Influence of pressure and solution concentration in the microstructure of fibrous airbrushed poly(?-caprolactone) (PCL) scaffolds

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Palavra chave: tissue engineering, polymeric scaffold, airbrushing

Resumo:
Scaffolds are three-dimensional matrices employed as temporary supports for growing cells in tissue engineering. They play the role of an artificial extracellular matrix, and are absorbed by the body as the cells secrete their own support. A scaffold’s microstructure is a factor that dictates its interaction with the physiological environment, influencing parameters such as rate of degradation and cell behavior. Therefore, being able to control microstructure during scaffold fabrication is very important. The aim of this work was to characterize the microstructure of fibrous PCL scaffolds fabricated through the airbrushing technique, but applying different values of solution concentration and pressure, to verify their influence on the scaffold’s microstructure and mechanical properties. The fibers were deposited over an aluminum collector, using an airbrushing device connected to a compressor. The parameters chosen were: 4% m/V and 6% m/V solution concentration and pressure of 30 psi and 40 psi. Samples were selected and characterized by scanning electron microscopy (SEM), confocal microscopy (CM), differential scanning calorimetry and tensile tests. SEM images showed that all combinations form fibers, but the ones of 4% m/V 30 psi and 6% m/V 40 psi produce some dense areas, which may hinder cell infiltration. CM images showed that these combinations also resulted in higher average fiber diameter, and tensile tests indicate they have poorer mechanical properties compared to the other samples. As virtually no difference in crystallinity was detected across the board, it is believed that the presence of dense areas and fiber diameter had a bigger impact on mechanical behavior. As a conclusion, it is safe to say that airbrushing parameters can be manipulated in order to modulate the scaffold’s structure. Characteristics such as fiber density and alignment, that have yet to be assessed, may also play an important role, and they are going to be explored in future works.