

Bio and Chemical Attributes of Polyethylene Glycol Coated Gold Nanoparticles

Polyethylene glycol (PEG; HO-(CH₂-CH₂-O)_n-H) is a water soluble polymer compatible with the immune system of the human body with nonimmunogenicity, nonantigenicity, and protein rejection properties.^{1,2} PEG, therefore, is a good candidate to serve as a soft spacer for modifying surfaces with different biomolecules such as proteins and antibodies.

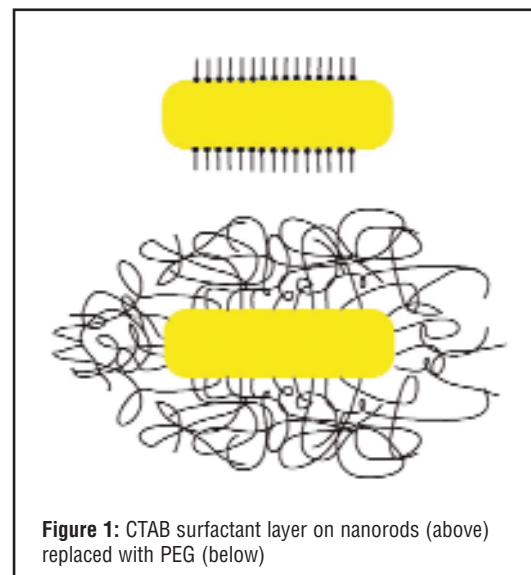
PEGylation is routinely achieved by incubation of a reactive derivative of PEG with the target macromolecule or particle. The covalent attachment of PEG can “mask” the agent from the host’s immune system (reduced immunogenicity and antigenicity) in particular by antibodies and degradation enzymes, increase the hydrodynamic size (size in solution) of the agent which prolongs its circulatory time by reducing renal clearance therefore the compound/particles stays longer in the body. The half life in the body is significantly improved. PEGylation can also provide water solubility to hydrophobic drugs, proteins and biomarkers.

Polyethylene glycol has been implemented for a number of medical and biotech applications. For example, the success of anti-cancer therapies largely depends on the ability of the therapeutics to reach their designated cellular and intracellular target sites, while minimizing accumulation and action at non-specific sites. Surface modification of nanoparticulate carriers with poly (ethylene glycol) has emerged as a strategy to enhance solubility of hydrophobic drugs, prolong circulation time, minimize non-specific uptake, and allow for specific tumor-targeting through the enhanced permeability and retention effect. Furthermore, PEG modification has emerged as a platform for incorporation of active targeting ligands, thereby providing the drug and gene carriers with specific tumor-targeting properties through a flexible tether, promoting tumor-targeting capabilities, thereby enhancing efficacy of anti-cancer therapeutic strategies.³

Extending this concept for hyperthermia ablation of cancer cells, researchers have demonstrated the superior thermal properties of Methyl PEGylated gold nanorods (NR) when irradiated with a near-infrared laser. PEG-NRs are highly stable, relatively non-cytotoxic to primary hepatocyte cell cultures, and exhibit long circulation times in mice (t_{1/2}~17 hrs). Following intravenous administration, PEG-NRs efficiently permeate into human tumors and act as intratumoral nanoantennas to capture photonic energy. Using a combination of thermographic imaging and computational photothermal heat transfer modeling to design therapeutic trials, the MIT researchers found that a single injection of PEG-NRs enabled tumor destruction using otherwise benign near-infrared light (2W/cm², 5min at 72hrs post-injection).⁴

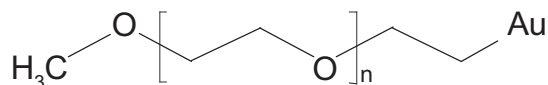
In summary, the benefits include^{4,5}

- Reduced antigenicity and immunogenicity of the molecule or particle to which PEG is attached
- Markedly improved circulating half-lives in vivo due to either evasion of renal clearance and/or through evasion of cellular clearance mechanisms
- Improved solubility. PEG has been found to be soluble in many different solvents, ranging from water to many organic solvents such as toluene, methylene chloride, ethanol and acetone
- Improved bioavailability via reduced losses at subcutaneous injection sites
- Reduced toxicity
- Improved thermal and mechanical stability
- Reduced sensitivity to pH and salts
- Gold nanoparticles and PEG are FDA approved materials

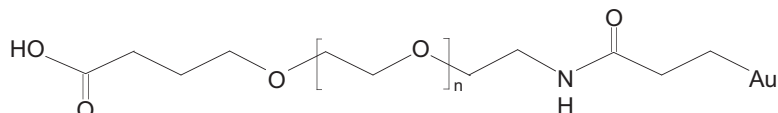


We currently offer three PEGylated gold nanoparticle (PEG-AuNP) terminations: methyl (-CH₃), carboxyl (-COOH) and amine (-NH₂).

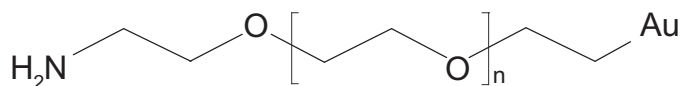
Methyl-PEG



Carboxyl-PEG



Amine-PEG



The methyl terminated PEG-AuNP is neutrally charged with demonstrated long circulation times⁵ for in vivo studies. Standard EDAC chemistry can be applied to the carboxyl terminated AuNPs as an activating agent for amide bonding with primary amines. The amino terminated AuNPs can readily conjugate with carboxylic terminated targets to form amids.

Ordering Information:

Cat. #	Description	Size
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24876	Amino PEGylated Gold Nanoparticles 15nm	1ml
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