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Polymeric Microspheres for Bone Tissue Engineering

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Abstract : Poly (lactic-co-glycolic) acid (PLGA) is a synthetic polymer that can be used in bone tissue engineering with the aim of creating a scaffold in order to support the growth of cells. The formation of microspheres from this polymer is an attractive strategy that would allow for the development of an injectable system, hence avoiding invasive surgical procedures. The aim of this study was to develop a microsphere delivery system for use as an injectable scaffold in bone tissue engineering and evaluate various formulation parameters on its properties. Porous and lysozyme-containing PLGA microspheres were prepared using the double emulsion solvent evaporation method from various molecular weights (MW). Scaffolds were formed by sintering to contain 1 -3mg of lysozyme per gram of scaffold. The mechanical and physical properties of the scaffolds were assessed along with the release of lysozyme, which was used as a model protein. The MW of PLGA was found to have an influence on microsphere size during fabrication, with increased MW leading to an increased microsphere diameter. An inversely proportional relationship was displayed between PLGA MW and mechanical strength of formed scaffolds across loadings for low, intermediate and high MW respectively. Lysozyme release from both microspheres and formed scaffolds showed an initial burst release phase, with both microspheres and scaffolds fabricated using high MW PLGA showing the lowest protein release. Following the initial burst phase, the profiles for each MW followed a similar slow release over 30 days. Overall, the results of this study demonstrate that lysozyme can be successfully incorporated into porous PLGA scaffolds and released over 30 days in vitro, and that varying the MW of the PLGA can be used as a method of altering the physical properties of the resulting scaffolds.

Keywords : bone, microspheres, PLGA, tissue engineering
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