Research in Pharmaceutical Sciences, 2012;7(5)
School of Pharmacy and Pharmaceutical Sciences
Isfahan University of Medical Sciences

Synthesis of nanovectors via functionalization of SWNT with PEI (polyethyleneimine) for gene delivery

A. Hashem Nia[1,*], M. Ramezani[2], M. Rahimizadeh[1], H. Eshghi[1], K. Abnous[2]

[1]Chemistry Department, Science Faculty,Ferdowsi University Of Mashhad, Mashhad, Iran
[2]Pharmaceutical Research Center, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

Background and Aims: Carbon nanotubes (CNT) have found their use in biological sciences at molecular and cellular levels.In order to improve the solubility and biocompatibility of CNT, PEI was used for functionalization. By attaching PEI to the surface of SWNT, resulting vectors are able to bind plasmid efficiently and internalize the cell.
Methods: Three different methods were used for attachment of PEI with three molecular weights using amidation reaction between NH2 groups of polymer and carboxylic acid groups and 9 nanovectors were synthesized.
1-Direct attachment via carboxylic acid groups on the surface of SWNT
2- Attachment via succinic acid linker: Two different reactions were used to attach the uccinct linker to the surface of SWNT:
a)By esterification of hydroxyl groups introduced onto the surface
b)By Friedel- carft acylation
Results: structures were confirmed by FTIR spectrums.Plasmide binding abilities and cell viabilities were evaluated by Ethidium Bromide method and MTT assay respectively. Gene delivery and transfection efficiency of vectors were investigated in N2A cells using Luciferase assay. Size and zeta potential of vector were determined by Malvern Zeta sizer.
Conclusions: As it is expected, data from zeta potential show that all structures bear positive charges, due to the cationic polymer on the surface. Size of nanovectors lay in the range of 90-130 nm .In each set best results were obtained in the case of vectors synthesized based on PEI 1800 and comparing the attachment mode of PEI onto the surface, direct or indirect, vectors with succcinc linker were much more efficient in transfection. It seems that the lower the size of polymer, the more polymer molecules are attached to a specific area of SWNT surface, thus transfection increases compare to polymer.

Keywords: Single wall carbon nanotube; Functionalization; Poly ethylene imine; Gene delivery