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SELF-ASSEMBLED COLLOIDS FORMED BY BLOCK COPOLYMERS AND DNA

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During the past years, gene therapy has been receiving much attention due to its great potential for treating or preventing various diseases. One of the main requirements is the condensation of DNA into nanosized colloidal structures, in order to fit long DNA chains within the limited space that is available in cells. These structures should have small size, but at the same time maintain their functionality.[1] The research on polymer/DNA complexes,[2] using different polymeric systems, can be helpful in the finding of a model system for successful transfer of DNA.

In this work the self-assembly of DNA is investigated, in two different aqueous colloidal systems containing water-soluble diblock copolymers. The first system is a bio-inspired one that contains poly(styrene-b-quaternized 2-vinylpyridine) block copolymer micelles with a positively charged corona. Upon addition of DNA, the latter is compacted around the spherical micelles, giving small nearly monodisperse complexes. This mechanism of DNA compaction around spherical particles is also observed in histone-DNA complexes, where DNA is compacted through electrostatic interactions, forming the nucleosome.

The second system consists of a novel poly[ethylene oxide-b-quaternized 3,5-bis(dimethylaminomethylene)hydroxystyrene] double hydrophilic block copolymer with one neutral and one positively charged block, which in aqueous solutions exists as free polymer chains. Upon addition of DNA, the latter is bound to the positively charged block, which becomes neutral and hydrophobic, thus forming the core of a micelle. The PEO blocks can act as a stealth coating, protecting the complex during circulation (reduction of opsonisation), and optimizing its mobility. In this mechanism of DNA compaction, not only DNA is highly compacted and organized, but also protected against degradation.

References

1. G.D. Schmidt-Wolf, I.G.H. Schmidt-Wolf Trends Mol. Medicine 2003, 9, 67.
2. A. Harada, K. Kataoka Prog. Polym. Sci. 2006, 31, 949.