Synthesis, characterization and bi-functional nanostructure near-infrared emitting quantum dots ***Mohamed F. Foda1,2, Heyou Han1* and Liang Huang1***

1*State Key Laboratory of Agricultural Microbiology, College of Science, Huazhong Agricultural University, Wuhan, 430070, P.R. China* **2**Central Key Laboratory of Agricultural Biochemistry, Faculty of Agriculture, Benha University, Egypt * Corresponding author address Tel: +86-27-87288246; fax: +86-27-87288246.
E-mail: hyhan@mail.hzau.edu.cn

Abstract Semiconductor nanocrystal quantum dots (QDs) have drawn great scientific interest in biological labeling due to their unique optical properties. To date, *in vivo* imaging in biomedical field has become the cutting edge in science. Unlikely, QDs with a visible emission have less penetration ability *in vivo*, which limited their extensive applications. Therefore, near-infrared (NIR) emitting QDs with a spectral window of 750-900 nm have been conducted to overcome this obstacle, which were most interested for *in vivo* imaging and cancer tracking. Herein, we report the synthesis, optical characterization and near-infrared (NIR) emitting CuInS2/ZnS (CIS/ZnS) quantum dots and their biolabeling properties. To synthesis hydrophobic I–III–VI2 QDs, first the CuInS2 core was prepared at 240℃ for 30 min. Then the temperature of the CIS core was decreased to 160℃ for the ZnS shell surface passivation to improve the photoluminescence (PL) of the final nanoparticles. Furthermore, we investigated the oil and water phase composite, morphology and optical properties of the as-prepared QDs by Xray diffraction (XRD), transmission electron microscopy (TEM), UV-vis absorption spectra and PL spectra. The as-prepared CuInS2/ZnS QDs were incorporated in silica beads, for further bi-functional modification, with an average diameter 15-35 nm while maintaining an absolute and symmetric photoluminescence (PL) spectrum with emission peak tunable in the range of 660-700 nm and photoluminescence quantum yield (PL QY) up to 40-50%. Moreover, the CIS/ZnS silica beads showed remarkable biocompatible and excellent NIR emitting properties that favor their further biolabeling applications. **Keywords:** CuInS2/ZnS quantum dots, near-infrared emission, surface passivation, silica beads