Curcumin loaded waste biomass resourced cellulosic nanofiber cloth as a potential scaffold for regenerative medicine: An in-vitro assessment

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ABSTRACT

This article demonstrates the development of nanofibrous cloths by electrospinning of renewable materials, i.e., curcumin-loaded 90% cellulose acetate (CA)/10% poly(ε-caprolactone) (PCL), for applications in regenerative medicine. The CA is derived from the biomass waste of the oil palm plantation (empty fruit bunch). The nanofiber scaffolds are characterized for the fiber morphology, microstructure, thermal properties, and wettability. The optimized smooth and bead-free electrospun fiber cloth contains 90% CA and 10% PCL in two curcumin compositions (0.5 and 1 wt%). The role of curcumin is shown to be two-fold: the first is its function as a drug and the second is its role in lowering the water contact angle and increasing the hydrophilicity. The hydrophilicity enhancements are related to the hydrogen bonding between the components. The enhanced hydrophilicity contributed to improve the swelling behavior of the scaffolds; the CA/PCL/Cur (0.5%) and the CA/PCL/Cur (1.0%) showed swelling of ~700 and 950%, respectively, in phosphate-buffered saline (PBS). The drug-release studies revealed the highest cumulative drug release of 60% and 78% for CA/PCL/Cur (0.5%) and CA/PCL/Cur (1.0%) nanofibers, respectively. The in-vitro studies showed that CA/PCL/Cur (0.5 wt%) and CA/PCL/Cur (1.0 wt%) nanofiber scaffolds facilitate a higher proliferation and expression of actin in fibroblasts than those scaffolds without curcumin for wound healing applications.

KEYWORDS

Natural medicine; Renewable materials; Skin tissue engineering; Surface wetting; Adsorbent polymers

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