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Biodistribution And Clearance Of Quantum Dots In Small Animals

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INTRODUCTION

Quantum dots (QDs) are 1–10-nm semiconductor nanocrystals with unique optical и photophysical properties such as size- and composition-tunable emission, high brightness, narrow emission bands, and high resistance to photobleaching.

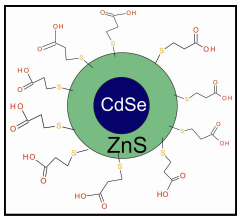
The many potential biomedical applications of QDs have been recently and extensively reviewed elsewhere, but progress is currently impeded by a lack of understanding of how nanostructures interact with biological systems [2]. All of the reports in the literature were unanimous in concluding that QDs show a preference for deposition in organs and tissues and that they do not remain circulating in the bloodstream [3].

GOAL

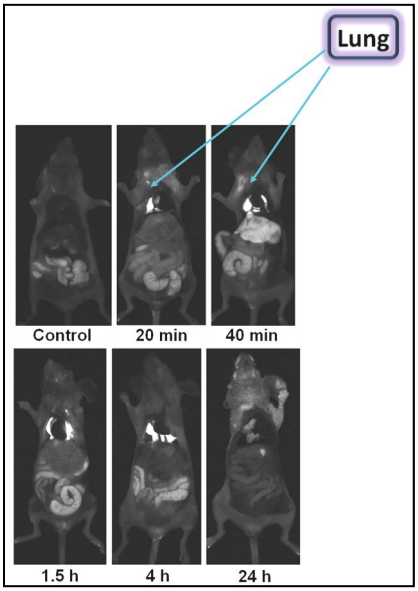
Studying of the impact of the QDs coating and size on their in vivo fate after intravenous (IV) injection into mice using fluorescent methods.

OBJECTS

❖ synthesized QDs coated with 3-mercaptopropionic acid (QD MPA)
❖ commercially available Qtracker 705 nontargeted quantum dots with poly(ethylene glycol) coating (QD PEG)



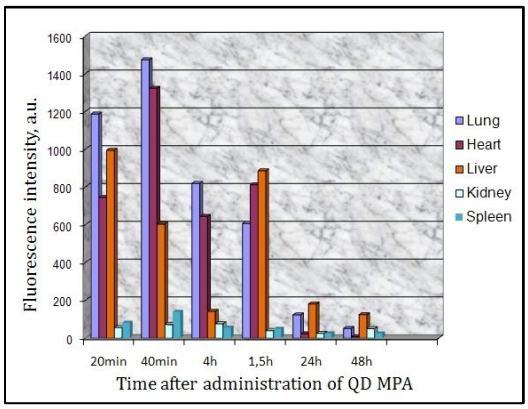
RESULTS



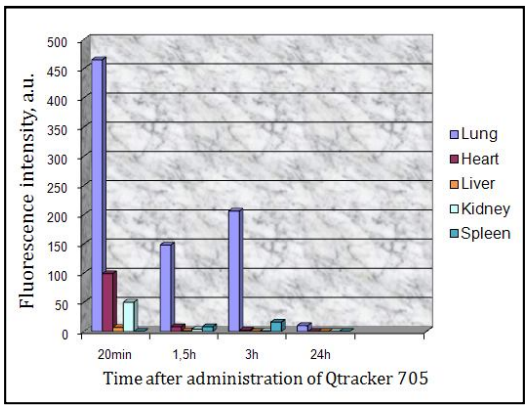
The optical fluorescent imaging was obtained on UVP iBox (UVP, USA): light source is 150 W halogen lamp; exposition 25 s; excitation filter 502-547 nm; emission filter 570-640 nm.

Dynamics of change of a fluorescent signal in lungs, heart, a liver, a spleen and kidneys after intravenous injection of QD MPA 620 (a) and Qtracker 705 (b) .

a)

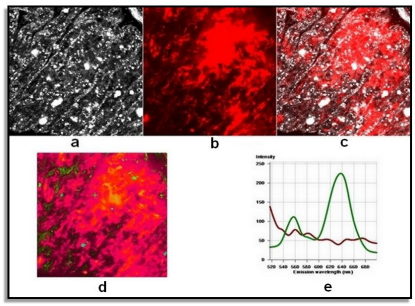


b)



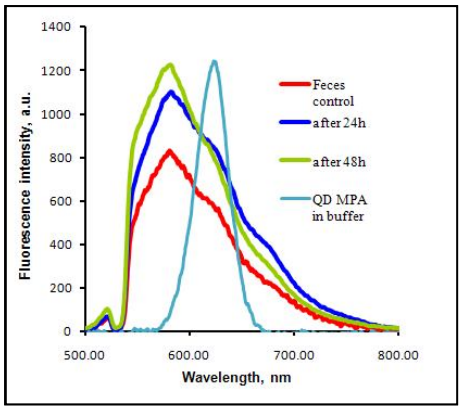
Studying of dynamic biodistribution of all types QDs after injection in *v.jugularis* has shown primary accumulation of QDs in lungs. QDs was seen to deposit in some departments of heart, in particular in the left and right *atrium,* in liver, spleen and kidney. The distribution of QD MPA proved to be true at research of organs' and tissues' samples by the method of confocal fluorescent microscopy.

Specimen of lungs 40 min postinjection of 630 nm-emitting QDs MPA into the jugular vein of nude mice.

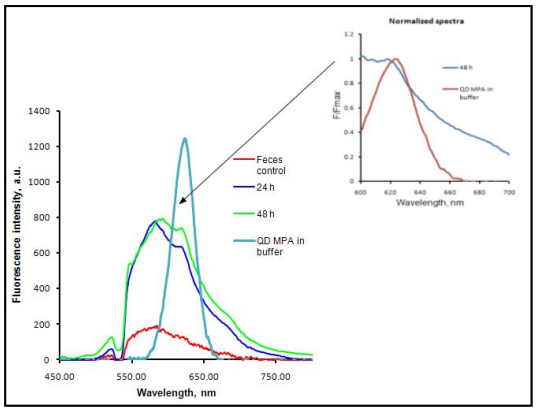


a – reflected light, b – fluorescence, c – overlapping of fig. a and fig. b images , d – pseudo-color images, e – fluorescence spectra from the points marked on fig. d

Feces of mice after administration of QD MPA



Samples of urine of mice after administration of QD MPA



Feces and urine were collected and analyzed by method of fluorescent laser spectrometry. Fluorescence of all samples were not significantly different from background values of control mice.

ACKNOWLEDGMENT

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CONCLUSIONS

The results show primary accumulation of synthesized QDs MPA and commercially available QDs 705 in lungs. Moreover, QDs was seen to deposit mainly in liver, spleen, kidney and lymph nodes. Finally, we therefore concluded that QDs MPA and QDs 705 are both sequestered and not excreted with feces or urine.