

Electrospun poly (vinyl alcohol) nanofibers doped with mesoporous silica nanoparticles for controlled release of hydrophilic model drug

ABSTRACT

Nanofiber materials have often been reported as transporters for clinical drugs but face the limitation of burst releasing the drugs. Therefore, mesoporous silica nanoparticles (MSNs) have raised much interest to be used in drug delivery system because of their large pore volume and high surface area. In this study, nanofiber drug delivery system based on poly(vinyl alcohol) (PVA) loaded with novel ionic liquid templated MSNs were successfully prepared by the electrospinning method. The composite fiber mat was designed for the prolonged and sustained release of drug. MSNs were synthesized by co-condensation method with average particles size of ~70 nm and then loaded with hydrophilic model drug methylene blue (MB). The effect incorporation of MB-loaded MSNs into the polymer solution to form fibrous structure was investigated. Uniform PVA/MB nanofiber mat was also produced as controls. The morphologies of nanoparticles and composite nanofiber were characterized by field emission scanning electron microscope (FESEM). After electrospinning, electron microscope revealed that MSNs were randomly distributed in the regions of nanofiber. Drug release profiles of MB from MSNs and electrospun mats were evaluated. The results indicated that adsorption of model drug MB into MSNs and incorporation them into nanofiber are effective way of minimizing burst release of drug. Sustained delivery was achieved with controllable release during the 120h releasing period.

Keyword: Poly(vinyl alcohol); Mesoporous silica nanoparticles; Nanofiber; Electrospinning; Drug delivery