264 Quantum Dot Sensitized Solar Cell based in biosynthesized CdTe nanoparticles

N. Órdenes-Aenishanslins[1,2], L.A. Saona[1,2], A. Gran-Scheuch[1,2], J.P. Monrás[1,3], J.M. Pérez-Donoso[1]

[1]*Bionanotechnology and Microbiology Lab, Center for Bioinformatics and Integrative Biology (CBIB), Universidad Andrés Bello, República 239, Santiago, Chile*

[2]*Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile, Sergio Livingstone Pohlhammer 1007, Santiago, Chile*

[3]*Facultad de Química y Biología, Universidad de Santiago de Chile, Alameda 3363, Santiago, Chile*

email address corresponding author: nicolas.ordenes@gmail.com

In the last time, the research and development of Quantum Dot Sensitized Solar Cells (QDSSCs) has been strongly stimulated and they could be an alternative for the next generation of solar cells. The unique characteristics of fluorescent semiconductor nanoparticles or Quantum Dots (QDs), such as tunability of the bandgap, high absorption coefficient and generation of multiple electron carriers under high energy excitation, make them good candidates for this type of sensitized solar cell [1].

On the other hand, the rapid advance of nanotechnology and the increasing number of applications involving nanomaterials have prompted the interest in developing simple and environmentally friendly protocols for nanoparticles synthesis. Thus, during the last years, methods to biosynthesize nanoparticles involving microorganisms or plant extracts have taken hold.

Our group recently published a work where we report the intracellular CdTe Quantum Dots biosynthesis in bacteria *Escherichia coli* overexpressing the *gshA* gene involved in glutathione synthesis [2]. In the present work, we report the use of these biosynthesized CdTe nanoparticles in Quantum Dot Sensitized Solar Cells, a sustainable alternative for energy production.

A schematic representation of the solar cell used to evaluate the biosynthesized CdTe nanoparticles is shown in Figure 1. When QDs absorb light, they inject electrons from their excited levels to the conduction band of the TiO_2 nanoparticle film. The recirculation of the redox electrolyte in its oxidized-reduced state allows to recharge the electrons lost by oxidized QDs while serving as a pathway for electron transfer between the two electrodes. Thus, when light shines on the solar cell, the device directly converts sunlight into electricity and the current and voltage data can be recorded in an external circuit.

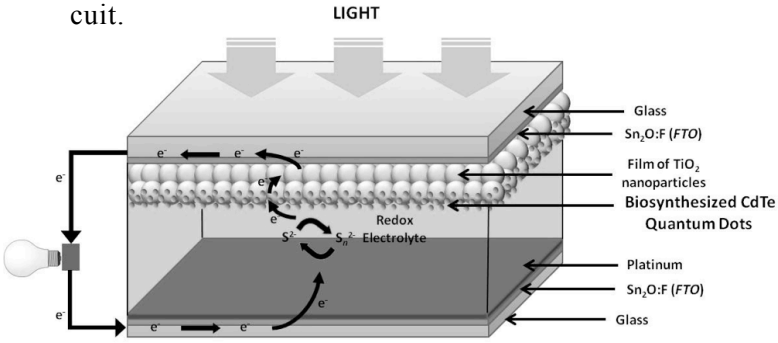

Fig. 1 *Scheme of a Quantum Dot Sensitized Solar Cell. The film of TiO_2 nanoparticles on conductive glass is sensitized with biosynthesized CdTe QDs forming the photoanode, while the cathode or counter electrode is platinum on FTO glass. The redox electrolyte fills the space between electrodes.*

References

[1] S. Rühle, M. Shalom, and A. Zaban, ChemPhysChem. **11**, 2290 (2010).

[2] J. P. Monrás, V. Díaz, D. Bravo, R.A. Montes, T.G. Chasteen, I.O. Osorio-Román, C.C. Vásquez, and J. M. Pérez-Donoso, PLoS One. **7**, e48657 (2012).