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Modified Polyethylenimine: Self Assemble Nanoparticle Forming Polymer for pDNA Delivery

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Abstract

Objective
Polyethylenimine (PEI), a readily available synthetic polycation which has high transfection efficiency owing to its buffering capacity was introduced for transfection a few years ago. But it has been reported that PEI is cytotoxic in many cell lines. In this study, in order to enhance the transfection efficiency of 10 kDa PEI and reduce its toxicity, hydrophobic residues were grafted on PEI.
Materials and Methods
PEI polymers were modified by adding hydrophobic chains to the primary amines of PEI in different degrees of grafting using bromoacetic acid derivatives with different lengths. These polymers were complexed with plasmid DNA at different C/P ratios and the resulting nanoparticles were characterized by dynamic light scattering and EtBr-DNA binding assay to determine particle sizes and complex formation, respectively. Cytotoxicity and transfection efficiency of the polymers were also tested in cultured Neuro2a cell line.
Results
DNA condensation measurement revealed that the resulted polymers could form polyplexes with plasmid DNA and they have the ability to condense DNA in relatively low amounts of polymers. Particle size measurement of polyplexes showed that they form particles in the size range of below 190 nm. Transfection experiments showed that polymers which have been modified with hexanoic derivative could transfect pDNA as good as 25 kDa PEI with the advantage of being much less toxic.
Conclusion
Results indicate that the structure modifications of PEI accomplished in this study play a significant role in increasing the transfection efficiency and without inducing the cytotoxicity compared to PEI itself.

Keywords: Gene delivery, Nanoparticle, Polyethylenimine, Transfection

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