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STUDY OF THE ELECTROACTIVE BEHAVIOUR OF CHITOSAN/PVA NANOFIBERS

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Introduction. The aim of this work was to study the electroactive properties of Electroactive Polymers based nanofibers. The nanofibrous material was obtained by electrospinning a chitosan/PVA solution, with chitosan acting as the electroactive polymer. From the results obtained it was possible to validate the influence of amino groups ($-NH_2$) on the electroactivation of the material. The development of new materials which exhibited a deformation or a change of shape as a response to an external stimulus is of great interest in the field of robotics, primarily for the development of soft actuators [1,2]. Electroactive Polymers (EAPs) are a group of polymers which deform under the influence of an electric stimulus [3]. Biopolymers such as gelatin, cellulose, alginate, starch, chitosan, and so forth, exhibit good electroactive properties, due to their polar groups [4]. Electrospinning is a process that allows the formation of micro- and nanoscale fibers. It is well known that nanofibers exhibit unique properties due to their high surface to volume ratio [5]. The study of the electroactive behavior of chitosan-based nanofibres is necessary for their potential application as soft actuators.

Main body. In order to study the electromechanical response of chitosan at its nanoscale, electrospinning process was utilized for the formation of chitosan/PVA nanofibers. The nanofibers where electrospun from solution with different chitosan content (from 2.5 – 4 wt.%) while maintaining a constant PVA content (5 wt.%), dissolved in a 40% acetic acid solution. Additionally, a second batch of nanofibers were electrospun in which chitosan and PVA where kept constant at 4 and 5 wt.%, respectively, and were dissolved at different acetic acid concentrations (10, 40, 60, and 80 %). Nanofibers samples were characterized using Fourier transform infrared analyses, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), optical microscopy, and tensile test. The FTIR spectra was deconvoluted in the 3000 – 3700 cm^{-1} -NH and -OH regions. The deconvolution reveals that the proportion of free amine in the samples is connected to the electroactive sensitivity of the material. As an example, the proportion of free amine detected on the chitosan/PVA nanofibers increased as the chitosan content has higher, being 3.6% and 4.59% for nanofibers with chitosan content of 2.5 and 4 wt.%, respectively.

Conclusions. From the results obtained, it can be concluded that chitosan/PVA nanofibers are a potential material for its further applicability as a soft actuator. Its electroactive properties can be easily tailored by varying parameters such as polymer content and acetic acid concentration, which have a direct influence on the proportions of free amine available in the material, thus influencing the electroactive response of the system.

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