Near-infrared fluorescent nanoprobes for highly sensitive cyanide quantification in natural waters

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Near-infrared fluorescent nanoprobes for highly sensitive cyanide quantification in natural waters

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Abstract

Near infrared (NIR) emitting Ag_2S quantum dots have been synthesized, characterized and evaluated for chemical sensing applications. After their optical characterization, it was observed that the Ag_2S quantum dots present both, excitation and emission in the NIR region, and an excellent quantum yield of 33.2 %. These features are of great value for many biological applications, since autofluorescence of biological tissues or cells is minimized, and also for environmental applications, where other fluorescent concomitant species with excitation and emission in the ultraviolet-visible region might be present.

Different purification procedures were evaluated in order to obtain a stable and homogeneous population of nanoparticles, which is necessary to perform quantitative analysis (e.g.: mass spectrometry-based applications), as well as to obtain a narrow NIR emission spectrum for optical applications.

Comprehensive characterization using X-ray diffraction, transmission electron microscopy, and asymmetric flow field flow fractionation coupled to inductively coupled plasma-mass spectrometry has been performed to obtain parameters not easily achieved and of great interest in different research areas, such as the nanoparticle concentration NIR-emitting nanoparticles, and the surface ligand density, which directly affects to the interactions of the nanoparticles with their close environment, including unspecific adsorptions, cellular uptake, macrophage interaction, etc.

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