Salt-assisted biofunctionalization protocol for the ligand exchange of CTAC-capped gold nanocubes

Nicole Slesiona, Sophie Thamm, Lisa Stolle, Andrea Csáki, Wolfgang Fritzsche

Leibniz Institute of Photonic Technology, Albert-Einstein-Str. 9, 07745 Jena, Germany

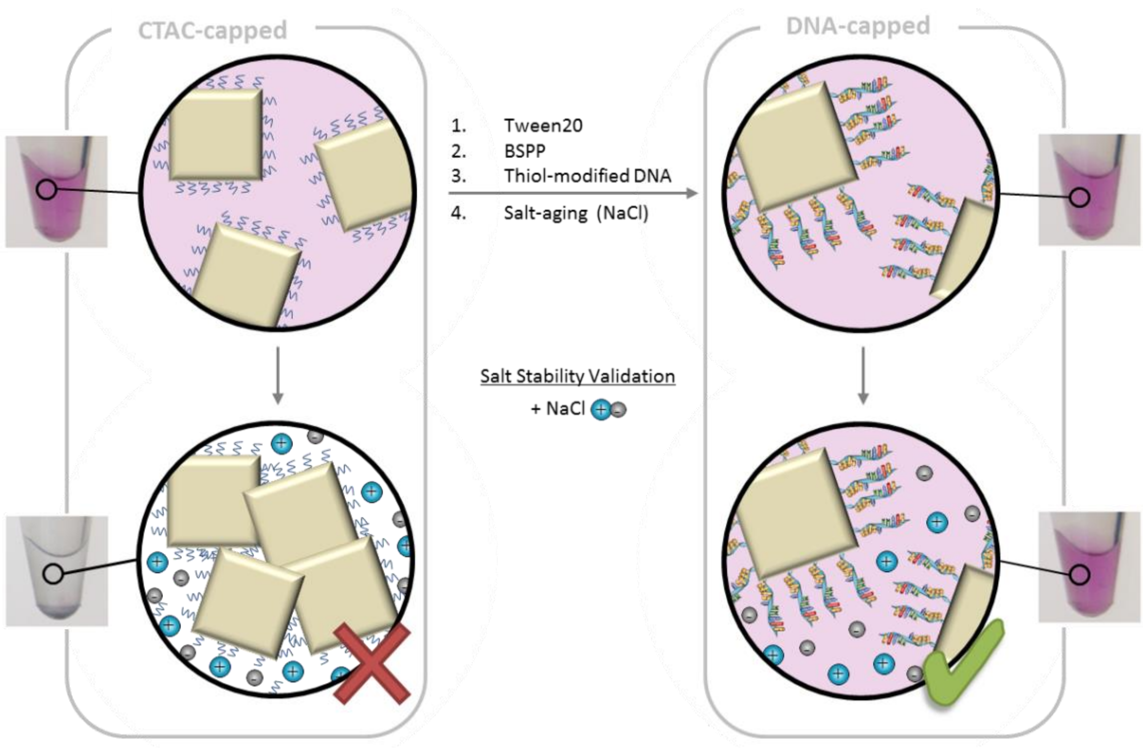
Due to their strong interaction with light in the visible/IR spectrum and the strong field enhancements that can be found at edges and corners of shape-anisotropic gold nanoparticles[1], these nanostructures have become an integral part in various biomedical detection devices and nanotherapeutics[2]. The high biocompatibility of gold nanoparticles especially facilitates their incorporation into biosensor designs that exhibit enhanced analytical performance.[2]

Shape-anisotropic gold nanoparticles are synthesized with the help of facet blocking agents, such as CTAB/CTAC (cetyltrimethylammonium bromide/chloride) that selectively adsorb on particular crystallographic planes.[3, 4, 5] Oftentimes, biocompatible groups such as DNA cannot sufficiently penetrate through a dense layer of capping agents, preventing their transfer into existing protocols of biologically relevant applications. In order to merge shape-anisotropic gold nanoparticles into analytic sensing devices, it is necessary to establish a reliable modification protocol to reduce their cytotoxicity, stabilize them against aggregation, and to functionalize them with other biomolecules to increase their biocompatibility for analytical applications.

Here, a two-step protocol is presented that combines the approaches of

1. ligand exchange with BSPP (bis(p-sulfonatophenyl) phenylphosphine) as the intermediate capping-agent, and
2. electrostatic interaction with a salt-aging step.

This protocol allows for a reliable and efficient conjugation of thiol-modified DNA strands to anisotropic particles with great potential for biosensing applications and nanotherapeutics. The combination with DNA Nanotechnology allows for the self-assembly of the particles directed by a DNA origami scaffold.



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