

Synthesis and Colloidal Properties of Gold Nanoparticles Functionalized with Cyclic Poly(ethylene oxide)s

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Abstract

Particular polymer topologies such as cyclic polymers, beyond linearity, have been shown to alter significantly the properties of diverse polymer preparations in both bulk and solutions, when compared to their linear counterparts.[1] Click chemistry and in particular, copper-catalyzed alkyne-azide cycloaddition (CuAAC) has allowed access to a variety of cyclic architectures.[2] On the other hand, gold nanoparticles (AuNPs) continue to attract much attention across a wide range of fields due to their optical properties and biocompatibility. [3] [4]

In this work, we explore the possibility of applying cyclic polyethylene oxide (PEO) on inorganic AuNPs, with particular attention to how this polymer topology might affect the colloidal stability. The exchange of citrate ligand (used in the synthesis of AuNPs) with thiol functional group of cyclic PEO will allow to form a strong covalent bond with the gold surface. Thiolated cyclic polymers were obtained by performing CuAAC between a PEO bis(azide) of $M_n = 2, 6$ or 11 kg/mol and a previously synthesized thiolated di-alkyne molecule.

Purity and mono-dispersity of synthesized thiolated cyclic polymer were confirmed by MALDI-ToF MS, NMR and SEC techniques. [5] UV-Vis-NIR spectra of initially stabilized AuNPs exhibits a maximum of localized surface plasmon band at 517 nm. Upon addition of cyclic PEO, the plasmon band shifted to 522 nm, suggesting the ligand exchange. The width of the plasmon

band remained constant after washing confirming the colloidal stability of AuNPs.

To conclude, macrocyclic PEOs containing a pendant thiol group have been synthesized by the click reaction between PEO bis(azide) and a previously-synthesized bis(alkyne) linker. We used this system to decorate gold nanoparticles with potential applications in biomedical devices.

References

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Figures

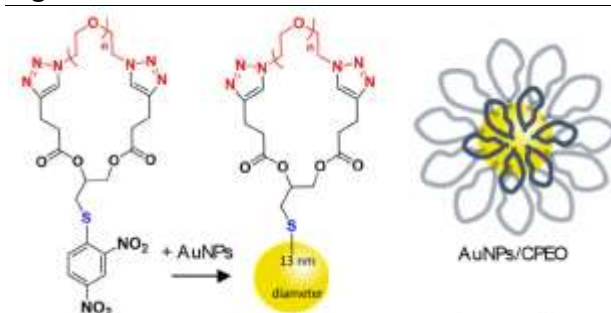


Figure 1: Synthesized AuNP@CPEO samples by ligand exchange of AuNP@citrate against cyclic PEO samples.

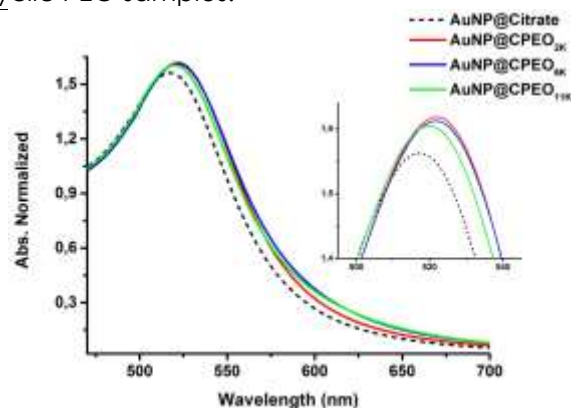


Figure 2: Normalized UV-Vis absorbance spectra of AuNP@CPEO conjugates in water.