

Diamine biomolecules surface functionalization single-walled carbon nanotube as gene-delivery vector

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INTRODUCTION: The single-walled carbon nanotube is at the same scale with DNA that the aromatic rings on surface of CNT can directly combine together with ring structure on DNA molecules through the electron exchanging and inducing the π - π stacking force in between^{1,2}. In this study we use the commercialized single-walled carbon nanotube to combine with two different kind of biocompatible molecules after purification. The molecules are putrescine and polyoxyethylene bis-amine to form complex with plasmid DNA, EGFp-C1 is selected for direct expression, and evaluate the in vitro properties...

METHODS: Computer simulation with Hyperchem was first devoted to predict the stability of this system. 14 start codons of EFP-C1 was selected to build a single-stranded DNA (ssDNA) and combine with chiral form single-walled carbon nanotube (SWCNT) with length 10nm. The formation energy was calculated. physical experiments contains the examination of ssDNA-SWCNT complex with Raman spectroscopy and the surface modification of SWCNT by diamine biomolecules. The surface-modified SWCNT was analyzed with FTIR, TGA and TEM. Bioassay was the last part to evaluate the biocompatibility and transfection efficiency. LDH, MTT, total DNA and IL-6 release were done to fully estimate the bioproperties of these materials. HeLa and 3T3 were chosen as transfection host to justify the transfection efficiency.

RESULTS:

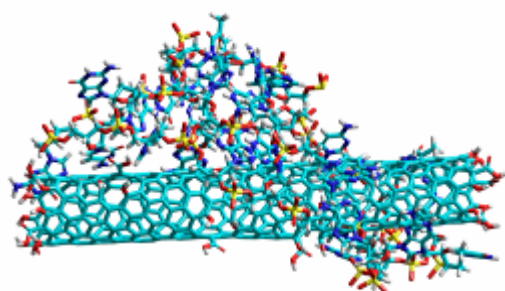


Fig.1 Complex of ssDNA-SWCNT showing the wrapping of ssDNA around SWCNT and having a great stability.

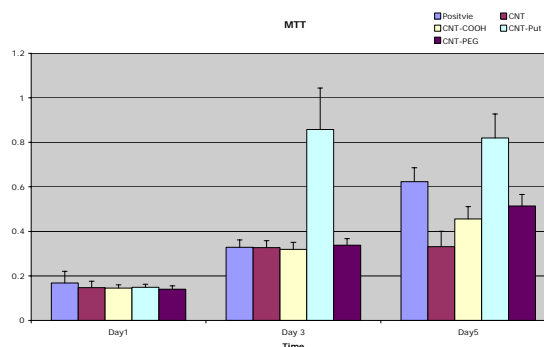


Fig.2 MTT result gives the direct evidence that surface-modified SWCNT can enhance the activity of cells.

DISCUSSION & CONCLUSIONS: Computer simulation indicates that the ssDNA-SWCNT complex can form spontaneously and with a great stability through surface interaction. The Raman spectroscopy further proved the wrapping geometry of this complex. Surface-modified SWCNT can bind to DNA selectively with different surface functional groups. A series of bioassay promote the idea that diamine surface-modified SWCNT have a good biocompatibility and inspire the cell growth. In-vitro transfection did not show a great result as expected which may due to the insufficient functional groups on the surface of SWCNT

REFERENCES: ¹M.Zeng et al., *Science*, 302(2003),1545-1548. ² R. K. Castellano, F. Diederich and E. A. Meyer, *Angew. Chem. Int. Ed.* 42, 11(2003),1210-1250

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