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The Effect of polymer/ceramic scaffold architecture and composition on the growth of MC3T3 osteoblastic cell line

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Abstract

Tissue engineering scaffolds seeded with cells and growth factors have shown promise for the treatment of bone defects. In this study, we have developed a method of fabricating polymer/ceramic scaffolds that leads to a controlled pore size and fully interconnected pores, while avoiding the use of toxic solvents. Our scaffolds were produced through melt processing, which involves heating a blend of two polymer powders above their melting temperatures to generate an interpenetrating network. Polycaprolactone (PCL) was the primary scaffold material used in this study due to its low melting temperature (below 70^0C). Poly (ethylene oxide) (PEO) has a similar melting point and was used as the primary porogen. Hydroxyapatite (HA) was incorporated into the polymer blend so as to produce constructs with enhanced osteoconductivity. The porosity and interconnectivity of the scaffolds were achieved through dissolving PEO in water. The effects of polymer ratio, HA content, and pressure applied during the fabrication process were investigated in this study. The effectiveness of these scaffolds were determined by examining the porosity, pore interconnectivity, and mechanical properties through performing micro-computed tomography (µ-CT) and unconfined compression analyses. Our results demonstrated that melt processing was capable of producing scaffolds with desired pore size range (> 150 µm), and porosity greater than 55%. Also, the incorporation of HA into the scaffolds did not negatively impact scaffold morphology or pore formation. The *in vitro* studies were performed using osteoblastic MC3T3-E1 cell line to verify the suitability of these constructs for bone tissue engineering.

Biography

Amy Yousefi completed her Ph.D. in Chemical Engineering at University of Montreal in 1996. After postdoctoral studies on computational fluid dynamics (CFD) at the same university, she joined the National Research Council of Canada (NRC) in 1999 as a researcher, where she established a research program on tissue engineering scaffolds. Since 2009, Dr. Yousefi has been holding a faculty position as a Spooner Schallek Associate Professor at Miami University. She has published 20 papers in reputed journals and has given over 50 conference presentations. Since 2010 she has been working with 4 NIH study sections as a reviewer.