222 Importance of inorganic phosphate in the biosynthesis of CdS QDs by *Escherichia coli*

F.A. Venegas[1], J.P. Monrás[1,3], L.A. Saona[1,2], J.M. Pérez-Donoso[1]

[1]*Bionanotechnology and Microbiology Research Lab, Center for Bioinformatics and Integrative Biology (CBIB), Universidad Andres 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.*

venegas.fa@gmail.com

Different applications of metal chalcogenides (S, Se and Te) nanoparticles (NPs); Quantum Dots (QDs), in areas like biomedicine (inmunefluorescence) [1], chemistry (cation quantification) [2] and energy (photovoltaic cells) [3] has increasing the interest in developing new, safer, cheaper and environmentally friendly protocols for its synthesis. The use of bacteria as biofactories for QDs "biosynthesis" has been explored and diverse groups had developed protocols to biosynthesize QDs [4], but the molecular and biochemical factors involved are still unclear.

In this study we determined the importance of inorganic phosphate (Pi) on the biosynthesis of CdS QDs in bacteria. The effect of metal and Pi-divalent metal transporters on *Escherichia coli* biosynthetic process were determined. When a wild type (WT) *E. coli* strain was treated with $CdCl_2$ and Pi, bacterial cells display tunable fluorescence colors dependent on Pi or Cd amount. Also, we found that Pi improves the Cd-uptake by cells. Finally, the overexpression of genes involved in transport of Mn^{2+} or Pi-divalent metal complexes, and a deletion of a gene involved into the Cd^{2+} release, improve the biosynthetic behavior in *E. coli*.

In summary, results obtained in this work represent the first step in understanding the biological and molecular process behind bacterial CdS QDs biosynthesis, and show an easy-way to control the spectroscopic properties of these NPs. On the other hand, obtained results indicate that Pi is an important molecule to consider within the QDs biosynthetic process.

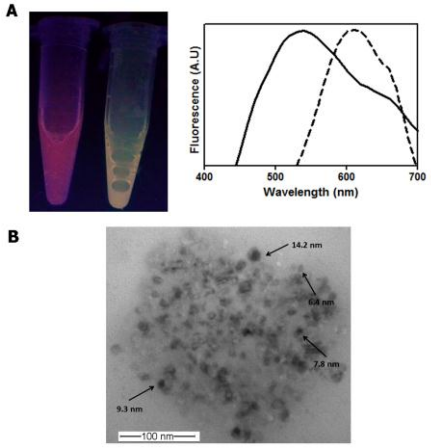

Fig. 1. Characterization of QDs purified from E. coli cells exposed to Cd. *A), photographic recording (left) and emission spectra (right) of two NPs purified from E. coli cultures treated with 60 ug/mL (red and dashed line) and 250 ug/mL $CdCl_2$ (yellow and solid line). B), TEM of purified NPs.*

We acknowledge contributions from Fondecyt 11110077.

References

[1] J. Li, D. Wu, Z. Miao and Y. Zhang, Curr. Pharm. Biotechnol. **11(6):**662-71**.** (2010).

[2] V. Durán-Toro, A. Gran-Scheuch, N. Órdenes-Aenishanslins, J.P. Monrás, L.A. Saona, F.A. Venegas, T.G. Chasteen, D. Bravo and J.P. Pérez-Donoso, Anal. Biochem. **450:**30-6. (2014).

[3] Z. Pan, I. Mora-Seró, Q. Shen, H. Zhang, Y. Li, K. Zhao, J. Wang, X. Zhong and J. Bisquert, J. Am. Chem. Soc. **136(25):**9203-10. (2014).

[4] K.B. Narayanan and N. Sakthivel, Adv. Colloid Interface Sci. **156(1-2):**1-13. (2010).