Detecting and Imaging Triple Negative Breast Cancer Using Water-Soluble Perovskite Quantum Dots

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he purpose of this study is to synthesize stable water-soluble perovskite quantum dots and to use their highly luminescent properties to detect cancer. Despite recent progress in breast cancer research, advances specific to triple-negative breast cancer (TNBC) have lagged. 15% of breast cancer victims are diagnosed with TNBC and those victims face higher mortality rate. There is a clear need for quick and reliable form of detection at early stage. Cancer exosomes can be a potential source for accessing tumor type and stage, and for monitoring the cancer treatment response. Perovskite compounds such CsPbX3 have exceptional photoluminescence quantum yield. However, these materials are moisture sensitive and degrades quickly under ambient conditions, hence they cannot be used for bio-imaging applications. In this study the aqueous stability and solubility of CsPbX3 perovskite quantum dots (PQDs) are achieved by encapsulating PQDs in organic polymer matrix (Pluronic F127). Polymer substrate forms an excellent barrier layer around the PQDs, which protect the nanocomposite from air, moisture and hydrophilic groups makes them soluble in water. Photoluminescence spectra from the nanocomposite at different storage times show that nanocomposites retain their luminescence properties in water for over 8 days, then decreases slowly to 60% of its initial photoluminescence after one month. The anti-CD63 antibody specific for triple negative breast cancer cell exosomes are attached to polymer coated CsPbBr3 PQD nanocomposites via non covalent interaction. These novel PQD nanocomposites are capable of tracking triple-negative breast tumor-derived exosomes via capture using antibody and luminescence imaging using new CsPbBr3 PQD nanocomposites.

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