A comparison between electro and rotary-jet spinning to produce micro/nano-fibers of different concentrations of polycaprolactone

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Statement of Purpose: One of the most important components in tissue engineering is the support, to promote a model for fixing cells to the tissues, in which determines the cellular behavior [1]. For this, is very important to development new materials with better properties than the currently used [2]. Briefly, the biomaterials should have: 3D structure, biocompatibility, biodegradability, favorable mechanical property and similarity to extra cellular matrix (ECM) [3]. Poly (ε-caprolactone) (PCL), is a biodegradable and semi crystalline polymer with superior mechanical properties compared to other polyesters, and for this it has attracted a great interest for biomedical applications [4]. Electro and rotary-jet spinning surge as interesting techniques to produce micro/nano-fibers for cultivate cells and to promote tissue growth. Herein, we perform an interesting comparison between techniques to produce micro/nano-fibers using different concentrations of PCL. **Methods:** Produced fibers: (i) electrospinning of PCL in different concentrations (12-20% wt) using acetic acid; and (ii) rotary jet spinning in two different concentrations (15 and 20 % wt) in chloroform. Scanning electronic microscopy (SEM) characterized the fiber and ImageJ was used to measure the diameters. The differential scanning calorimetry (DSC) was used to evaluate thermal properties. The contact angle measurements were used to evaluate the wettability. **Results:** Fig. 1 showed morphologies and diameters of the electro (A, B, C and D) and rotary-jet (E and F) spun fibers. Clearly, different morphologies and diameters were observed when the concentrations were changed. At low concentrations, the electrospun fibers presented thinner and at high were thickened. Interesting, when PCL was electrospun at 12 and 15% (wt) concentrations a similarity to the ECM structures were observed (Fig. 1A and B) [3]. However, several beads in their structures were noticed, could be attributed to residual solvent and then would be toxic when applied to biological environment [5]. Meanwhile, when the PCL was electrospun at 17% (Fig. 1C) neither beads or defects were observed. By the time, when PCL at 20% was electrospun, both irregularity and defects were observed (Fig. 1D). However, when the PCL was rotary-jet spun independently of concentrations the produced fibers were thickener and porous than electrospun. These characteristics are very important whether these produced fibers were used to cultivate cells [6]. Both,

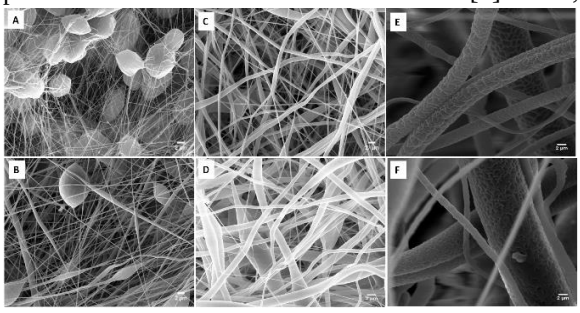

Figure 1: Morphologic and diameter of PCL fibers produced by electrospinning (A to D) and rotary jet spinning (E and F) in different concentrations. A - PCL 12% (w/t) with diameter between 102 to 260 nm, SD 32,07 nm. B – PCL 15% (w/t) with diameter between 182 to 307 nm, SD 33,74 nm. C – PCL 17% (w/t) with diameter between 124 to 989 nm. SD 296,36 nm. D – PCL 20% (w/t) with diameter between 2009 to 1399 µm, SD 419,19 nm. E – PCL 15% (w/t) with diameter between 1 to 9 µm, SD 2 µm, F – PCL 20% (w/t) with diameter between 1 to 12 µm, SD 3 µm, .

electro and rotary-jet spun presented an endothermic peak at 60 ºC. However, the crystallinity degree showed a decrease with increasing polymer concentration for both techniques. All the produced fibers presented hydrophobic character independently of methodology, could be attributed to PCL characteristics. However, the rotary-jet spun fibers presented an increase at time (50 min) until complete absorption of the drop of water. **Conclusions:** The polymer concentration interfered on the morphology of the fibers independently of methodology to produce fibers. However, it did not interfere the thermal property of the material. The diameter of the rotary jet spun fibers was higher than electrospinning process. We observed a more porous fiber when applied rotary-jet spinning. We attributed the best concentration the PCL at 17% (w/t) for electrospinning and PCL at 15% (w/t) for rotary-jet spinning. **Acknowledge:** The authors would like to thank the São Paulo Research Foundation (FAPESP: 2014/16295-2, 2011/17877-7, 2011/20345-7, 2015/08523-8, 2015/09697-0 and 2016/00576-1) and Coordination for the Improvement of Higher Education Personnel (CAPES, grant 88881.068048/2014-01) and scholarship from CAPES (88887.116351/2016-00). **References:** [1] Chan G. Trends in biotechnology. 2008; 382-392. [2] Sachlos E. Eur Cell Mater. 2003; 5: 39-40. [3] Ku SH. Biomaterials. 2010; 9:2535-41. [4] Kweon H. Biomaterials. 2003; 24: 801–808. [5] Badrossamay, M.R. Nano Letters. 2010; 10: 2257-2261. [6] langer, R. Bio/Tech. 1994; 12.