World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:10, No:01, 2016

Polypeptide Modified Carbon Nanotubes – Mediated GFP Gene Transfection for H1299 Cells and Toxicity Assessment

Authors : Pei-Ying Lo, Jing-Hao Ciou, Kai-Cheng Yang, Jia-Huei Zheng, Shih-Hsiang Huang, Kuen-Chan Lee, Er-Chieh Cho

Abstract : As-produced CNTs are insoluble in all organic solvents and aqueous solutions have imposed limitations to the use of CNTs. Therefore, how to debundle carbon nanotubes and to modify them for further uses is an important issue. There are several methods for the dispersion of CNTs in water using covalent attachment of hydrophilic groups to the surface of tubes. These methods, however, alter the electronic structure of the nanotubes by disrupting the network of sp2 hybridized carbons. In order to keep the nanotubes' intrinsic mechanical and electrical properties intact, non-covalent interactions are increasingly being explored as an alternative route for dispersion. Apart from conventional surfactants such as sodium dodecylsulfate (SDS) or sodium dodecylbenzenesulfonate (SDBS) which are highly effective in dispersing CNTs, biopolymers have received much attention as dispersing agents due to the anticipated biocompatibility of the dispersed CNTs. Also, The pyrenyl group is known to interact strongly with the basal plane of graphene via π-stacking. In this study, a highly re-dispersible biopolymer is reported for the synthesis of pyrene-modified poly-L-lysine (PBPL) and poly(D-Glu, D-Lys) (PGLP). To provide the evidence of the safety of the PBPL/CNT & PGLP/CNT materials we use in this study, H1299 and HCT116 cells were incubated with PBPL/CNT & PGLP/CNT materials for toxicity analysis, MTS assays. The results from MTS assays indicated that no significant cellular toxicity was shown in H1299 and HCT116 cells. Furthermore, the fluorescence marker fluorescein isothiocyanate (FITC) was added to PBPL & PGLP dispersions. From the fluorescent measurements showed that the chemical functionalisation of the PBPL/CNT & PGLP/CNT conjugates with the fluorescence marker were successful. The fluorescent PBPL/CNT & PGLP/CNT conjugates could find application in medical imaging. In the next step, the GFP gene is immobilized onto PBPL/CNT conjugates by introducing electrostatic interaction. GFP-transfected cells that emitted fluorescence were imaged and counted under a fluorescence microscope. Due to the unique biocompatibility of PBPL modified CNTs, the GFP gene could be transported into H1299 cells without using antibodies. The applicability of such soluble and chemically functionalised polypeptide/CNT conjugates in biomedicine is currently investigated. We expect that this polypeptide/CNT system will be a safe and multi-functional nanomedical delivery platform and contribute to future medical therapy.

Keywords : carbon nanotube, nanotoxicology, GFP transfection, polypeptide/CNT hybrids
Conference Title : ICNN 2016 : International Conference on Nanotechnology and Nanomedicine
Conference Location : San Diego, United States
Conference Dates : January 21-22, 2016