinning and to investigate the formation of pores on lactic acid polymer fibers. Therefore, poly(L-co-D,L-lactic acid) was dissolved into chloroform at 5 wt% and poured into a syringe with a metallic flat-end needle. A conventional electrospinning setup was used, and the fibers were collected in a silicon substrate. The process variables were: 20 cm of work distance, a feed rate of 1.0 mL/h, and 15kV voltage. The fibers collected were sputtered with a platinum layer, characterized by scanning electronic microscopy, and analyzed with Image J and Origin® software. It was obtained continuous, bead-free, and porous fibers, and without merged areas. The mean diameter measured (N=50) is 2.373 ± 0.564 µm, and the sample follows the normal distribution, indicating that the sample is homogeneous, despite the high standard deviation. The absence of defects suggests that the polymer concentration used was adequate since the balance between solution viscosity, surface tension, and electrostatic repulsion resulted in a continuous jet. However, the mean diameter measured is higher than the values reported for electrospun PLDLA with other solvents. The central aspect of the fibers is porosity. The pore formation can be explained by the rapid evaporation of chloroform and phase separation. When the solution is ejected from the needle, it contacts a medium poor in solvents and with water vapor. The chloroform on the surface evaporates very quickly, decreasing the surface temperature, and the inner solvent diffuses itself, causing water droplet condensation over the surface. Meanwhile, poor and rich-polymer phases occur. After electrospinning, the evaporation of solvent and water droplets let prints on the surface, forming pores. In conclusion, the electrospinning of poly(L-co-D,L acid lactic) dissolved in chloroform was conducted to obtain porous fibers for medical devices production. Chloroform affect the fiber morphology, mainly for its low boiling point and dielectric constant. Its fast evaporation and non-polarity induce pores formation along the fibers. The low charge density caused a wide diameter distribution, and thicker fibers compared to previously reported PLDLA fibers produced with other solvents.