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### PRODUCTION OF NANOFIBER FOR BIOMEDICAL APPLICATION

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**Abstract.** *The current interest in nanotechnology has increased due to exclusive properties of nanoscale materials. Electrospinning is a process for the production of polymeric fibers in nanometer scale, thus obtaining a greater surface area than the conventional spinning technique, enabling a variety of applications in areas such as tissue engineering, scaffolds, drug delivery, filters, biosensors, protective clothing, power generation, cosmetics, among others. One of the greatest attractions of this system lies on the simplicity of the equipment. The conventional system consists of three components: a spinneret, a high voltage power supply, and grounded collector, that may have several shapes. In this study, polymeric nanofibers were produced by means of a new technology consisting of a spinneret replaced by a metallic ring with a pyramidal shape on its external surface. This pyramidal metallic ring (PMR) was then connected to the motor rotation axis, being dipped in a polymer solution, all connected to a high voltage power supply and a collector plate. An electric field was established and the electric forces overcame the surface tension, thus forming a jet solution that addressed the grounded collector. On the way between the PMR and the collector, the solvent evaporated leaving only the polymer. Results indicate that the electrospinning process using PMR allows for the production of a larger amount of polymeric nanofibers compared to the conventional electrospinning system. Therefore, it can be concluded that the electrospinning process with PMR has potential use in biomedical applications.*

**Keywords:** *Electrospinning, fibers, biomedical applications.*

## 1. INTRODUCTION

Current interest in nanotechnology has increased due to unique properties of nanotechnology materials. Electrospinning is a process for the production of nanometric polymer fibers, thus obtaining a larger surface area than the conventional spinning technique, allowing a variety of applications in areas such as tissue engineering, scaffolding, drug delivery, filters, Biosensors, protective clothing, energy generation, cosmetics, among others (Liu e Xia, 2015).

However, traditional technology produces a little quantity of material that increases the cost (Cooley,1902). The aim of this study is the development of a new methodology to enable commercial use of nanofibers.

## 2. EXPERIMENTAL PROCEDURE

The conventional system consists of three components: a wiring, a high voltage power supply and a grounded collector, which can take many forms (Ramakrishna, 2003). In this study, the polymer nanofibers were produced by means of a new technology consisting of a spinneret replaced by a metal ring with a pyramidal shape on its outer surface. This pyramidal metal ring (PMR) was then connected to the axis of rotation of the motor, being immersed in a polymer solution, all connected to a high voltage power supply and a collector plate. An electric field was established and the electric forces overcame the surface tension, thus forming a jet solution that approached the grounded collector. In the path between the PMR and the collector, the solvent evaporated leaving only the polymer. The PCL Nanofibers surface were investigated using scanning electron microscopy (SEM) Fig. 3.

## 3. RESULTS AND DISCUSSION

The results indicated that the electrospinning process using PMR allows for the production of a larger amount of polymeric nanofibers compared to the conventional electrospinning system. Figure 1 shows the PMR with the hole in detail and Fig. 2 the system to product nanofiber. Therefore, it can be concluded that the electrospinning process with PMR has potential use in biomedical applications.

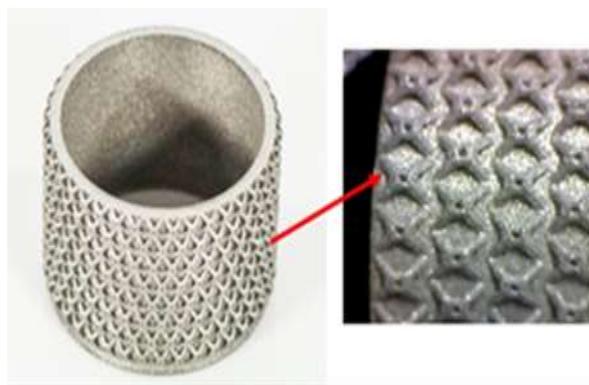


Figure 1: Pyramidal metal ring (PMR). In detail the hole of the top of pyramid

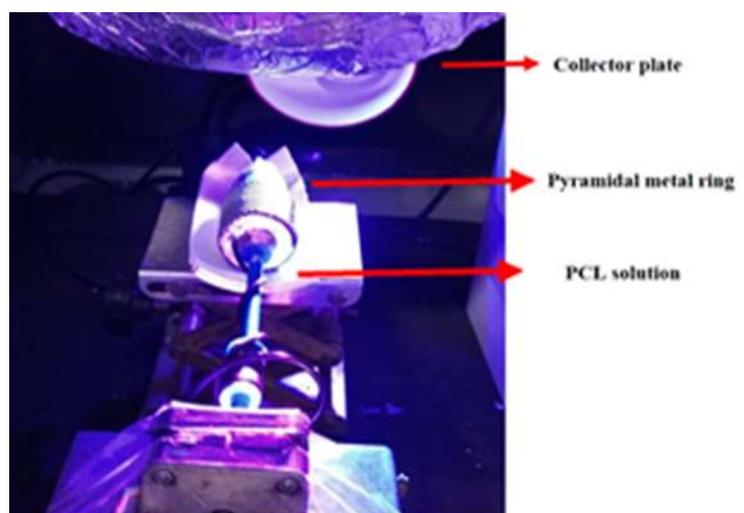


Figure 2 : Pyramidal metal ring (PMR) connected to the axis of rotation of the motor, being immersed in a polymer solution (PCL), all connected to a high voltage power supply and a collector plate.

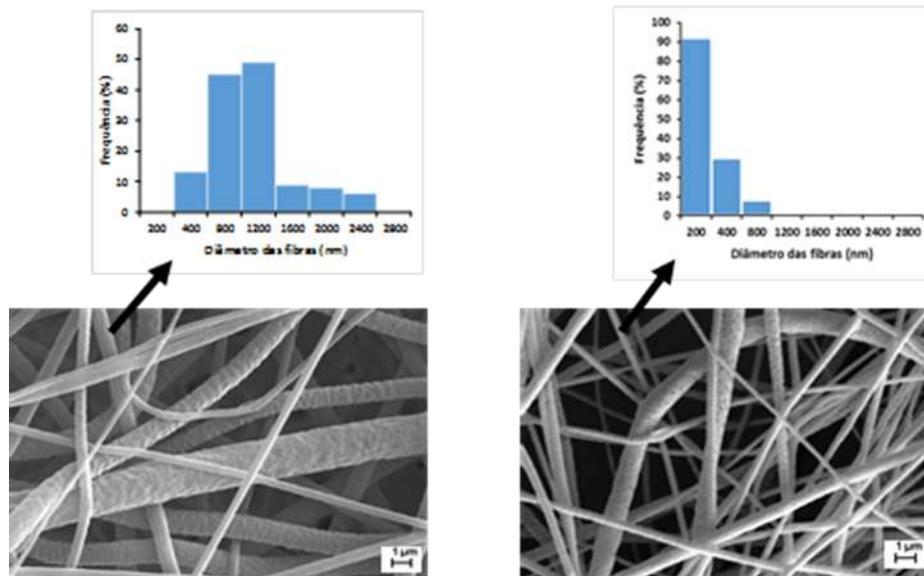


Figure 3: (a) Nanofibers obtained by the conventional syringe method and (b) nanofibers produced by Pyramidal metal ring (PMR). Detail of the histogram with the mean diameter of the nanofibers.

#### 4. CONCLUISON

The results indicated that the electrospinning process using PMR allows for the production of a larger amount of polymeric nanofibers compared to the conventional electrospinning system. It can be concluded that the electrospinning process with PMR has potential use in biomedical applications.

#### 5. ACKNOWLEDGEMENTS

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