SYNTHESIS AND CHARACTERIZATION OF BI-LAYERED, NANOFIBER SCAFFOLD FOR DRUG DELIVERY APPLICATIONS

By

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Abstract

Non-steroidal anti-inflammatory drugs (NSAIDs) are frequently utilized in the treatment of painful musculoskeletal disorders; however, oral use predisposes the body to moderate to severe gastrointestinal complications. Electrospun nanofibers have been explored as novel vehicle for drug delivery that offer site-specific distribution and improve therapeutic efficacy and reduce toxicity by delivering drugs at a controlled rate. Our objective was to develop a bi-layer nanofiber scaffold to effectively deliver therapeutic doses of a model NSAID. Electrospinning parameters were optimized to develop the PVA-NAP(Na) and PCL-NAP(Na) bi-layered nanofiber scaffold. Characterization of the electrospun bi-layered scaffold via SEM analysis showed that nano-scale diameter fibers were being produced for both the fast-degrading, PVA-NAP(Na) nanofibers and the slow-degrading, PCL-NAP(Na) nanofibers. Additionally, FITR spectra analysis confirmed the chemical integrity of the polymers used to electrospin the bi-layer. *In vitro* analysis was performed to determine the response of mouse macrophages to the polymer material, nanofiber matrix topography, and release of NSAIDs. Qualitative data revealed that macrophage morphology on the bi-layered scaffold was altered in comparison to controls, suggesting that the burst-release of NAP(Na) from the fast-degrading PVA nanofiber layer was affecting the phenotype of the macrophages. FTIR spectra analysis qualitatively revealed that after 72 hours in cell culture, the bi-layer nanofiber scaffold showed complete loss of spectral peaks corresponding to the NSAID, indicating that the NAP(Na) was being released from the nanofibers. These results collectively indicate that the electrospinning process can be used to develop a bi-layered NSAID-eluting nanofiber scaffold for drug delivery of naproxen-sodium (NAP(Na)) at both a burst-release and controlled rate.