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Preferential photochemical interaction of Ru (III) doped carbon nano dots with Bovine Serum Albumin over Human Serum Albumin

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Abstract:

The excitation wavelength dependent emission of carbon nano dots (CNDs) restricts their use in photophysical studies. However, instead of bare CNDs, the amine coated Ru (III) doped CNDs (Ru:CNDEDAs) are quite eligible to generate excitation wavelength independent fluorescence with high quantum yield. Herein, we report a detailed study on the photochemical interaction between two different serum albumins, bovine serum albumin (BSA) and human serum albumin (HSA), with Ru:CNDEDAs synthesized in our laboratory, using steady-state and time-resolved spectroscopic techniques. Absorption study reveals the formation of ground state complex between Ru:CNDEDAs and BSA/HSA while the circular dichroism study implies that Ru:CNDEDAs perturbs the secondary structure of the albumin proteins. Steady-state fluorescence study helps in understanding energy transfer from tryptophan, the fluorophore moiety of BSA and HSA, to Ru:CNDEDAs. Time-resolved studies within nanosecond time domain clarify the phenomenon of energy transfer from BSA/HSA to Ru:CNDEDAs with varied efficiency. Molecular dynamic simulation ascertains that the efficiency of energy transfer is highly dependent on the stability of protein-nanoparticle complex. This study provides a qualitative description regarding the structural rigidity of transport protein, BSA compared to HSA, which determines the transport ability of CNDs to deliver the desired drug molecule to the targeted cells.

Key words: carbon nano dots; serum albumin; fluorescence