

Dynamics of PEGylated-dextran-spermine nanoparticles for gene delivery to leukemic cells.

ABSTRACT

Leukemic cells are hard-to-transfect cell lines. Many transfection reagents which can provide high gene transfer efficiency in common adherent cell lines are not effective to transfect established blood cell lines or primary leukemic cells. This study aims to examine a new class of cationic polymer non-viral vector, PEGylated-dextran-spermine (PEG-D-SPM), to determine its ability to transfect the leukemic cells. Here, the optimal conditions of the complex preparation (PEG-D-SPM/plasmid DNA (pDNA)) were examined. Different weight-mixing (w/w) ratios of PEG-D-SPM/pDNA complex were prepared to obtain an ideal mixing ratio to protect encapsulated pDNA from DNase degradation and to determine the optimal transfection efficiency of the complex. Strong complexation between polymer and pDNA in agarose gel electrophoresis and protection of pDNA from DNase were detected at ratios from 25 to 15. Highest gene expression was detected at w/w ratio of 18 in HL60 and K562 cells. However, gene expression from both leukemic cell lines was lower than the control MCF-7 cells. The cytotoxicity of PEG-D-SPM/pDNA complex at the most optimal mixing ratios was tested in HL60 and K562 cells using MTS assay and the results showed that the PEG-D-SPM/pDNA complex had no cytotoxic effect on these cell lines. Spherical shape and nano-nature of PEG-D-SPM/pDNA complex at ratio 18 was observed using transmission electron microscopy. As PEG-D-SPM showed modest transfection efficiency in the leukemic cell lines, we conclude that further work is needed to improve the delivery efficiency of the PEG-D-SPM.

Keyword: Cationic polymer; Dextran-spermine; Gene delivery; Nanoparticles; Non-viral