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Preparation, characterization and transfection efficiency of galactosylated nanolipoplexes as a gene carrier

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Abstract- Cationic liposomes are known to be useful tools for delivery of naked DNA into cells. In this study, novel galactosylated lipids were developed. Non-viral vectors were prepared and characterized by these galactosylated lipids and DOTAP. Transfection activity, condensation ability and cytotoxicity of vectors were tested. All galactosylated lipoplexes showed positive zeta potential in C/P=6. Liposomes containing galactosylated derivatives showed higher transfection activities in HepG2 cells than Neuro2A cells. The condensation ability of vectors was confirmed by ethidium bromide test. Galactosylated carriers prepared by 100 nm precursor liposomes were not cytotoxic for both Neuro2A and HepG2 cells.

Among non-viral vectors, cationic liposomes are the most promising carriers in gene delivery. But the most critical issue about their application is their low transfection efficiency compared to viral vectors [1, 2]. The aim of this study was to introduce some novel vectors with high transfection efficiency.

In the present study, three galactosylated lipids with bifunctional properties of plasmid DNA binding via electrostatic interaction and a high affinity for hepatocytes via asialoglycoprotein receptors were developed. Non-viral vectors were prepared and characterized by these galactosylated lipids and DOTAP phospholipid. These liposomes were extruded through polycarbonate filters to produce 100 nm vesicles. Transfection efficiency in both Neuro2A and HepG2 cells was tested using pRL-CMV encoding *Renilla* luciferase and also the cytotoxicity of the prepared lipoplexes was evaluated. Furthermore, the condensation ability of prepared liposomes was determined by ethidium bromide test.

Sizes of lipoplexes obtained by 100 nm cationic liposomes were ranged from 98 to 131 nm in different C/P ratios. All galactosylated lipoplexes showed positive zeta potential in C/P=6. Liposomes containing galactosylated cholesterol derivatives showed higher transfection activities in HepG2 cells than Neuro2A cells (Figures 1 & 2). Lipoplexes formed from liposomes with derivative I showed the best transfection efficiency among other derivatives in HepG2 cells while the highest transfection activity between different liposomal formulations was achieved with liposomes composed of derivative III. The condensation ability of vectors was confirmed by ethidium bromide test. Galactosylated carriers prepared by 100 nm precursor liposomes were not cytotoxic for both Neuro2A and HepG2 cells.

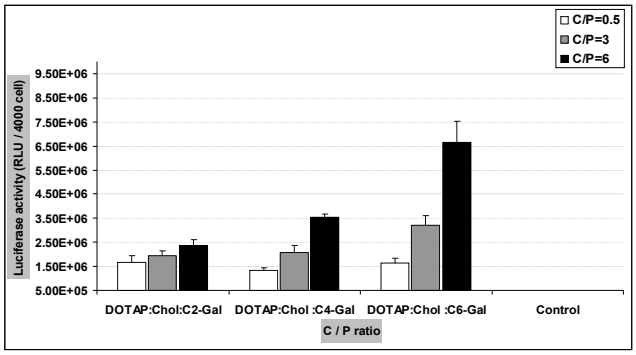

Figure 1. Transfection efficiency of galactosylated lipoplexes at different C/P ratios in Neuro2A cells.

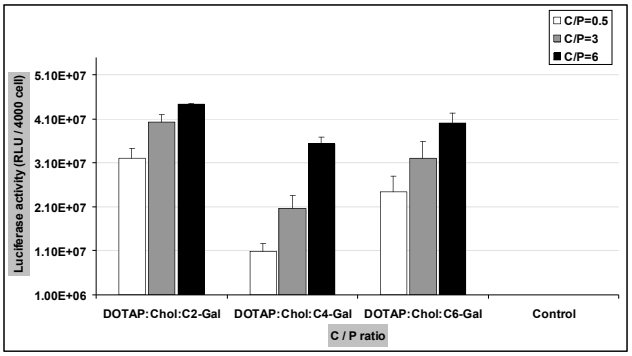

Figure 2. Transfection efficiency of galactosylated lipoplexes at different C/P ratios in HepG2 cells.

The chemical modifications allowed us to increase the transfection activity for HepG2 cells. The results indicate that the designed systems are promising carriers for targeted gene delivery.

[1] D. Luo and WM. Saltzman, Nature Biotechnol. 18 (2000) 33-37.
[2] S. L. Hart, Curr. Drug Deliv. 2 (2005) 423-428.