Release behaviour and toxicity evaluation of levodopa from carboxylated single-walled carbon nanotubes

ABSTRACT

This work explores the potential use of commercially obtained, carboxylated, single-walled carbon nanotubes (SWCNT–COOH) as nanocarriers for the antiparkinson drug, levodopa (LD). The resulting nanohybrid was characterized using materials characterization methods including Fourier transform infrared spectroscopy, Raman spectroscopy, elemental analysis, UV–vis spectroscopy and scanning electron microscopy. The results showed that SWCNT–COOH were able to form supramolecular complexes with LD via a π–π stacking interaction and exhibited favourable, slow, sustained-release characteristics as a drug carrier with a release period over more than 20 h. The results obtained from the drug release studies of LD at different pH values showed that the LD-loaded nanohybrid is pH activated. The release kinetics of LD from SWCNT–COOH were well-described by a pseudo-second-order kinetic model. A cytotoxicity assay of the synthesized nanohybrid was also carried out in PC12 cell lines (a widely used, in vitro Parkinson's model for neurotoxicity studies) using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay in order to investigate their possible effects on normal neuronal cells in vitro. It was found that the synthesized nanohybrid did not compromise the cell viability and the PC12 cells remained stable throughout the experiments up to 72 h after treatment.

Keyword: Carboxylic acid-functionalized single-walled carbon nanotubes; Levodopa; MTT assay; Nanomedicine; Parkinson's disease; PC12 cells; Sustained release