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Synthesis and Evaluation of Chemically-Conjugated Carbon Nanotubes with PEG as a Drug Carrier

M. Habibizadeh*, K. Rostamizadeh, N. Dalali

Chemistry group, Department of Science, University of Zanjan, Zanjan, Iran
Medicinal Chemistry Department, School of Pharmacy, Zanjan University of Medical Sciences, Zanjan, Iran

Background and Aims: Carbon nanotubes (CNTs) have been investigated as an excellent candidate for drug delivery carrier due to their unique structures including high aspect ratios, high surface areas, nanosized stability and facile functionalization by different ways. Recently various types of functionalized CNTs have been prepared for delivery of drugs, proteins, peptides and nucleic acids (for gene transfer or gene silencing), in vivo tumour imaging and tumour targeting. In this study, we report the preparation and characterization of multiwalled carbon nanotube (MWCNTs) conjugated with diamino-poly ethylene glycol (NH_2-PEG-NH_2) as a carrier for ipubrufen (Ip) as a model drug.
Methods: MWCNTs-PEG-NH_2 was synthesized by amidation reaction between MWCNTs and diamino-PEG. In order to drug loading, a saturated solution of Ip in methanol/water (1:1) was mixed with MWCNTs-PEG-NH_2 under ultrasonication for 6 h. then, they were shaked for 72 h. The solid was collected by centrifugation at 15000 rpm for 30 min and the extent of drug loading was evaluated by HPLC equipped with UV-Vis detector at 254 cm^{-1}. Drug release behavior of MWCNTs-PEG was studied in pH=7.4 and 37 °C (the physiological pH and temperature). Nanocarriers were characterized with Dynamic Light Scattering (DLS), FTIR and AFM.
Results and discussion: Conjugation of MWCNTs with PEG was demonstrated with FTIR. It was found that the size of nanocarriers were 1284 and 652.9 nm for MWCNTs and MWCNTs-PEG-NH_2, respectively. Decrease in size of MWCNTs can be interpreted due to this fact that PEG functionalized MWCNTs show good dispersity in aqueous solution compared to the MWCNTs. The drug-loading was determined to be 62%.The release of Ip in PH=7.4 and at 37 ^{0}C were also studied and the findings showed that totally 79% of loaded drug were released under experimental condition.
Conclusions: It can be concluded that Functionalized MWCNTs can be considered as promising candidate for drug delivery.

Keywords: PEG; MWCNTs; Nanotechnology; Drug delivery