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Highly sensitive detection of acid phosphatase by using a graphene quantum dots-based förster resonance energy transfer

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ABSTRACT

A novel and effective fluorescence strategy was developed for sensitive and selective detection of acid phosphatase (ACP). A förster resonance energy transfer (FRET) biosensor was established by attaching nile red (NR) to graphene quantum dots (GQDs) via lecithin/β-Cyclodextrin (lecithin/β-CD) complex as the linker. The introduction of lecithin/β-CD would brought GQDs–NR pair close enough through both electrostatic interaction and hydrophobic interaction, thereby making the FRET occur and thus resulting in the fluorescence quenching of GQDs (donor) and meanwhile the fluorescence enhancement of NR (acceptor). The presence of ACP in the sensing system would catalyze the hydrolysis of lecithin into two parts, resulting in the GQDs–NR pair separation. Meanwhile, considerable fluorescence recovery of GQDs and decreasing of NR was observed due to the inhibition of FRET progress. In this method, the limit of detection (LOD) is 28 μU mL^{-1} which was considerably low for ACP detection. Using the GQDs-based fluorescence biosensor, we successfully performed in vitro imaging of human prostate cancer cells.

Graphic Abstract