COLLOIDAL QUANTUM DOTS FOR APPLICATIONS IN DOSIMETRY AND LIQUID SCINTILLATION COUNTING

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The understanding of the health impact of low dose exposition to ionizing radiation is one of the scientific challenges of this century. To insure a proper assessment of the exposition to radioactivity, different methods of detection have been investigated. One of the most common detection methods is liquid scintillation counting, which convert the radiation energy into a light signal with the use of fluorophores. In our study, semiconductors colloidal quantum dots (cQDs) were optimized to detect ionizing radiation through liquid scintillation counting. Few experiments have been reported on the detection of actinides with cQDs and they were performed exclusively with nanocomposite materials embedding cQDs. Because radionuclides standards are mostly available in aqueous matrices, two approaches were explored to validate the potential of cQDs as scintillators: the dispersion of cQDs in water and the complexation of radionuclide in an organic solvent. The dispersion in water was performed by ligand exchange using dihydrolipoic acid whereas the radionuclides were complexed with H_2DEH[MDP] using a cloud point extraction methodology.

A linear relationship ($r^2 = 0.99995$) between the dose at which the cQDs were exposed and the level of light generated by the solution was observed between 0.05 and 3 Gy. For the DHLA–cQD system in a borate buffer, the maximal detection efficiency (DE) obtained so far was calculated to be 58% for a 4 hour counting period. This contribution highlights our recent progress concerning the use of different type of cQDs in organic and aqueous media for the detection of ionizing radiation through liquid scintillation counting.