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## Preferential accumulation of gold nanorods into skin hair follicles: Effect of nanoparticle surface chemistry

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The accumulation of nanoparticles into specific targets in skin such as hair follicles has an advantage to treat many skin diseases with high efficiency and fewer side effects. The surface chemistry of nanoparticle is a major determinent to its interaction with biological systems. In this study, gold nanorods (GNR) functionalized with various surface ligands (hydrophilic polyethylene glycol capped-GNR (PEG-GNR); anionic polyacrylic acid capped-GNR (PAA-GNR); cationic PEGylated-cystamine capped-GNR (PEG-Cys-GNR); and hydrophobic polystyrene capped-GNR (PS-GNR)) were evaluated for their accumulation into hair follicles of human skin sheets using ex-vivo setup. The extent of GNR accumulation into hair follicles and other skin compartments was quantified by inductively coupled plasma–optical emission spectroscopy (ICP-OES) and their spatial distribution through skin layers was investigated by laser ablation-inductively coupled plasma-mass spectroscopy (LA-ICP-MS). Results revealed that the accumulation of GNR into hair follicles and skin compartments was highly dependent on the surface chemistry of the nanoparticles. The lipophilic properties of sebum-rich hair follicles enhanced the accumulation of hydrophobic PS-GNR into hair follicles (~13% of the total applied dose). On the other hand, neutral PEG-GNR were distributed into all skin compartments, especially the dermis (~11.5% of the total applied dose), which exhibits hydrophilic characteristics. Charged GNR showed negligible percent of penetration into any of skin compartments. The systematic study presented in this work may help to optimize GNR as promising approach for targeted skin diseases treatment and transdermal administration of drugs and therapy.

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