Shih-Feng Chou, J Material Sci Eng 2017, 6:10 (Suppl)
DOI: 10.4172/2169-0022-C1-088

Effects of drug-polymer interactions on mechanical behaviors and pharmaceutical performance in drug-eluting nanofibers

Shih-Feng Chou
The University of Texas at Tyler, USA

Electrospun Nano fibers are advantageous in drug loading efficiency with the ability to tune release rates based on polymer compositions. As a result, the mechanical behaviors of the Nano fibers may be significantly affected by polymer compositions and drug loading. However, effects of drug loading on the mechanical properties and release behaviors of fiber-based delivery system have not been fully investigated. Here, we studied the mechanical behaviors and pharmaceutical performance of blend polycaprolactone (PCL) and poly(D,L-lactic-co-glycolic) acid (PLGA) Nano fibers at various blend ratios with drug loading up to 40 wt.%. Results from uniaxial tensile tests suggested that Nano fibers made from various PCL/PLGA blends and drug loadings exhibited strong drug-polymer interactions. Average Young's moduli and tensile strength of blank PCL/PLGA Nano fibers gradually increased with increasing PLGA contents in the blend Nano fibers. However, TFV loaded Nano fibers revealed a different trend in mechanical properties as comparing to blank Nano fibers, indicating the effects of drug-polymer interactions. In particular, PCL/PLGA 20/80 Nano fibers received minimal changes in mechanical properties due to offsetting effects in drug-polymer interactions at drug loading up to 40 wt.%. Tensile samples collected from the release media at predetermined time points showed significant decreases in average Young's modulus and tensile strength as compared to the blank Nano fibers. The additional loss of mechanical properties was associated with drug release and biodegradation of polymer matrix. Interestingly, TFV release rates increased in prestretched Nano fibers. Mechanical assessments on drug partition in PCL/PLGA Nano fibers suggested higher drug content in the PCL phase than in the PLGA phase. This study contributes significantly to the understanding of drug-polymer interactions in electrospun drug-eluting Nano fibers and provides important information for implantable therapeutic biomaterials in future clinical applications.

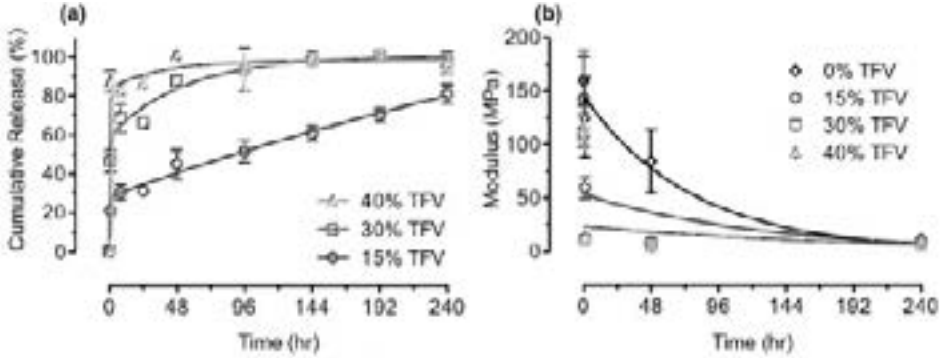

Figure 1. (a) Drug release profiles of PCL/PLGA 20/80 nanofibers at various TFV loading. (b) Young's modulus of PCL/PLGA 20/80 nanofibers at various TFV loading.

Biography

Dr. Shih-Feng Chou is an Assistant Professor in the Department of Mechanical Engineering at The University of Texas at Tyler. He completed his PhD from Auburn University in 2011 followed by working as a research associate at Dartmouth College from 2012 to 2013 and a senior fellow at University of Washington from 2014 to 2016. He has expertise in fabrication of electrospun nanofibers and evaluation of their mechanical and pharmaceutical properties. His goal is to inform the field on how to decouple mechanical performance and drug release behaviors of implantable biomaterials.

schou@uttyler.edu