World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:10, No:01, 2016

Quantum Dot – DNA Conjugates for Biological Applications

Authors : A. Banerjee, C. Grazon, B. Nadal, T. Pons, Y. Krishnan, B. Dubertret

Abstract : Quantum Dots (QDs) have emerged as novel fluorescent probes for biomedical applications. The photophysical properties of QDs such as broad absorption, narrow emission spectrum, reduced blinking, and enhanced photostability make them advantageous over organic fluorophores. However, for some biological applications, QDs need to be first targeted to specific intracellular locations. It parallel, base pairing properties and biocompatibility of DNA has been extensively used for biosensing, targetting and intracellular delivery of numerous bioactive agents. The combination of the photophysical properties of QDs and targettability of DNA has yielded fluorescent, stable and targetable nanosensors. QD-DNA conjugates have used in drug delivery, siRNA, intracellular pH sensing and several other applications; and continue to be an active area of research. In this project, a novel method to synthesise QD-DNA conjugates and their applications in bioimaging are investigated. QDs are first solubilized in water using a thiol based amphiphilic co-polymer and, then conjugated to amine functionalized DNA using a heterobifunctional linker. The conjugates are purified by size exclusion chromatography and characterized by UV-Vis absorption and fluorescence spectroscopy, electrophoresis and microscopy. Parameters that influence the conjugation yield such as reducing agents, the excess of salt and pH have been investigated in detail. In optimized reaction conditions, up to 12 single-stranded DNA (15 mer length) can be conjugated per QD. After conjugation, the QDs retain their colloidal stability and high quantum yield; and the DNA is available for hybridization. The reaction has also been successfully tested on QDs emitting different colors and on Gold nanoparticles and therefore highly generalizable. After extensive characterization and robust synthesis of QD-DNA conjugates in vitro, the physical properties of these conjugates in cellular milieu are being invistigated. Modification of QD surface with DNA appears to remarkably alter the fate of QD inside cells and can have potential implications in therapeutic applications.

Keywords : bioimaging, cellular targeting, drug delivery, photostability
Conference Title : ICNA 2016 : International Conference on Nucleic Acids
Conference Location : Singapore, Singapore
Conference Dates : January 07-08, 2016