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INTERACTION BETWEEN HEXON PROTEIN FROM ADV 5 AND PEGYLATED-ICOSAHEDRAL GOLD NANOPARTICLES

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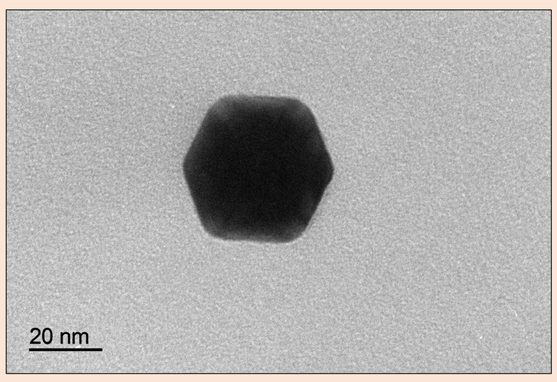
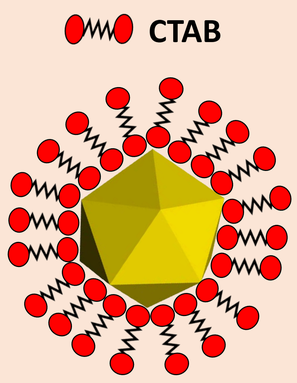
Introduction

Understanding the interaction of proteins with gold nanoparticles is vital to the development of new detection methods [1], delivery drugs [2] or vaccines [3]. In particular, the control over the type of interaction (covalent or non-covalent) between gold nanoparticles (AuNPs) and proteins present in viruses can represent a great advance in this context. For this reason, this work evaluates the effectiveness of attachment of hexon protein from Adv 5 at icosahedral AuNPs. For this purpose, a new protocol for the modification of icosahedral AuNPs (which are covered with CTAB from the synthesis [4]) with PEGs has been developed, obtaining totally stable pegylated-AuNPs. The icosahedral AuNPs were coated with different types of polyethylene glycols (PEGs) such as methoxy-PEG-thiol (mPEG-SH) and thiol-PEG-amine (SH-PEG-NH_2). When mPEG-SH was used, hexon protein interacted with AuNPs through hydrophobic and therefore reversible forces. On the contrary, when icosahedral AuNPs were modified with SH-PEG-NH_2 and subsequently with glutaraldehyde, imine groups were formed between the NH_2 residues of the hexon protein and the glutaraldehyde. The resulting NPs were mainly characterized by TEM and UV-vis.

Preparation of pegylated-icosahedral gold nanoparticles

1 Icosahedral CTAB-capped gold nanoparticles

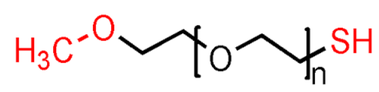




- **They were prepared by a seed-mediated growth approach**
- **CTAB is a hydrophobic molecule with a long hydrocarbon tail**
- **Zeta potential: + 33.93 mV**
- **No interaction between hexon protein and CTAB-AuNPs**

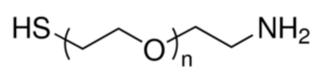
2 Pegylated-gold nanoparticles

mPEG-SH



(Average molecular mass = 1000)

SH-PEG-NH2

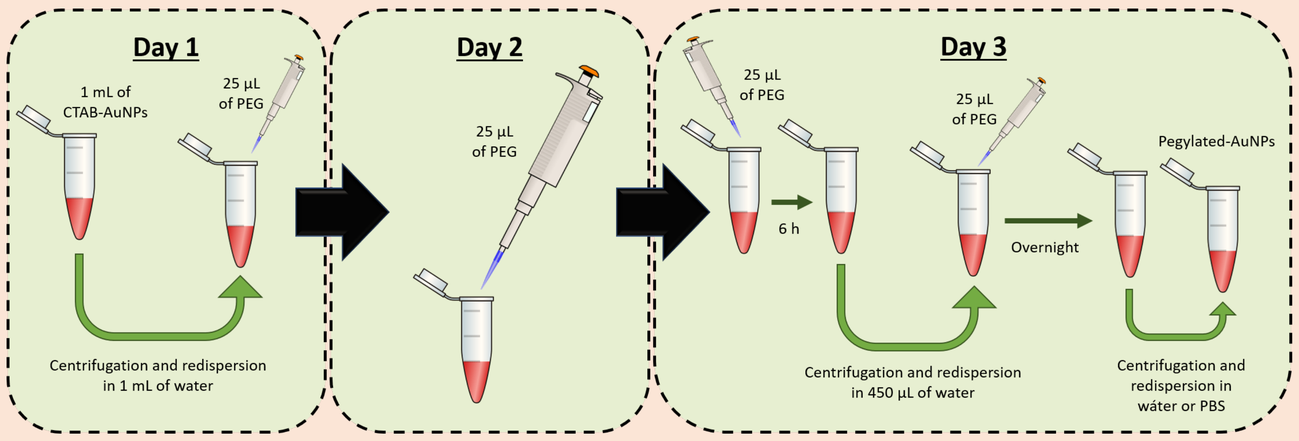


(Average molecular mass = 2000)

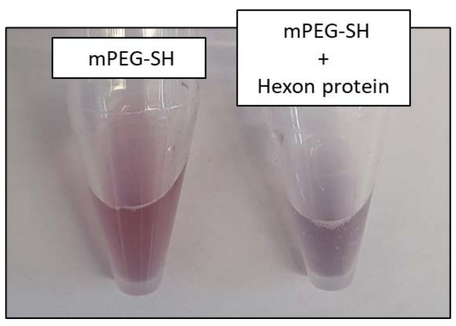
mPEG-SH/SH-PEG-NH2

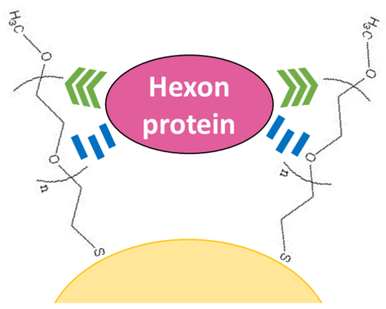
Ratios 70/30, 50/50, 30/70

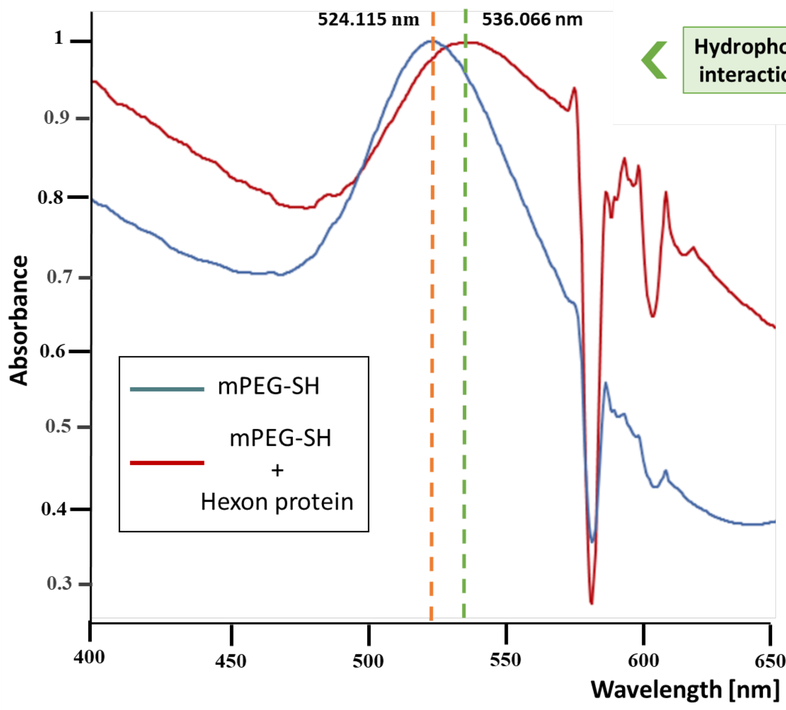
Pegylation protocol consisted of 3 steps



Non-covalent attachment of hexon protein





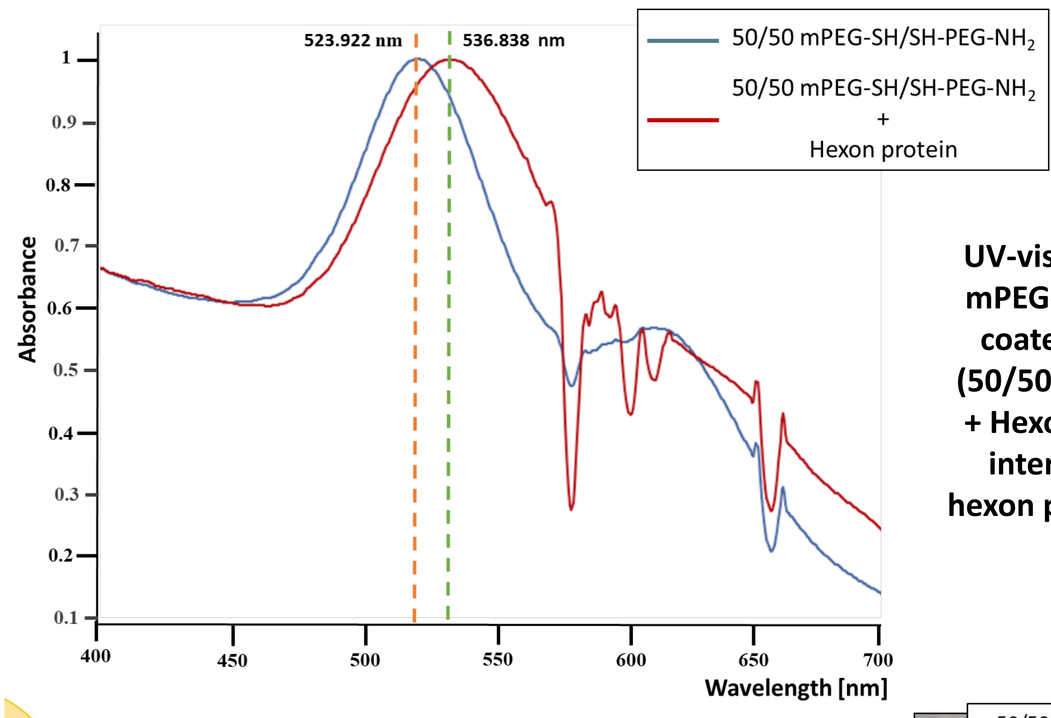


Hydrophobic interactions

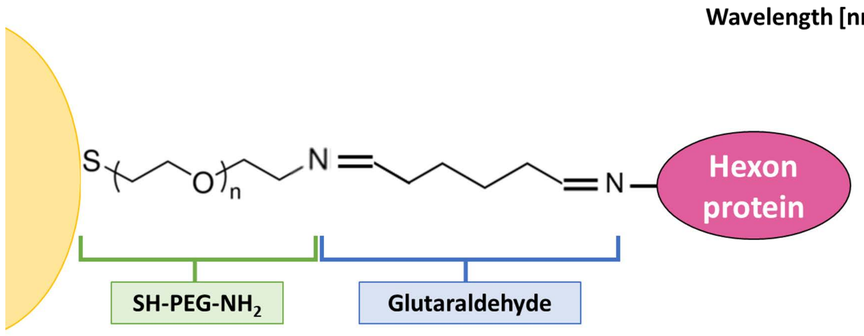
Hydrogen bonds

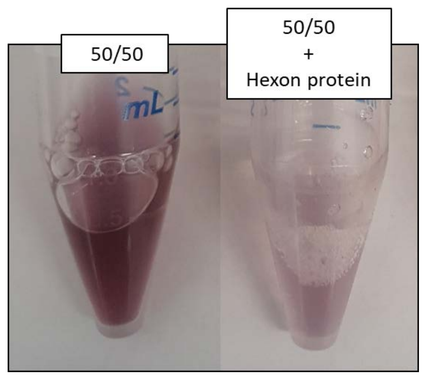
UV-vis spectra of mPEG-SH-coated AuNPs before (mPEG-SH) and after (mPEG-SH + Hexon protein) of the interaction with the hexon protein from Adv 5

Covalent attachment of hexon protein



UV-vis spectra of 50/50 mPEG-SH/SH-PEG-NH_2-coated AuNPs before (50/50) and after (50/50 + Hexon protein) of the interaction with the hexon protein from Adv 5





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1. Baptista, P., et al. Gold nanoparticles for the development of clinical diagnosis methods. Analytical and bioanalytical chemistry, 391 (2008) 943-950.
2. Xu, L., et al. Surface-engineered gold nanorods: promising DNA vaccine adjuvant for HIV-1 treatment. Nano letters, 12 (2012) 2003-2012.
3. Salazar-González, J. A., et al. Gold nanoparticles and vaccine development. Expert review of vaccines, 14 (2015) 1197-1211.
4. Kwon, K., et al. Controlled synthesis of icosahedral gold nanoparticles and their surface-enhanced Raman scattering property. The Journal of Physical Chemistry C, 111 (2007) 1161-1165.

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