431o Dynamic Self-Assembly and Characterization of DNA-Polycation Nanoparticles

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DNA-polycation nanoparticles hold great promise as safe and efficient vectors in gene delivery. They can be synthesized by simple mixing for self-assembly into nanocomplexes. Although considerable effort and progress have been made, the transfection efficiency of these non-viral vectors remains low. Since the structure of the nanoparticles greatly affects the DNA protection, cellular entry, intracellular transport, nuclear membrane penetration, and DNA release, an important strategy to improve their efficiency is to control the composition and molecular structure of the nanoparticles. In an attempt to better understand the complexation of plasmid DNA with polycations, we altered the conformation of the DNA by hydrodynamical stretching. We hypothesize that the significant increase in exposed area of the DNA from the coiled state to the stretched state would change the complexation efficiency and in turn affect the final structure of the nanoparticles considerably. The complexation was studied against different degrees of DNA stretching and various charge densities of the polycation. In addition to establishing the structure-transfection relationship of the nanoparticles, the DNA stretching method was also used to characterize the DNA-polycation complexation process at the single molecule level by fluorescence microscopy.