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Modulation of membrane electrokinetic properties by semiconductor nanoparticles

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Core/shell CdSe/CdS nanocrystals are one of the most important II–VI semiconductors with applications in solar cells, optoelectronics and electronic devices. CdSe / CdS nanocrystals are coated with thioglycolic acid to be water soluble. CdSe / CdS core-shell quantum dots have also been used, which reduce the toxicity of CdS nanocrystals on biological membranes. Semiconductor nanoparticles have great potential serving as a new generation of multifunctional agents for clinic diagnosis and treatment (Wang et al., 2018). This study will highlight the main biophysical points to be considered in order to evaluate the electrokinetic potential of erythrocyte membranes under treatments with semiconductor nanoparticles and discuss the issues and challenges emerging in the field of nanotechnology and electroketic stability of the erythrocytes.

We measure the electrophoretic mobility of human erythrocytes using three types of core/shell CdSe/CdS nanocrystals (NP1, NP2, NP3) by the method of microelectrophoresis. The restricted change in electrokinetic properties of erythrocyte membrane indicated that the structural phenomena observed are due to the erythrocyte-nanocrystals interaction.

A strong decrease in membrane transport across the human erythrocyte membrane is occurred due to OH-/Cl- antiport as well as H+/Cl- cotransport' inhibition.
Higher lipid peroxidation of erythrocytes in the presence of CdSe/CdS nanocrystals is determined compared to untreated erythrocyte membranes.

Concern about the toxicity potential of semiconductor nanoparticles is mainly attributed to this small size, large surface area and high reactivity compared to bulk-sized materials (Oberdörster, 2010). The results of the present study provide new insights into the biological impacts of semiconductor nanoparticles in vivo.

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