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Three-dimensional Electrospun Biodegradable Nanofibers Scaffolds Loaded With Amoxicillin For Wound Healing Applications: Preparation & Characterization

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Abstract

Background: The use of electrospinning technology (ET) in fabrication of three-dimensional biodegradable electrospun nanofibers scaffolds (BENS) has recently gained considerable attention in tissue engineering. BENS are superior to other existing scaffolds in tissue regeneration as they provide high surface area-to-volume ratio, possess high porosity, and offer a biomimetic environment in a nanometer scale.

Objectives: To fabricate & characterize BENS using polyethylene glycol 35000 (PEG35000) as a biodegradable polymer loaded with Amoxicillin Trihydrate (AT) for use as a wound dressing.

Method: Solutions of PEG35000 in chloroform of varying concentrations were used to fabricate BENS using ET. Blank & 10% w/v AT loaded BENS were fabricated & further characterized. Morphology, size and diameter of BENS were assessed using Scanning electron microscopy (SEM). Fourier Transform Infrared (FTIR) Spectroscopy was used to identify the interaction between PEG35000 and AT. Differential Scanning Calorimetry (DSC) was used to access the crystallinity and thermal behavior of the prepared BENS. X-Ray Diffraction (XRD) analysis for the blank and drug loaded electrospun fibers was carried out to identify the changes in their crystalline pattern.

Results: Blank & AT loaded 35% w/v PEG35000 solutions produced the most homogenous and intact nanofibers. Major bands of AT in FTIR were clearly observed in the spectrum of AT with PEG35000 post electrospinning. Moreover, DSC thermograms indicated that AT existed in it amorphous dissolved state within PEG fibers supported by the disappearance of its melting peak at 133 C° and confirmed by the complete absence of AT crystals under SEM. Finally, the results of DSC were confirmed by XRD patterns. Characterizing XRD peaks of AT loaded with PEG3500 post electrospinning disappeared as an indication of the complete dispersion of AT in the loaded fibers and its complete conversion to the amorphous form.

Conclusion: BENS using PEG35000 loaded with AT were successfully fabricated and characterized. Our findings show that this dressing has features that make it a promising product for wound healing applications.

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