

CdSe/ZnS Quantum Dots for Improving Detection Capabilities in Analytical Processes

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Abstract

Currently, the use of nanomaterials as analytical tools is one of the most exciting trend in (bio)chemical analysis, providing new opportunities in the development of innovative approaches in the different steps of the analytical process. In this way, a clear example is the use of "quantum dots" nanoparticles (QDs). The growing importance of this type of nanoparticles as tools in nanoscience and nanotechnology resides in their exceptional optoelectronic properties at nanoscale range due to "quantum confinement" effects and its very reactive surface. These features confer many of the interesting and, sometimes, unexpected properties of QDs [1]. Due to their exceptional optical properties, QDs have found vast applications in analytical research as the next generation fluorescent probes and new sensing assays. Therefore, QDs are now involved in many analytical applications as analytical tools.

In this way, the aim of this communication is to show several analytical procedures for the modification/solubilization of CdSe/ZnS QDs, and their subsequent use as analytical tools, contributing to improve the detection and then the determination of compounds of interest in the several fields, such as environmental [2, 3], food [4, 5] and clinical [6]. Thus, CdSe/ZnS QDs can be used in paper strips for a rapid screening of glucose at concentrations of clinical interest based on the different fluorescence color of the paper. CdSe/ZnS QDs can be functionalized with different types of ligands in order to introduce the appropriate selectivity for target compounds. Thiol ligands are very useful ligands. For instance, L-cysteine increases the fluorescence of CdSe/ZnS QDs in the presence of sulfonylurea herbicides, whereas cysteamine produces a quenching of fluorescence with the same type of pesticides. CdSe/ZnS QDs coated with 3-mercaptopropionic acid was used for the sensitive detection and quantification of paraquat in water samples. The modification with cyclodextrin ligands introduces interesting analytical possibilities, such as the fluorimetric determination of vanillin in food samples. Other different ligands can be used for a strategic modification of CdSe/ZnS QDs for new analytical purposes, as this communication reports.

References

- [1] G.M. Durán, A.M. Contento, Á. Ríos, *Current Organic Chemistry*, **19** (2015) 1134.
- [2] G.M. Durán, A.M. Contento, Á. Ríos, *Anal. Chim. Acta*, **801** (2013) 84.
- [3] G.M. Durán, M.R. Plata, M. Zougagh, A.M. Contento, Á. Ríos, *J. Colloid Interface Sci.*, **428** (2014) 235.
- [4] G.M. Durán, A.M. Contento, Á. Ríos, *Talanta*, **131** (2015) 286.
- [5] G.M. Durán, A.M. Contento, Á. Ríos, *Anal. Methods*, **7** (2015) 3472.
- [6] G.M. Durán, T.E. Benavidez, Á. Ríos, C.D. García, *Microchim. Acta*, DOI 10.1007/s00604-015-1685-3

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