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# DEVELOPMENT OF A DEVICE TO CONTROL THE DEPOSITION OF ELECTROSPIN NANOFIBERS

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## ABSTRACT
In this study PA nanofibers, with novel morphological properties, were developed via a newly designed electrospinning apparatus which allows a greater control on the oscillation of the electrospinning jet.

***Keywords:*** PA nanofibers, electrospinning, polymer, protective barriers.

## INTRODUCTION
It is common knowledge that electrospinning is an effective process to produce nanofibers. Amidst many other emerging applications the production of filters, membranes, composite reinforcement, drug delivery, protective barriers, sensors, wound dressings and tissue-engineered scaffolds produced with this technology is already a consolidated market. Nanofibers are valued for their small pore size and high surface area. The electrospinning process results from the ejection of a polymer fluid jet, from a capillary by the action of a strong electrostatic force, and its deposition onto a grounded target. An electrospinning apparatus, in its basic form, is comprised by a support containing the polymer solution (pippete or syringe), a pump, two electrodes, a DC voltage power supply in the kV range (typically 5kv to 25kv) and a grounded collector medium.

## RESULTS AND CONCLUSIONS
PA 6 and PA 6,6 polymeric solutions were prepared by dissolving each polymer into a mixture of 50% ratio of formic acid (Merck) and 50% of acetic acid (Sigma Aldrich). Afterwards 1% of NaCl was added to increase the electrical conductivity of the attained solution. The final mixtures were magnetically stirred (300rpm) and heated at 30ºc and 60ºc, respectively, to assure a homogeneous spinning solution. PA 11 was dissolved in 98% formic acid under magnetic stirring and heated at 90ºc for two hours. All solutions were cooled at room temperature prior being used in the electrospinning process. The main required features of the solutions are described in Table 1.

Table 1 - Characterization of the used polymeric solutions.

| Polymer | Concentration % (m/v) | Viscosity (mPA.s) a 23ºC | Conductivity (mS/cm) |
|---|---|---|---|
| PA 6 | 8 | 11,9 | 2,47 |
| | 10 | 14,1 | 2,59 |
| PA 6,6 | 8 | 12,2 | 2,94 |
| | 10 | 14,6 | 3,02 |
| PA 11 | 8 | 13,2 | 3.55 |
| | 10 | 15,7 | 3,82 |

Two power supplies Glassman models PS/ML40P07.5-22 and PS/ML40P07.G06 were used to apply voltages ranged from 8,3 Kv to 25Kv to the electrodes. Polymer solution was fed through a syringe Nordson model precision dispenser tip with 0,25 mm inner diameter using a Harvard Apparatus model PHD 2000 Infusion pump at a constant rate of 0,01 mL/min for the PA6 and PA6,6 polymer solutions and 0,03 mL/min. Three stainless steel rings with a diameter of 10cm each and a metallic fixed collector panel completed the experimental setup.(Figure 1).

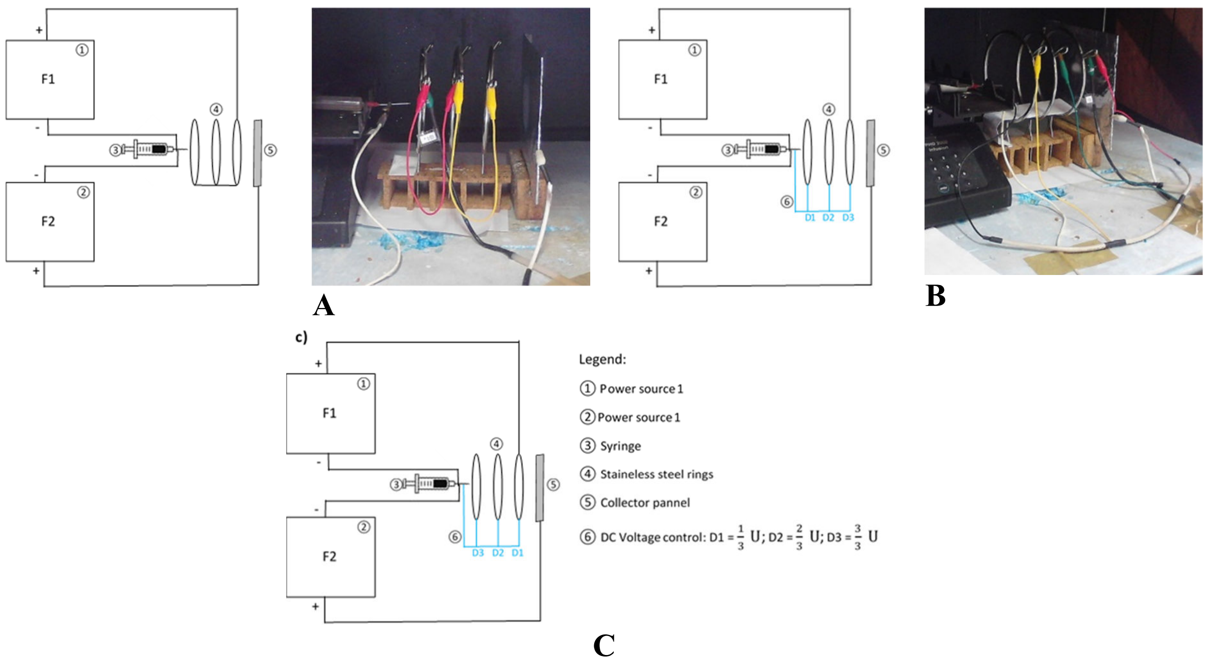


Fig. 1 - Electrospinning process variants

Our findings have demonstrated that the use of the novel electrospinning drafting system - experimental variant with increasing voltage - proved to be successful in the obtainment of thinner nanofibers with lower standard deviation and few beads formations. This fact can be explained by the tight control of the electrostatic field which, in turn, exerts a greater control over the inherent instability of the polymer jet along his travel from the needle tip to the collector panel and, consequently, ensuring a more controlled nanofiber deposition

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