

**Electrospun Polyester Fiber Composites for Controlled Release of
Parathyroid Hormone**

by

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ABSTRACT

The N-terminus of parathyroid hormone (PTH₁₋₃₄) is an anabolic bone forming protein that the FDA has approved for treating osteoporosis. Current methods of PTH administration include daily systemic injection, which is inconvenient, costly and can preclude use for treating large bone defects. This work proposes a novel biomaterial for the localized controlled release of PTH over an extended amount of time. This biomaterial consists of the biodegradable polyester, poly(L-lactic acid) (PLLA) and poly(L-lactic-co-glycolic acid) (50:50) (PLGA) composited with hydroxyapatite nanoparticles (HAp-NPs). PTH was incorporated into the PLLA and PLGA electrospun fibers using two different approaches, by directly electrospinning the PTH into the polyester and by first binding the PTH to HAp-NPs and then electrospinning these nanoparticles with the polyester. Three different release media were utilized to stabilize, destabilize, or not to participate in the dissolution of HAp to study the impact of HAp degradation on PTH release. A PTH₁₋₃₄ specific ELISA quantified the PTH release from the polyester fibers and scanning electron microscopy (SEM) and transmission electron microscopy (TEM) examined the degradation and change in morphology of fiber samples. Cumulative release of PTH was almost two-times higher from the PLGA-based fibers than from the PLLA-based fibers, and was further enhanced by the inclusion of HAp-NPs. PTH release rates from electrospun fibers were tunable by changing the polymer type and adsorbing the PTH onto HAp-NPs prior to electrospinning. *In vitro* cell bioactivity assays showed that the released PTH retained significant bioactivity through two weeks. These PTH-releasing electrospun fiber scaffolds may have clinical potential to heal bone defects and fractures by delivering PTH locally over an extended period of time.