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Production of electrospun biodegradable PVA nanofiber membranes for tissue engineering scaffold design

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Introduction: Electrospinning is an attractive technique by which we can produce fibrous biodegradable polymeric scaffolds for tissue engineering (TE) applications. Polyvinyl alcohol (PVA) is a biodegradable, biocompatible polymer with a fast-hydrolytic degradation rate due to its hydrophilicity, which however makes it suitable for cell viability and function. The combination of hydrophilic (cytocompatible) with hydrophobic (less cytocompatible but mechanically strengthen and more resistant to degradation) polymers may result in a suitable polymer scaffold design.

Aim: In the present work, we aimed to produce PVA polymeric membranes, as a potential part of a composite polymeric TE scaffold, with specific nanofiber architecture, giving special attention to the orientation of the fibers and, hence, controlling the final mechanical behavior to match that of the physiological tissues to be replaced.

Materials & Methods: We used a specifically designed and constructed drum collector for our custom-made electrospinning system, with accurate angular velocity control, and tested different electrospinning parameters (concentration of polymer aquatic solution, transfer rate, needle-collector distance, applied high voltage and angular frequency) to obtain optimization of the design.

Results: SEM results showed that the fiber diameters ranged from 200-400 nm, with a good quality of fiber appearance. Fiber orientation was directly related to the angular velocity (or rotational speed) of the drum collector (500, 1000, 1500 and 2000 rpm). Tensile testing up to breaking point, to assess Young's modulus and ultimate tensile strength and strain, as well contact angle measurements to assess scaffold's hydrophilicity are currently running.

Biography

D Mavrilas is an Associate Professor of Biomedical Engineering in the University of Patras, Greece. He has completed his PhD in Biomechanics from the University of Patras. He has published more than 30 papers in the fields of Biomechanics and Biomaterials, as well as in Scaffolds for Tissue Engineering.

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