Development and Characterization of Polymeric Nanofibrous Scaffolds Loaded with Drugs for Cardiovascular Applications

Αγγλική Περίληψη

The aim of this thesis was the development and characterization of polymeric biodegradable fibrous nanoplatforms that function as tissue engineering scaffolds and drug delivery, for their use as coatings for stents, thereof to overcome their complications, resulting to their successful implantation and the treatment of atherosclerosis. In this thesis, polymeric biodegradable nanofibrous scaffolds were fabricated through Electrospinning process, of two polymeric materials in which drugs were added, and combined scaffolds through Dual Syringe Electrospinning System consisting of both polymers combined randomly, as long as combined scaffolds with both drugs included. In particular, Polycaprolactone nanofibrous scaffolds and Polycaprolactone scaffolds loaded with the anti-inflammatory drug Curcumin, were fabricated, then Polylactic acid nanofibrous scaffolds, as long as Polylactic acid scaffolds loaded with the anti-platelet drug Dipyridamole, were also fabricated. Finally, through the Dual Syringe Electrospinning System, a combined scaffold of Polycaprolactone and Polylactic acid and this combined scaffold loaded with the two drugs, were fabricated as well. The morphology and topography of all these scaffolds, were studied with Optical Microscopy, Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM), and measurements of Contact Angle verified their hydrophobicity, also, degradation studies of all scaffolds, drug realease kinetics of the drug loaded scaffolds were conducted along with time, as well as in the end, cytotoxicity studies to confirm their cytocompatibility. In conclusion, all scaffolds had excellent morphology and proper roughness to promote the adhesion, growth and proliferation of L929 cells that were placed on their surface, also slow degradation rate of the scaffolds and controlled release of the drugs. Along with their successful cell viability studies, as MTT assay, Methylene Blue staining and immobilization of the cells and observation with SEM, it had been confirmed that all scaffolds were cytocompatible. Specifically, this innovative combined scaffold of Polycaprolactone with Curcumin and Polylactic acid with Dipyridamole, fabricated with the novel method of Dual Syringe Electrospinning System, is a unique biofunctional microenvironment that mimics the extracellular matrix of the cells. Through the study of this scaffold, it has been proved that it is a promising tool for stent coating, that releases both drugs simultaneously in a controlled manner, to combat stent complications and facilitate the treatment of Cardiovascular Diseases (CVDs).