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Natural rubber latex/PVA nanostructures used as system the skin regeneration

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Abstract -Natural rubber latex extracted from the *Hevea brasilliensis*, and Polyvinyl alcohol (PVA) can be used as scaffold to stimulate angiogenesis and neo-formation of tissues [1-3]. In this sense, the propose of this work is create a scaffold that mimics the extracellular matrix to be used as a powerful dressing to skin regeneration using the electrospinning technique to produce latex/PVA nanofibers.

Nanofibers and nanomaterials are potentially recent additions to materials in relation to tissue engineering (TE). TE is a interdisciplinary field to study the regeneration of biological tissues through the use of cells to support structures and biomolecules. In this sense, the developments of materials that improve cell proliferation are important for TE field. Nanofibers can be fabricated by a variety of methods including the electrospinning.

An electrospinning system comprises a polymer solution, contained in a syringe with a connected needle, figure 1. The polymer solution is usually provided a charge using a high voltage power source. In the process, a high voltage electric field is applied to the tip of the needle connected to the syringe containing the polymer solution. During this process, the polymer droplet gets charged and mutual charge repulsion within the droplet gives rise to a force that opposes the surface tension at the tip of the needle. At a critical voltage, the droplet elongates to form a cone at the tip of the needle known as the ‘‘Taylor cone’’. When the applied voltage exceeds a critical voltage, the electrical force within the liquid overcomes the surface tension and a fine jet of polymer emerges from the cone. The charged polymer jet is directed to the grounded collector. As the jet travels in air, the solvent evaporates, resulting in formation of polymer fibers, which are collected as a nonwoven fiber mesh on the grounded collector. The parameters that affect electrospinning can be classified into three categories: (i) solution parameters such as viscosity, conductivity/polarity, and surface tension, (ii) process parameters such as applied electric voltage, tip-to-collector distance, diameter of the needle tip, feed rate, and the hydrostatic pressure applied to the polymer solution, and (iii) ambient parameters such as temperature, air velocity, and humidity of the electrospinning chamber [4].

Natural rubber latex, extracted from the *Hevea brasilliensis*, performs a biological action that accelerates the healing process, being a powerful stimulator of cicatrisation. Latex induces angiogenesis and neo-formation of tissues, which makes it useful as a band-aid curative for the treatment of ulcers in diabetic patients [1-3]. Samples of pure latex can not electrospun because of its low viscosity.

In this context, the aim of this work is investigate the processes for fabrication of 3D latex/PVA nanostructure using electrospinning technique. Electrospun latex/PVA film will be produced using water solution in different concentrations. Also we will investigate the process parameters like applied electric voltage tip-to-collector distance, feed rate.

The characterization of the membranes produced will be investigated using differential scanning calorimetry Analyses (DSC), scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FTIR). The diameter of the fibers will be evaluated using *Image J* software. Cytotoxicity tests and cell cultured in vitro will be performed in fibroblast cells of mice.