RHODAMINE B DERIVATIVE-LOADING ON UPCONVERSION NANOSTRUCTURES FOR FLUORESCENCE RESONANCE ENERGY TRANSFER AND INTRACELLULAR DETECTION OF GLUTATHIONE

[1]THU THUY T. NGUYEN, [2]BUI THEHUY, [3]ZAYA KHUU, [4]LEE YONG ILL

Department of Chemistry, Changwon National University, Changwon 641-773, Korea

Abstract: Glutathione (GSH, $_{y}$-$_{L}$-Glutamyl-$_{L}$-cysteine-y-l-glycine) which is one of the most abundant thiolatedtripeptide eukaryotic and mammalian cells, has played as an essential endogenous antioxidant in cellular defense against free radicals and toxins. However, GSH levels are closely related to many cancers, heart problems and dysfunction of organs. In this study, a novel Rhodamine B derivative (RBD) in conjunction with upconversion nanoparticle (UCNP, $NaGdF_4$:Lu,Yb,Er) demonstrated high sensitivity and specific selectivity in the detection of GSH. Using Polyethylene glycol (PEG) to modify UCNPs showed good water solubility and highly uniform distribution. In the nanostructure of sensing probe, RBD was loaded on the surface of UCNPs through noncovalent bonding with UCNPs (to be known as UCNP@RBD) that served as an energy donor and the GSH-responded RBD that served as an energy acceptor. This process was conducted through Fluorescence resonance energy transfer (FRET) between UCNPs which emitted at 550 nm and RBD that was absorbed at 550 nm and then emitted at 585 nm. The ability to detect GSH of UCNP@RBD showed the low limit of detection (LOD = 0.2 μM) in aqueous solution, quick response time and high selectivity toward GSH in comparison with the other thiol compounds in terms of reaction time and sensing efficiency. In addition, the sensing mechanism and characterization of UCNPs and fluorescence sensor toward GSH were discussed. This work demonstrates a simple and novel nanostructure in combination with GSH sensing based on FRET between upconversion luminescence and Rhodamine B derivative for practical applications.

Keywords: Upconversion, FRET, Rhodamine B derive, Glutathione sensing.