

Supporting information

Double Probes-based Fluorescence Sensor Array to Detect Rare Earth Element Ions

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Instrumentation

Fluorescence spectra were captured with a Cary Eclipse fluorescence spectrophotometer (Agilent, USA). Absolute photoluminescence quantum yield (PLQY) assessments were executed using an Integrating Sphere (Edinburgh Analytical Instruments, UK). Fluorescence lifetime evaluations were conducted utilizing an F900 Lifetime Spectrometer (Edinburgh Analytical Instruments, UK) in the time-correlated single photon counting mode. UV-visible (UV-vis) absorption spectra were recorded on a UV-2450 Scanning Spectrophotometer employing a 1 cm quartz cuvette (Shimadzu, Japan). Particle size analysis was performed using a JEM 2100 Transmission Electron Microscopy (TEM) (JEOL, Japan). X-ray photoelectron spectroscopy (XPS) examination was carried out utilizing an ESCALAB 250 XI electron spectrometer (Thermo, USA).

Experimental reagent

Sodium hydroxide and bovine serum protein were bought from Shanghai National Medicine Group Chemical Reagent Co., Ltd. Glycine, Tetrachloroauric(III) acid trihydrate ($\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$), 3-mercaptopropionic acid, and 6-aza-2-thiothymine were obtained from Aladdin reagent (Shanghai) Co., Ltd. Other reagents and chemicals are at analytical levels and used without any further purification.

Solution preparation

All solutions used are of analytical grade and prepared using deionized water.

1. $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ solution preparation: Dissolve 5 g of $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ powder in deionized water, transfer to a 250 mL volumetric flask using a glass rod, and prepare a 20 mg/mL HAuCl_4 solution. Store it in the dark and refrigerate.
2. ATT solution preparation: Dissolve 0.1717 g of ATT powder in 15 mL of 0.2 mol/L NaOH solution to prepare a solution with a concentration of 80 mmol/L for later use.
3. BSA solution preparation: Dissolve 0.625 g of BSA powder in 12.5 mL of deionized

water to prepare a BSA solution with a concentration of 50 mg/mL.

4. MPA solution preparation: Using a syringe, draw MPA liquid, weigh 0.8491 g, and add it to 2 mL of deionized water to prepare a 4 mol/L MPA solution.
5. NaOH solution preparation: Dissolve 2 g of NaOH solid pellets in 50 mL of deionized water to prepare a 1 mol/L solution. Take 4 mL of NaOH (1 mol/L) and dilute it with 16 mL of deionized water to obtain a concentration of 0.2 mol/L for later use.
6. Gly-NaOH buffer preparation: Dissolve 3.7535 g of glycine powder, and transfer it to a 1 L volumetric flask to prepare a solution with a concentration of 20 mmol/L in deionized water. Adjust the pH to the desired value using the prepared NaOH (1 mol/L) solution.
7. REEs solution preparation: Weigh an appropriate amount of each REE, and dissolve it in 5 mL of deionized water to prepare a solution with a concentration of 10 mmol/L. Dilute the solution stepwise according to the required concentration when in use.