Investigation of the degradation rate of porous PEG-PLLA-DA copolymer for tissue engineering applications

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Abstract

Poly(ethylene glycol) (PEG) is a hydrophilic and biocompatible polymer that is readily cleared by the body. It is a polymer that has been widely investigated for biomedical applications. PEG becomes photopolymerizable by replacing the end-capped hydroxyl groups with acrylate and forming PEG-DA. Hydrogels formed by the photoinitiated cross-linking of PEG-DA are versatile and can be customized by modifying chain length and adding degradable linkages. Poly(L-lactide) (PLLA) is a hydrophobic and biodegradable polymer that has been studied extensively for biomaterial applications and introducing units of PLLA into acrylated PEG-PLLA creates a copolymer that is degradable under physiological conditions. In this study porous PEG-PLLA copolymer hydrogel has been investigated in degradation studies and mechanical testing. Gels of concentrations 12.5%, 25% and 50% with same size porosity and 25% gels with varying size porosity are prepared. Porosity is obtained by a salt-leaching method. The gels are made porous to improve cell migration, tissue invasion, molecular transport and cell adhesion by introducing increased surface area. Such cell behavior is important for tissue engineering applications for good cell adhesion and proliferation. After the synthesis of the porous hydrogels their degradation rate in vitro has been quantified by confocal microscopy and mechanical properties using compression testing. Variations in degradation rate according to the different gel concentrations have been recorded.