Surface Engineering of Quantum Dots for Improved Membrane Interactions and Intracellular Trafficking

RONGJUN CHEN

Department of Chemical Engineering, Imperial College London, South Kensington Campus, London SW7 2AZ, UK. Email: rongjun.chen@imperial.ac.uk

Abstract

Luminescent semiconductor nanocrystals, e.g. quantum dots (QDs), have unique characteristics for long-term, multiplexed, quantitative imaging and detection of molecular targets as well as traceable drug delivery in living cells and animal models. Low cellular uptake, endosomal trapping and nanotoxicity of QDs remain significant challenges for their biomedical applications. Surface modifications were carried out to control interactions of QDs with phospholipid membranes. QDs were incorporated with intracellular drug-delivery polymers and tested for medical imaging and drug delivery in cancer cells and multicellular spheroids tumour models. It was demonstrated that the novel hybrid nanoparticles had a significantly enhanced capacity for tumour penetration, cellular uptake and endosomal escape compared to free QDs. This fluorescent prototype combines the delivery potential of novel biomimetic polymers with the unique imaging capability of QDs and has promising applications in the future *in-vivo* and clinical research for effective cancer theranostics.