BIOCOMPATIBLE AND HEAVY METAL FREE $CuInS_2$/ZnS QUANTUM DOTS FOR CANCER DIAGNOSTICS

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Quantum dots (QDs) have long been considered for various biomedical and therapeutic applications, for example, as drug delivery carriers or medical imaging agents. Possibly the most widely studied QDs for these purposes are CdSe and CdTe QDs because of their well-established and standardized synthesis methods, and good optical properties [1]. Another type of QDs that are currently under intense investigation are lead chalcogenide (namely PbS, PbSe and PbTe) QDs. These QDs exhibit photoluminescence (PL) in near-infrared (NIR) spectral region which coincides with human tissue transparency window; this property is important for deep-tissue imaging applications [2]. Even though Cd and Pb based QDs have very appealing PL properties over a wide range of emission wavelengths (from ultraviolet (UV) to NIR), both types of QDs are intrinsically toxic, which renders them unsuitable for therapeutic use [3]. This calls for research on QDs better suited for biomedical purposes, as such, these QDs would have to be composed of non-toxic materials and should still emit in the NIR region of tissue transparency window.

Heavy metal free $CuInS_2$ QDs are known to be less toxic, and emit bright PL reaching the tissue transparency window. In addition, core/shell structured $CuInS_2$/ZnS QDs can be obtained, further improving their PL quantum yield [4]. In spite of rapid advances made on the material science front, these structures are rather poorly researched from the biomedical standpoint. In order to make a move from material research to biomedical use, the nano-bio interface of these structures is ought to be thoroughly characterized and understood.

In this work, optical properties of $CuInS_2$/ZnS core/shell QDs and their stability in various media were investigated using steady-state and lifetime fluorescence spectroscopy. The size of the QDs was evaluated using atomic force microscopy and dynamic light scattering methods. The colloidal stability of the QDs in solution was assessed by measuring their zeta potential. The accumulation of QDs in cancer cells was investigated as well. Results of these experiments will help to assess the potential of using $CuInS_2$/ZnS QDs for cancer diagnostics, as well as their possible therapeutic use.

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