

Preparation and evaluation of nano copolymer of PEI conjugated PLL via 10-carbon linkers for gene delivery into eukaryotic cells

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Abstract

Background & Aim: A lack of efficient gene-delivery carriers has always been the biggest challenge in gene therapy. Polyethylenimine (PEI) and poly (L-lysine) (PLL) are the most studied non-viral gene carriers. The purpose of this study is to prepare new nano-carriers, by conjugating these two polymers via 10 carbon linkers (10-bromodecanoic acid), in order to take advantage of them and compensate their deficiencies for gene delivery aims.

Methods: In this experimental study, two types of copolymers were synthesized. In the first step, a high molecular weight PLL (30-70 kDa) was considered as the core of the particle, and then the 10-carbon linkers were attached to the PLL relative to 10% and 50% of the PLL's amines. After that, the PEI polymer with an average molecular weight of 25 KDa was conjugated to PLL via linkers. The physiochemical properties of the synthesized carriers, cytotoxicity and gene transfer efficiency were evaluated in mouse neuroblastoma cells (Neuro2A).

Results: The synthesized carriers were able to form polyplexes in nano-scale size (96-122 nm), and the carrier PLL-L10%-PEI was able to increase transfection relative to its base polymers (PEI and PLL); moreover, it also showed less cellular cytotoxicity in comparison with unmodified PEI.

Conclusion: The best obtained nanoparticle in this study showed an acceptable charge (+8 mV) and proper nano-scale size (116 nm). This nano-copolymer increases the efficiency of transfection while it reduces cytotoxicity. Therefore, this nano-carrier is suggested for further gene delivery purposes to various cells.

Keywords: Gene delivery, Nanoparticles, Non-viral vector, Poly (L-lysine), Polyethylenimine