Essential oil-loaded coaxial wet-spun fibers for potential wound therapies

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Chronic wounds (CWs) are frequently associated with bacterial infections. The development of antibiotic-resistant microorganisms makes it crucial to think of alternative solutions. Considering these issues, a drug delivery system made of coaxial wet-spun fibers loaded with essential oils (EOs) was proposed. Coaxial structures were produced using the wet-spinning technique, in which 10% w/v polycaprolactone (PCL, a synthetic polymer with excellent mechanical properties and elastic behavior) was used to produce the core and loaded with three EOs, Clove Oil (CO), Cinnamon Leaf Oil (CLO) and Tea Tree Oil (TTO) at 2×Minimum Bactericidal Concentration (MBC). The shell was made of a blend of 10% w/v cellulose acetate (CA, a natural polymer which has been reported to offer good structural integrity) and 10% w/v polyethylene glycol (PEG, a synthetic polymer often used as a plasticizer), mixed at a ratio of 90/10 v/v, respectively, so pores could be opened in the outer layer, allowing for a sustained release of the EOs loaded at the fibers' core overtime. The formation of coaxial structures was confirmed by Brightfield Microscopy. Coaxial fibers exhibited high maximum elongations at break (≈350%). EO-loaded fibers were effective against *S. aureus*, *S. epidermidis*, *E. coli* and *P. aeruginosa*, the most common bacteria present in CWs. Results confirmed the potential of the engineered coaxial wet-spun fibers for wound healing applications. Still, further characterization on the fibers is necessary, including cytocompatibility tests to assure non-toxic profiles of the fibers when in contact with fibroblasts and keratinocytes.

Keywords: antimicrobial effectiveness; core-shell fibers; therapeutic natural extracts.