QUANTUM DOTS-BASED FLUORESCENT INMUNOASSAY FOR THE DETERMINATION OF AFLATOXINS

M. T. Fernández-Argüelles, L. Trapiella, J. M. Costa, R. Pereiro and A. Sanz-Medel.
Department of Physical and Analytical Chemistry, Faculty of Chemistry,
University of Oviedo,Oviedo, 33006, Spain.
fernandezteresa@uniovi.es

Luminescent colloidal semiconductor nanocrystals, known as "quantum dots" (QDs), have captivated researchers from multiple areas of the science and technology, owing to their fascinating optical and electronic properties, which are not available from either isolated molecules or bulk solids. These properties include high quantum yields, large extinction coefficients, high photostability, and broad absorption spectra coupled to narrow size-tuneable photoluminescent emission spectra. Unlike conventional dyes, distinct populations of QDs can be simultaneously excited by a single wavelength far from their respective emissions, which suggests they could be especially suited for multiplexing assays *via* simultaneous detection of multiple signals [1]. Due to these favourable optical properties, analytical chemists have started to explore the use of QDs as a new generation of luminescent labels in different biochemical applications, and particularly in the development of luminescence-based immunosensors [2]. In this line, very recently, we have investigated the applicability of QDs as photoluminescent labels in the development of an immunoassay for the detection of the toxic species, Aflatoxin B1, based on the bioconjugation of ZnS-CdSe QDs to anti-aflatoxin antibodies.

Colloidal ZnS-CdSe QDs used as labels in this work were synthesized from organometallic precursors and are inherently hydrophobic. Different approaches have been used to make them hydrophilic and, so, water-soluble and compatible with biological media while preserving their optical properties. In this work we resorted to an approach involving the coating of the surface of the native hydrophobic QDs with an amphiphilic polymer shell. The hydrophilic functions of the polymeric shell provide water-compatibility and can be used for further simple and general bioconjugation of the nanocrystals to appropriate antibodies [3].

Further, bioconjugation of the synthesized polymeric-layered water-soluble QDs to anti-aflatoxin antibodies was performed by a simple method. The formed bio-conjugates were purified from an excess of free antibodies and of free nanoparticles by size-exclusion chromatography and then exhaustively characterized by fluorescence spectroscopy and MALDI-TOFMS. Finally, applicability of the proposed QDs-based immunoassay to Aflatoxin B1 detection was demonstrated by resorting to photoluminescence measurements.

References:

[1] A. Paul Alivisatos, Science, **271** (1996) 933.
[2] R. E. Bailey, A. M. Smith, S. Nie, Physica E, **25** (2004) 1.
[3] M. T. Fernández-Argüelles, A. Yakovlev, R. A. Sperling, C. Luccardini, S. Gaillard, A. Sanz Medel, J. M. Mallet, J. C. Brochon, A. Feltz, M. Oheim, and W. Parak, Nano Lett., **7(9)** (2007) 2613.