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Bulk compounding of PCL-PEO blends for 3D plotting of scaffolds for cardiovascular tissue engineering

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Abstract

3D plotting of micro-extruded filaments is a promising method for the additive manufacturing of porous scaffolds (for tissue engineering) in thermoplastic polymers. A much investigated polymer for degradable scaffolds is poly-ε-caprolactone (PCL). One of the remaining issues with the material is its inherent hydrophilicity, which leads to non-specific protein adsorption. Specifically for cardiovascular applications, it has also been found that PCL is insufficiently flexible to mimic the mechanic-elastic behavior of the natural tissue. Earlier research has shown that blending with low molecular weight poly-ethylene-oxide (PEO) may offer an improvement in terms of both hydrophilicity and flexibility. Until now, condensation polymerization has been used as a manufacturing method for these blends, since PCL and PEO are largely immiscible in the melt. Condensation polymerization, however, is tedious work which yields only a few grams of material at a time. Therefore, in the current research, a method has been developed for the bulk compounding of PCL-PEO blends, using a double-screw extruder. The manufactured blends were evaluated for composition, dispersion of the PEO, surface and mechanical properties of 3D-plotted scaffolds and crystalline morphology.

Biography

Kim Ragaert is a postdoctoral researcher at the Centre for Polymer Materials and Technologies at Ghent University, Belgium. In 2011, she obtained her PhD in Engineering from Ghent University, on a topic related to micro-extrusion based 3D plotting of scaffolds for tissue engineering. She is the author of several peer-reviewed manuscripts, a patent application and a book chapter. She also lectures to engineering students on materials science, polymer processing and material characterization.