Optically active hybrid nanostructures based on semiconductor quantum dots and chiral molecules for biomedicine

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Abstract

Unique optical properties of colloidal semiconductor quantum dots (QDs) allow to use them as a basis for hybrid nanostructures (HyNSs) with organic molecules for a wide range of biomedical applications: from highly sensitive biosensor devices to a new generation drugs [1].
A molecule, which is a part of HyNSs, may be chiral (has two mirror-image forms, known as enantiomers, which are not superimposable in three dimensions). Chirality plays a crucial role in biology, chemistry, pharmacology, and medicine since most of the biomolecules and drugs are chiral [2]. In HyNSs, optical activity of a molecule and QD can be affected by each other [3]; that could also potentially lead to functional properties changes.
Here we report the studies on interactions between semiconductor QDs and chiral molecules (cysteine, chlorin e6) (Figure 1, Figure 2). It was found that the optical activity of both QDs and molecules inversely depends on the distance between them in HyNSs. Our future work will involve investigation of the correlation between chiroptical and functional properties of HyNSs.

References

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[3] Kumar J., Thomas K. G., Liz-Marzán L. M., Chemical Communications, 85 (2016) 12555-12569

Figures

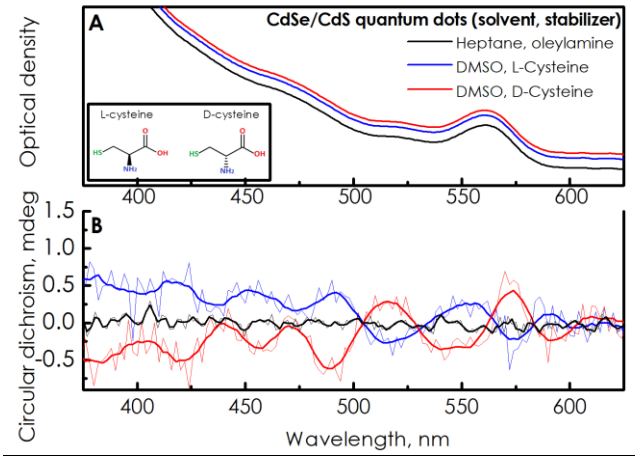

Figure 1: Comparison of (A) absorption and (B) circular dichroism spectra of QDs stabilized with achiral and chiral ligands.

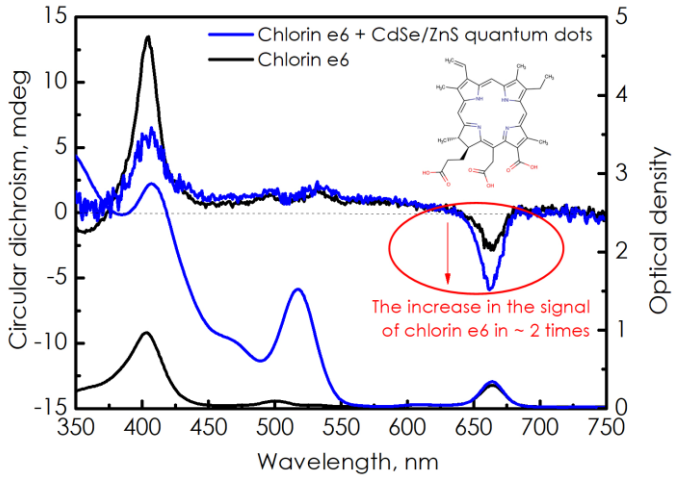

Figure 2: Absorption and circular dichroism spectra of HyNSs based on QDs and chlorin e6 in comparison to that of with free chlorin e6.