Title:	DEVELOPMENT OF PHOTO-ACTIVE SEMI SHELLS AND HOST SPECIFIC QUANTUM CLUSTERS FOR THERAPEUTIC APPLICATIONS
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Abstract:	Noble metals, especially gold and silver, have been used as nanocolloids for the treatment of various diseases dating back to as early as 2500 BC. With the advancement of science and development of nanotechnology, these nanomaterials are being extensively used in healthcare applications due to their biocompatibility, anti-inflammatory, and antimicrobial properties complemented by their ease of synthesis, surface modification as well as possible clearance from the body. With size playing major role in determining the optical properties of noble metal based nanoparticles, in this thesis we have explored ~ 200 nm sized nanoparticles with unique semi shell morphology and < 2 nm sized quantum clusters for therapeutic applications. The first two chapters of the thesis discuss a novel procedure for colloidal gold semi shell (SS) fabrication using nano metal organic framework (MOF) as a sacrificial template and its application in photothermal therapy (PTT). The formation of the SS involves simultaneous anisotropic chemical etching of MOF and in situ nucleation & growth of gold. The as synthesized SS possess a strong localised surface plasmon resonance in the near infrared region, which is retained even after surface passivation with polyethylene glycol and cryopreservation for extended shelf-life. Freshly reconstituted PEGylated SS was found to be hemocompatible & biocompatible under in vitro conditions as well as safe & non-toxic in C57BL/6 mice post intravenous administration for up to 28 days. The PEGylated SS displayed significant photothermal efficiency of ~ 37 % with 808 nm laser irradiation. Preclinical assessment of intra-tumoral photothermal efficacy indicated complete remission of primary breast tumor mass with insignificant metastasis to vital organs. PEGylated SS mediated PTT also yielded morbidity free survival of 75 % in a syngeneic breast tumor model, indicating their suitability to manage advanced breast tumors. In the next two chapters, we investigated personalised nanomedicine with noble metal (Au and Ag) quantum clusters (QC) stabilized by host derived serum proteins called as NanoSera (QCNS). Due to their ultrasmall size, metal QCs are inherently photoluminescent in nature and can be used as optical tracers in bioimaging. As they are derived from host's serum components, QCNS are highly biocompatible and non-immunogenic. We employed Au-QCNS as radiosensitising agents against hepatoma cells while Ag-QCNS were validated as antibacterial agents in-vitro. Pre-clinical safety assessment of autologous QCNS in healthy C57BL/6 mice – including hemocompatibility, inflammatory cytokine analysis, serum biochemical parameters and histopathology of vital organs established their safety post intravenous administration. The proof of concept results demonstrate both Au-QCNS and Ag- QCNS as promising host-specific nanomedicines
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