Triple Functionalization of Single-walled Carbon Nanotubes For Cancer Therapy

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Abstract

Chemotherapy is a mainstay strategy in the management of cancer. Regrettably, they suffer from serious side effects due to their effect on healthy cells besides cancerous cells. Therefore, many researchers are eager to develop new drug delivery systems that may help to decrease the side effects and the effective dose of the drug in addition to target delivery of the chemotherapy to cancer cells. One of the epochal drug delivery systems in this field are based on carbon nanotubes technology. The aim of this work is the covalent functionalization of single walled carbon nanotubes with Doxorubicin in the presence oftetra ethylene glycol linker to improve the solubility and dispersibility of the developed nanodrug. Moreover, in order to target the cancer cells, a targeting agent mannose was also loaded on the nano-system, and as a unique step in detecting the effectiveness of our system we add fluorescent part FITC. The characterization of the developed nano-drug by transmission electron microscopy showed good dispersibility of the functionalized single walled carbon nanotubes with diameters (6-10) nm. Thein vitrorelease profile of Dox from Dox-mannose-SWCNTs showed 75% of the loaded drug was released over 5hr at pH 5.5 at 37 ºC. The cytotoxity effect of the compounds was studied at different concentrations and different pH conditions and compared with Dox alone. The maximum cytotoxity effect was observed at 4μg/ml and at pH 6.5. After that, the pre-incubation with any of the tested concentrations of mannose reduced the cytotoxicity of Dox-mannose-SWCNT by approximately 40- 57%, suggesting that the entry of this complex might be dependent on mannose receptors, which imparts this complex a kind of selectivity for cancer cells that overexpress this type of receptors. And the final test is the in vivo test which will be done soon in Germany.