ssDNA Amphiphile Self-Assembly Forms DNA Nanotubes (20140227, Dr. Efie Kokkoli)

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Nanotubes Synthesized from DNA

Nanotube structures can be synthesized from DNA conjugated to hydrophobic molecules to form amphiphiles. Experimental data shows that these structures form spontaneously in solution, are not dependent upon a specific salt concentration, and remain viable even after the solvent is removed from the system. Because of the simplicity of this approach, it is likely that it could confer economic benefits in a production setting.

Nanoscale Lithography Alternative

Nanostructures have the potential to solve many issues associated with drug delivery and can act as tissue engineering scaffolds, sensors of biological compounds, and scaffolds for bioengineering. One of the principal tools used to produce nanoscale architectures is lithography, an expensive, time-consuming, and often dangerous process that utilizes various acids and toxic chemicals. Lithography is also limited in its ability to generate 3-dimensional shapes. Self-assembly is a means to generate nanoscale constructs economically; however, many methods are very complicated and rely on specific solution compositions and temperatures in order to function.

ssDNA Scaffolds

The ssDNA (single-strand DNA) scaffolds offer a viable alternative to lithography and other current methods. These scaffolds have potential applications in a variety of fields. In the medical sciences, this could be used to cheaply and simply encapsulate and deliver drugs to specific sites, such as cancer cells. In biomedical engineering, nanostructures such as these could be beneficial as an element in scaffolds for tissue engineering. Nonbiological nanotechnological applications are also abundant, in that this is a non-lithographic method for the fabrication of nanoscale architectures. There is also precedent for nanotubes being used in applications such as chemical sensors.

BENEFITS AND FEATURES OF ssDNA SCAFFOLDS:

- Self-assembly is cheaper and easier than lithographic methods
- Single-stranded DNA remains available to interact with complementary sequences for functionalization and targeting
- Simple design doesn’t require complex reaction networks for assembly

Phase of Development - Proof of concept

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