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Preliminary studies on the biosafety of CdSe/ZnS quantum dots based on metallomics

Quantum dots (QDs) exhibit great prospect in clinical application, and the bioavailability of QDs has aroused extensive concerns with limited consensus has been reached so far. Several important problems need to be resolved urgently, such as the lacking of standardization methods, and unknown molecular mechanism and secondary effects of QDs. To solve these problems, studies on the biosafety of QDs should be carried out more deeply and systematically by introducing novel strategies and methodologies.

Metallomics is a novel omics science, focusing on the amount, species, distribution, structure and function of metals in biological system. The effective platform for metallomics study presently is hyphenated techniques combining high-resolution separation technique with sensitive elemental specific detection techniques and molecular mass detection techniques. Due to the metal composition of QDs, utilization of these hyphenated techniques would provide the information of the amount, species, distribution, transformation and metabolism of QDs in living cells and organism, which benefits the explanation of the mechanism of toxicity caused by QDs from molecular levels.

We carried out preliminary studies on the biosafety of CdSe/ZnS QDs from the point view of metallomics. The main contents include (1) study the biokinetic behavior (uptake, distribution and elimination) and toxicity of CdSe/ZnS QDs in HepG2 cells by mass spectrometry-based hyphenated techniques and biochemical methods; (2) analyze the species of CdSe/ZnS QDs in HepG2 cells by mass spectrometry-based hyphenated techniques and related analytical methods; (3) explore comprehensive information on the species of Cd-metallothioneins by high resolution mass spectrometry, providing strategy and basic data for revealing the molecular mechanism of QDs toxicity.

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