281 Using Nanotechnology and Microbiology to biosynthesize fluorescent semiconductor-nanoparticles with biotechnological applications

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Quantum Dots (QDs) are fluorescent semiconductor nanoparticles with tremendous biotechnological and industrial applications (renewable energy, biomedicine and chemistry). They are composed by chalcogenides such as CdS, ZnS, CdTe, CdSe or mixtures as CdTe/ZnS, among others. The unique properties that QDs display are mostly determined by its nanometric size, structure and composition.

Many protocols for chemical production of QDs have been established to date, but biological methods involving organisms and/or biomolecules have gained importance since they are cheaper, eco-friendly and produce biocompatible QDs with novel properties.

To produce QDs using green technology, microbiologists have developed QDs biosynthesis methods using fungi, yeast and bacteria. The process of QDs biosynthesis is still not well understood and the molecular bases of QDs formation in different microorganisms have not been elucidated to date. However, the participation of biomolecules such as thiol rich proteins, peptides, antioxidants and some volatile compounds have been reported [1, 2].

Our group has developed biomimetic protocols to biosynthesize CdS, CdTe and CdSe QDs based on molecules produced by bacteria (glutathione and cysteine, among others) [3, 4, 5]. In addition, we have determined that bacteria displaying good antioxidant responses, high metal tolerance and living in extreme environments are favored for nanoparticle production [1, 2]. In this context, we have isolated a great number of microorganisms able to biosynthesize QDs from different extreme environments (Atacama Desert, volcanoes, metal contaminated soils, Uyuny salt flats, and Antarctica). In particular, we have participated in three Antarctic expeditions in which metal resistant microorganisms were isolated (Cd, Te and Se). Based on spectroscopic studies we determined that different nanoparticles are produced by *Psychrobacter*, *Shewanella* and *Pseudomonas* Antarctic strains. In addition, *Pseudomonas* strains were able to produce QDs at low temperatures (below 15°C) [2].

Regarding the biotechnological applications of green produced nanoparticles, we have recently demonstrated its use on Quantum dots sensitized solar cells [6], pathogen identification [2], cancer cells immune-fluorescence [3] and Cu^{+2} quantification [7].

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