Electrospun composite nanofibers containing biocompatible inorganic tungsten disulfide nanoparticles

Abstract

Tungsten disulfide nanoparticles (WS2) emerged as excellent theranostics tool due to their exquisite optical properties and wide surface available for bioconjugation. However, their controlled delivery in vivo remains a challenge. Poly (lactic-co-glycolic acid) (PLGA) nanofibers are widely used as preferred carriers for the controlled release of drugs due to their biodegradability and their easy formation and preparation. In this study, the inorganic WS2 nanoparticles demonstrated lack of cytotoxicity towards human peripheral blood mononuclear cells (PBMC) in vitro up to 100 µg/ml. Although these nanoparticles were easily internalized by monocytes, they did not modulate PHA induced proliferation of PBMCs significantly. After loading of WS2 with fluorescein isothiocyanate (FITC) as a model drug, they displayed similar cytotoxic profile in culture with PBMCs. PLGA composite nanofibers containing FITC-loaded WS2 were prepared through an electrospinning solution technique. Field-emission scanning electron microscopy and in-situ scanning probe microscopy imaging were used to examine the morphology of the biocompatible nanoparticles and electrospun nanofibers, respectively. The distribution of fluorescent nanoparticles in the composite nanofibers was evaluated by fluorescence microscopy. Cumulatively, the electrospun composite nanofibers incorporated with biocompatible WS2 inorganic nanoparticles represent new attractive theranostics platform, enabling a well-controlled delivery of bioactive molecules.