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Fabrication and characterization of antibacterial herbal drug-loaded poly-lactic acid/cellulose acetate composite nanofibers for wound dressing applications

Gomaa F Salma[1], **Sherbiny M Ibrahium** and **Madkourtarek**[2]
[1]American University in Cairo, Egypt
[2]Zewail City for Science and Technology, Egypt

In this study, an interactive electrospun nanofibrous scaffolds, based on two biopolymers, Polylactic Acid (PLA) and Cellulose Acetate (CA), was prepared.Thymoquinone (TQ), was incorporated into the electrospun fibers. TQ is the active ingredient of *Nigella sativa*, known for its antibacterial properties and ability to promote wound healing. The potentiality of the prepared scaffolds, as an interactive wound dressing, has been investigated including, swelling behavior, water vapor permeability and porosity. TQ-release profile was examined at the physiological pH (7.4) and temperature (37°C). The antimicrobial efficiency of the scaffolds against gram negative and gram positive bacteria were determined by the agar diffusion assay. The interaction between fibroblasts and the prepared scaffolds such as viability, proliferation, and attachment were characterized. TQ-loaded PLA: CA scaffolds showed burst TQ release after 24 h, compared with TQ-loaded PLA scaffolds, followed by a sustained release rate. The presence of CA in the scaffolds improved its hydrophilicity, and water uptake capacity. Furthermore, it created a moist environment for the wound, which can accelerate wound recovery.The TQ-loaded PLA: CA nanocomposite also showed a significant antibacterial activity against both gram positive and gram negative bacteria. Furthermore, the nanocomposite scaffolds enhanced cell proliferation and attachment, as compared to TQ-loaded PLA nanofibers. A preliminary in vivo study performed on mice skin wound models demonstrated that TQ-loaded PLA: CA (7:3) scaffolds significantly accelerated the wound healing process by promoting angiogenesis, increasing re-epithelialization and controlling granulation tissue formation. Our results suggest that TQ-loaded PLA: CA nanocomposite could be an ideal biomaterial for wound dressing.

Biography

Gomaa F Salma is an MSc holder in Nano-chemistry from American University in Cairo (AUC). She first graduated from Faculty of Science, Ain Shams University in 2010. In spring 2012, she joined the American University, as a chemistry Master student, and got her degree in fall 2015. She worked as teaching assistant in the chemistry department, AUC, from fall 2012-till spring 2015. In 2013, she joined Zewail City for Science and Technology where she worked as both teaching assistant in the chemistry department, and research assistant in the material science department, nanotechnology center. She was awarded the University fellowship and the thesis grant from the School of Science and Engineering, AUC. Also she was awarded the graduate student of honor for her academic achievement throughout her graduate study.

Salma88@aucegypt.edu

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