Development of gene delivery system using PLGA nanospheres

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For gene therapy, development of non-viral vectors delivered more efficiently and safely into cells has long been awaited. Recently, many non-viral vectors which were modified with cationic lipids, cationic polymers and so on, have been reported. However, those non-viral vectors with the cationic materials are still required to improve stability, duration of gene expression, and to reduce cytotoxicity.

We had successfully prepared mucoadhesive poly (lactide-co-glycolide) nanospheres (PLGA NS) by modifying of the nanoparticulate surface with chitosan (CS) for improvement of mucosal peptide absorption after oral and pulmonary administration. Furthermore, we found that nucleic acid which was unable to be dispersed in the organic solvent, could be dispersed by forming a complex with cationic lipid. By using this phenomenon, polynucleic acids for gene therapy (plasmid DNA, antisense oligonucleotide, small interfering RNA, etc.) can be encapsulated into the matrix of the polymer particles with the emulsion solvent diffusion (ESD) method. Advantages of this preparation method are simple in process and to avoid ultrasonication process for submicronization of particle. The resultant nanospheres show a better cellular uptake and the different gene therapeutic effects compared with conventional vectors due to their improved adherence to the cell and sustained releasing polynucleic acid. In conclusion, chitosan coated PLGA NS can possibly applied to the non-viral vector for gene therapy.