

Preparation and characterization of drug-loaded, electrospun nanofiber mats formulated with zein or zein-based mixtures for wound healing applications.

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ABSTRACT

Electrospun zein mats are known to have poor mechanical and water uptake properties limiting their usefulness as wound dressings.

In this study, the effects of the solvent system used, the incorporation of the polymeric additives; polyethylene glycol 20000 (PEG20K) and polyvinylpyrrolidone K30 (PVPK30); and the crosslinking agent Tannic Acid (TA) on the mechanical and water uptake characteristics of zein – based nanofiber mats were investigated.

The incorporation of either PEG20K or PVPK30 resulted in an improvement in water vapor sorption and a reduction in water contact-angle of the nanofiber mats. In addition, the incorporation of PEG20K and PVPK30 reduced the ultimate tensile strength, and Young's modulus while increasing the percent elongation of the nanofiber mats. The use of tannic acid as a crosslinking agent led to an increase in the water vapor sorption, ultimate tensile strength, and Young's modulus of the nanofiber mats.

Mats with smaller average fiber diameter, greater ultimate tensile strength, higher Young's modulus, and greater water vapor sorption were obtained when using 80% (v/v) aqueous ethanol as a solvent system during the preparation of the nanofiber mats when compared to those produced using 60% (v/v) aqueous ethanol. In addition, using solutions with lower zein concentration resulted in mats with lower average fiber diameter, lower ultimate tensile strength and Young's modulus, and higher percent elongation.

Selected formulations were loaded with tetracycline hydrochloride and drug release was evaluated in bulk liquid and using Franz diffusion cells. The use of Franz diffusion cells allowed the discrimination between formulation performance as a function of composition and water uptake properties. Drug release from nanofiber mats was also confirmed by observing the formation of an inhibition zone in cultures of *E. coli* and *S. aureus* using the agar diffusion assay.

Improved performance of zein nanofiber mats was achieved using polymeric modifiers and crosslinking with tannic acid improving their suitability for wound dressing applications.