2013-14

Rajnibhai V. Patel
PharmInnova Award
Best M. Pharm Thesis

WINNER

Winner

Mr. Vannuruswamy Garikapati

Research Guide

Dr. Anand P. Gadad

Subject:
Pharmaceutics & Pharmaceutical Technology

Thesis Title :
Development of Non-Woven NanoFiber formulations of Thermosensitive Polymer blends as wound healing application

College:
KLE University College of Pharmacy, Belgaum

Nonwoven nanofiber synthetic dressing with antibacterial drug

Outcome of Research:

Synthetic polymers have a wide biomedical application in the preparation of synthetic dressings. However, formulating nanofibers using naturally occurring polymers normally exhibit better biocompatibility and less potential of allergic reaction, as compared to synthetic polymers. This study proposed an innovative method of formulating non-woven nanofibers enriched with antibacterial drug (Nadofloxacin), by blending shellac (a naturally occurring polymer) with synthetic and natural polymers to demonstrate wound healing application. Electrospinning technique was adopted to achieve the set target. Developed nanofiber mats with nadifloxacin exhibited faster wound healing as compared to commercial antibacterial dressing in various in vitro and in vivo studies.

Thesis Title: Development of non-woven nanofiber formulation for thermo sensitive polymer blends as wound healing application

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ABSTRACT

Shellac is being used in food, pharmaceutical and agricultural industry. However, shellac is seldom used for biomedical applications due to its drawbacks like poor mechanical and instability properties. Hence, the objective of this study is to improve properties of shellac by blending with synthetic and natural polymers and fabricate non-woven nanofiber mats enriched with antibacterial drug to demonstrate wound healing application. Designed formulations of thermo sensitive poly (N-isopropylacrylamide) (PNIPAM), shellac and gelatin polymeric blend solutions with and without nadifloxacin and fabricated non-woven nanofiber mats by electrospinning method. The morphology of nanofiber mats was analysed by environmental scanning electron microscope (ESEM). Interactions between polymers, polymer with drug and variation in thermal and crystalline properties before and after nanofiber formation were analyzed by Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), and X-ray diffraction (XRD). ESEM analysis revealed that nanofiber formation was influenced by concentration of polymer, drug and polymer blend composition and nanofiber mats of shellac/gelatin/PNIPAM blend of composition 3/7/3% was suitable for developing various formulations. In-vitro drug release studies showed slow, constant and sustained release for 140 h. The amount of drug released from the drug loaded nanofiber mats at the respective time interval was above minimum inhibitory concentration (MIC). Release kinetics and mechanism confirmed zero order release with resultant r2 values greater than 0.99 and the Korsmeyer - Peppas release exponent (n) was slightly higher than 0.8, which indicated that the drug diffusion was anamolous or non-fickian type, which implied release of drug followed by diffusion and chain stretching. The bacterial zone of inhibition increased as a nadifloxacin concentration increased in nanofiber mats. In direct cytotoxicity studies revealed that there was no significant toxic effect against normal human fibroblast (NHF) cells. Antibacterial activity, in-vitro and in vivo studies demonstrated that the developed nanofiber mats with nadifloxacin were more suitable for faster wound healing as compared to nanofiber mats without drug and commercial antibacterial gauze dressing.

Key words: nanofibers, electrospinning, wound healing, thermosensitive, shellac.