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Functionalized near-infrared quantum dots for biological applications

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As light emitting quantum dots (QDs) have been a noteworthy center of innovative work amid the previous decades. In the present study, water dispersion of the CdSe/ZnS quantum dots were accomplished by their encapsulation within polyethylene glycol (PEG)-grafted phospholipid micelles with biotin as a free end. The prepared near infra-read (NIR) QDs micelle permit photon infiltration through tissue and minimize the impacts of tissue autofluorescence. In addition, the micelle formation reduces the cell cytotoxicity and increses the fluorescence signal in the cell. For the separation purpose, we added iron oxide nanoparticle in the micelle core. This type of micelle easily uptake cancer cells without further modification, because it will enter the cancer tissue through blood vessel holes. The photostability of micelle under ultraviolet irradiation is stronger than free CdSe/ZnS quantum dots. The interaction of micelle with human serum albumin was studied using steady state and excited state fluroescence spectroscopy and the binding parameter was obtained with various temperature. Hydrophobic force and hydrogen bond stabilized the interaction between albumin and micelle. Furthermore, we checked cell viabilty and cellular uptake of prepared micelles using the following cell lines HeLa, RAW 267.4 and A549. There is no notable cytotoxicity observed micelle concentration up to 25 µg/mL. We observed fluorescence images of micelle using confocal laser scanning microscope. The observed fluorescence images clearly shows the high intensity of micelles after 24 h incubation. This methodology demonstrates the huge guarantee of quantum dots as a part of tests for multimodel imaging and therapy.

Biography

Chinnathambi Shanmugavel has completed his PhD from Anna University. He was awarded the JSPS Post-doctoral fellowship to work under the guidance of Prof. Nobutaka Hanagata, National Institute for Materials Science, Japan. His research focuses on regulation of cellular functions using quantum dots for infectious diseases, allergy treatments, and cancer therapy.

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