ULTRATHIN COLLAGEN AND GELATIN FIBERS: BENIGN SOLVENTS TO PRODUCE POTENTIAL BIOMIMETIC BIOMATERIALS BY SOLUTION BLOW SPINNING

Murilo Álison Vigilato Rodrigues [1,2,3,*], Virginia da Conceição Amaro Martins [1], Ademar Benévolo Lugão [3], Luiz Henrique Caparelli Mattoso [2], Ana Maria de Guzzi Plepis [1]

[1] São Carlos Institute of Chemistry (IQSC)/ University of São Paulo, Brazil

[2] Embrapa Instrumentação/Brazilian Agricultural Research Corporation, Brazil

[3] CEQMA/Instituto de Pesquisas Energéticas e Nucleares (IPEN/CNEN)/Universidade de São Paulo, Brasil

* Corresponding author: murilovigilato@gmail.com

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Introduction and objective: The main constituent of extracellular matrix (ECM) of various tissues is collagen, a biodegradable and biocompatible protein with excellent regenerative properties. A promising way to produce scaffolds, artificial ECM, involves the production of nanometric or submicrometric fibers, dimension of the natural fibers found in the ECM of many tissues. Solution blow spinning (SB-Spinning) allows the production of fibers with high feed rates and *in situ* deposition. Here we produce ultrathin collagen and gelatin (polymer obtained from collagen denaturation) fibers by SB-Spinning using solvents that preserve the integrity of the polymers and evaluate the morphology and properties of these fibers [1,2].

Methodology: Collagen (10 wt%) and gelatin (10 and 15 wt%) solutions were prepared in 90 wt% acetic acid under stirring overnight at room temperature. A glass syringe was used to spin 25 cm (for gelatin) or 20 cm (for collagen) away from the collector using 30 psi (gelatin) or 10 psi (collagen) of pressure at 3.6 to 10.8 mL/h for gelatin and at 3 to 6 mL/h for collagen. The fibers were characterized by scanning electron microscopy, differential scanning calorimetry and polyacrylamide gel electrophoresis.

Results and discussion: Gelatin and collagen submicrometric fibers were produced from 90% acetic acid solutions, a benign solvent that allows the solubilization of high amounts of these polymers and present low toxicity with low cost, what reveals it as a promising benign solvent for this application. Gelatin fibers presented average diameters between 740 ± 299 nm and 909 ± 326 nm for 15% solutions and between 175 ± 64 nm and 196 ± 113 nm for 10% solutions, indicating the direct effect of polymer concentration on the diameter of fibers. Collagen fibers presented average diameters between 542 ± 185 nm and 543 ± 242 nm, being thicker than the gelatin fibers obtained with the same polymer concentration, an indicative of the preservation of the natural structure of these protein, the triple helix secondary structure. The preservation of collagen triple helix after the spinning process was confirmed by differential scanning calorimetry and gel electrophoresis results.

Conclusions: Aqueous acetic acid was considered a good solvent for the solubilization of these collagenous proteins, being adequate to the production of biomaterials due to its low toxicity and ability to preserve the natural structure of collagen. It was also possible to understand the effect of some production parameters on the diameter of these fibers, an important step in the development of new biomimetic biomaterials produced by solution blow spinning.

References

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