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Research paper

Manipulation of mechanical compliance of elastomeric PGS by incorporation of halloysite nanotubes for soft tissue engineering applications

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ABSTRACT

Poly (glycerol sebacate) (PGS) is a promising elastomer for use in soft tissue engineering. However, it is difficult to achieve with PGS a satisfactory balance of mechanical compliance and degradation rate that meet the requirements of soft tissue engineering. In this work, we have synthesised a new PGS nanocomposite system filled with halloysite nanotubes, and mechanical properties, as well as related chemical characters, of the nanocomposites were investigated. It was found that the addition of nanotubular halloysite did not compromise the extensibility of material, compared with the pure PGS counterpart; instead the elongation at rupture was increased from 110 (in the pure PGS) to 225% (in the 20 wt% composite). Second, Young's modulus and resilience of 3–5 wt% composites were ~0.8 MPa and >94% respectively, remaining close to the level of pure PGS which is desired for applications in soft tissue engineering. Third, an important feature of the 1–5 wt% composites was their stable mechanical properties over an extended period, which could allow the provision of reliable mechanical support to damaged tissues during the lag phase of the healing process. Finally, the *in vitro* study indicated that the addition of halloysite slowed down the degradation rate of the composites. In conclusion, the good compliance, enhanced stretchability, stable mechanical behavior over an extended period, and reduced degradation rates make the 3–5 wt% composites promising candidates for application in soft tissue engineering.

1. Introduction

The immediate availability of functional tissue replacements for use as implants is of great importance to human healthcare. Huge efforts have been invested into the development of synthetic biomaterials that mimic the physical and molecular properties of natural tissue. Despite much earlier progress, there are few satisfactory products available for clinical use that can substitute soft tissues, such as muscle and connective tissue (Freed et al., 2009),

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