Electronic Supplementary Information

A FRET System Built on Quartz Plate as a Ratiometric Fluorescence Sensor for Mercury Ions in Water

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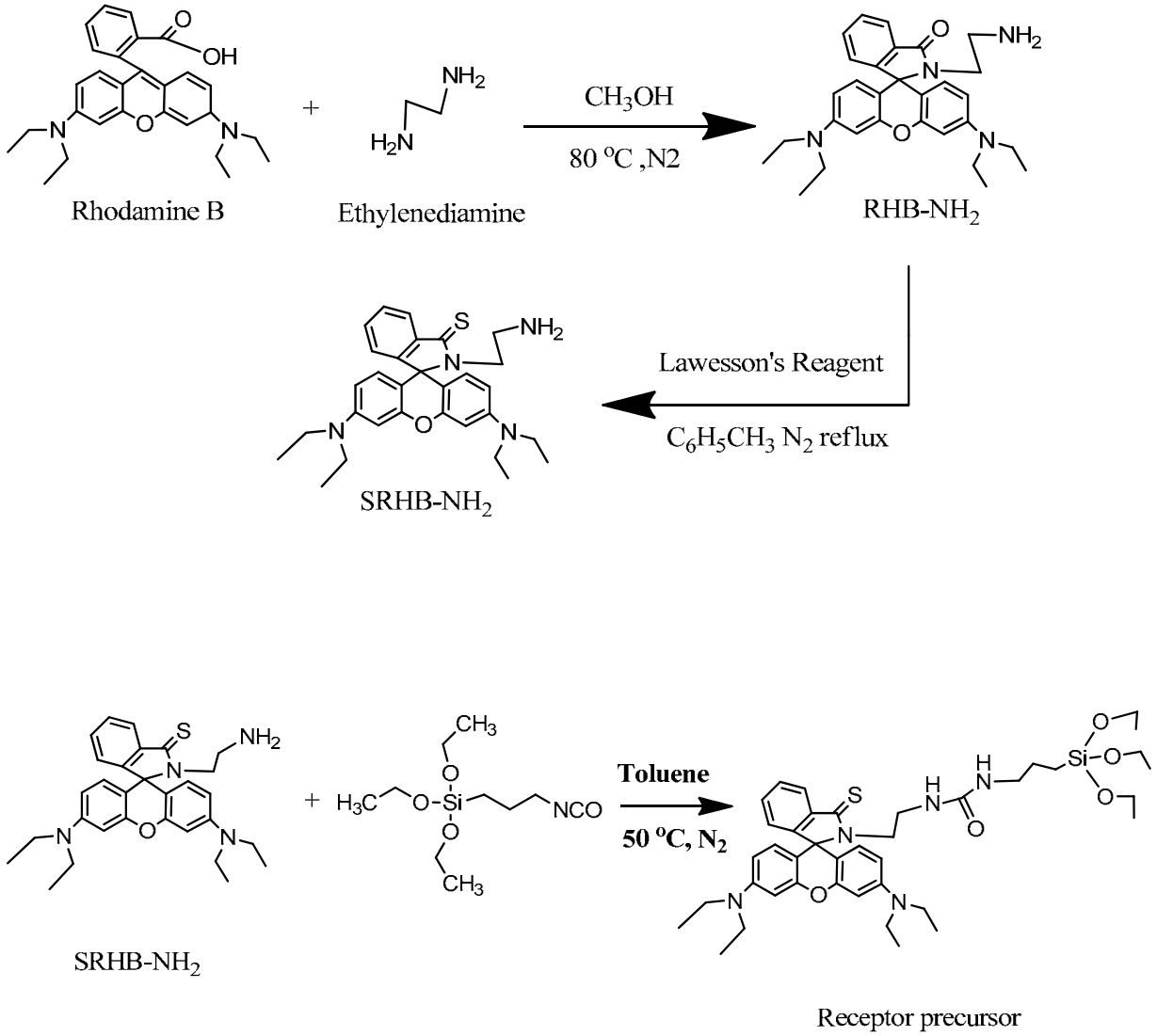
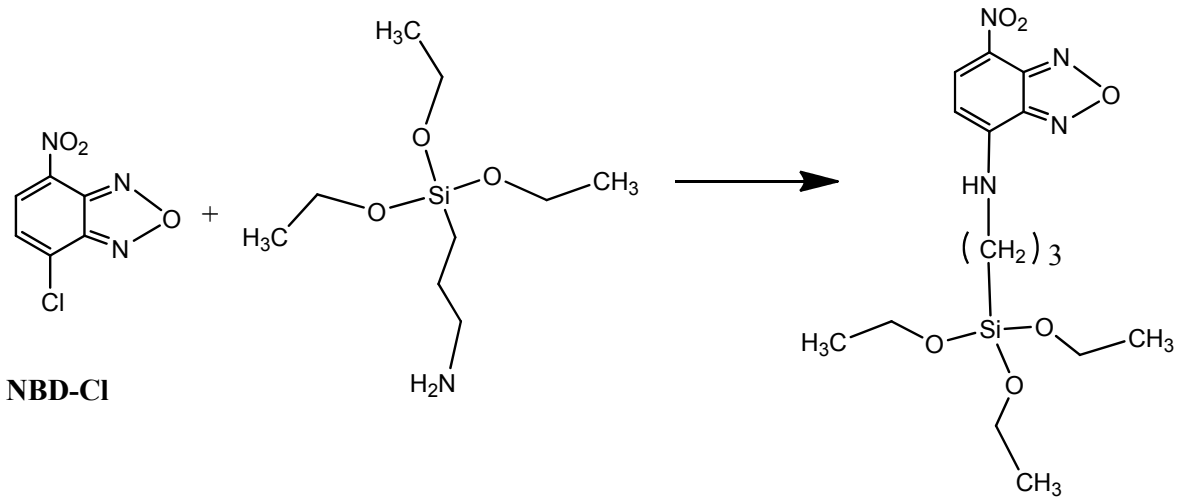
1. Schemes for synthetic routes:

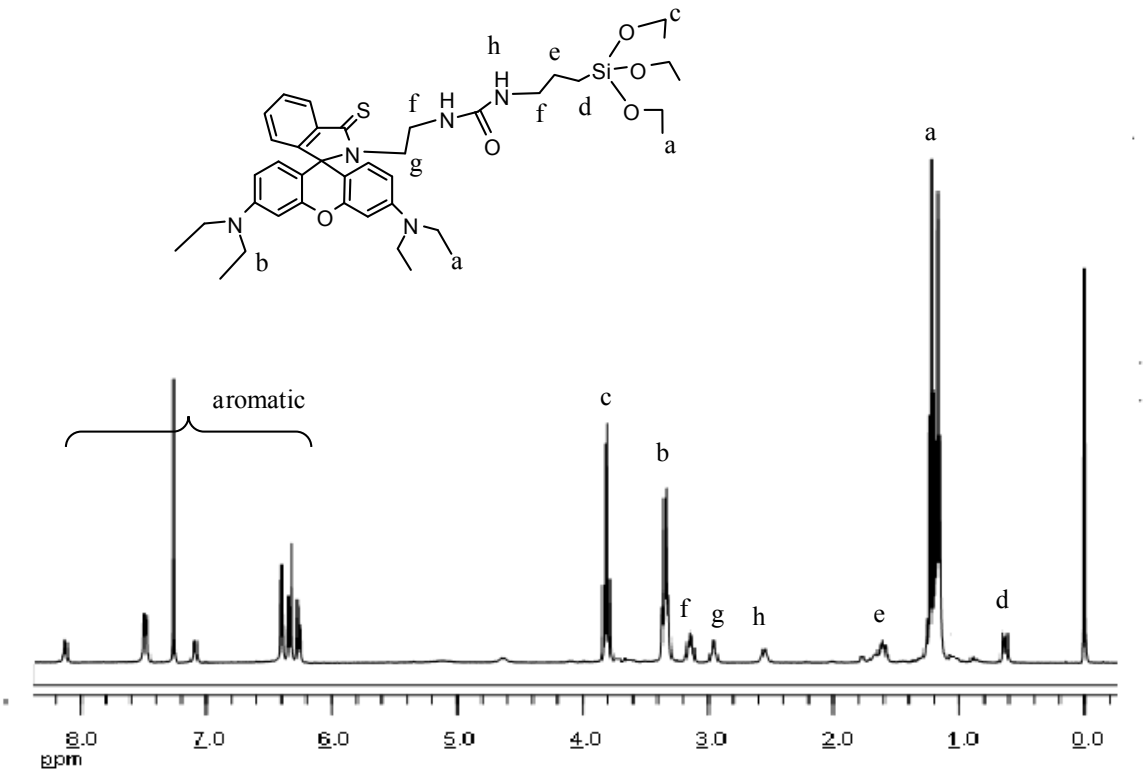


Scheme S1. Synthetic route of the Hg^{2+} receptor (SRhB-NH_2) and ethoxysilane-linked receptor (SRHB-APS, the receptor precursor).

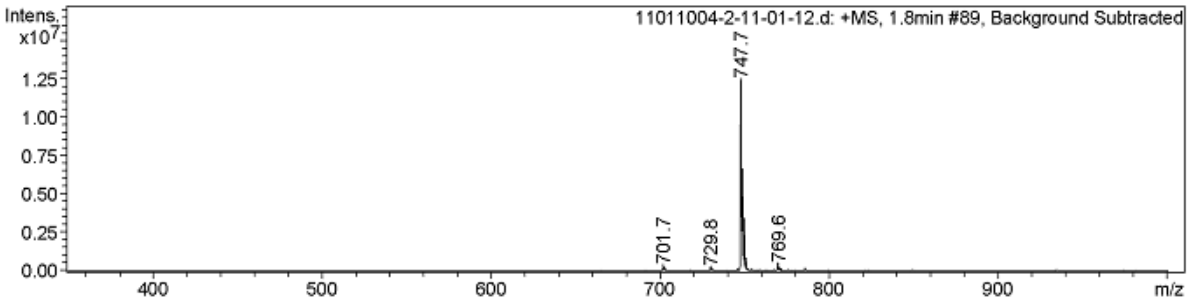


Scheme S2. Synthetic route of ethoxysilane-linked donor (donor precursor, NBD-APS)

2. **Characterizations**

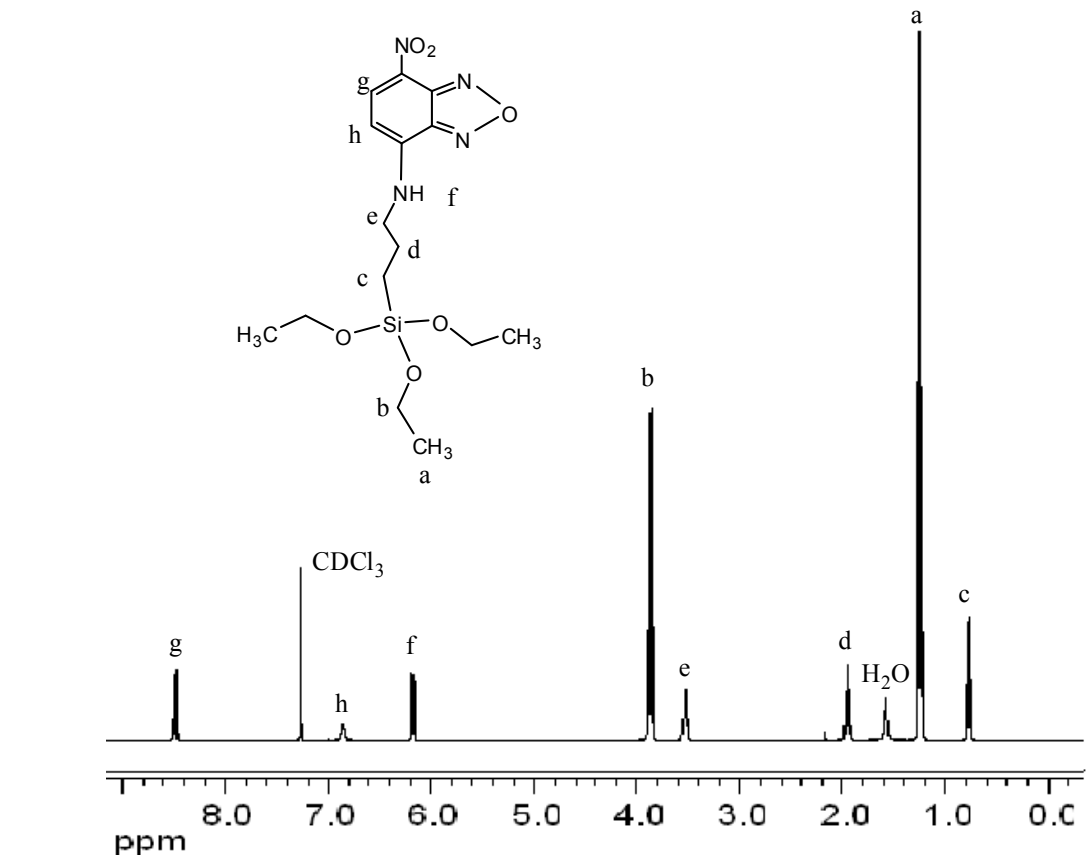


(a)

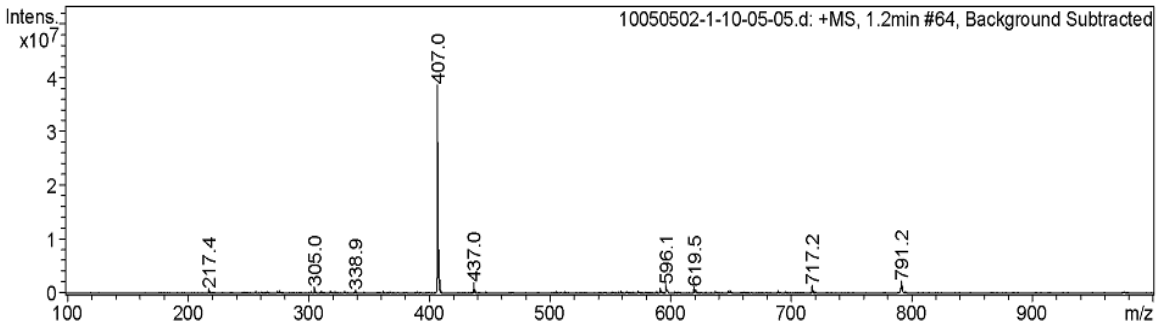


(b)

Fig. S1. ^{1}H NMR and MS spectra for probe precursor.



(a)



(b)

Fig. S2. ^{1}H NMR (a) and MS spectrum (b) for donor precursor.

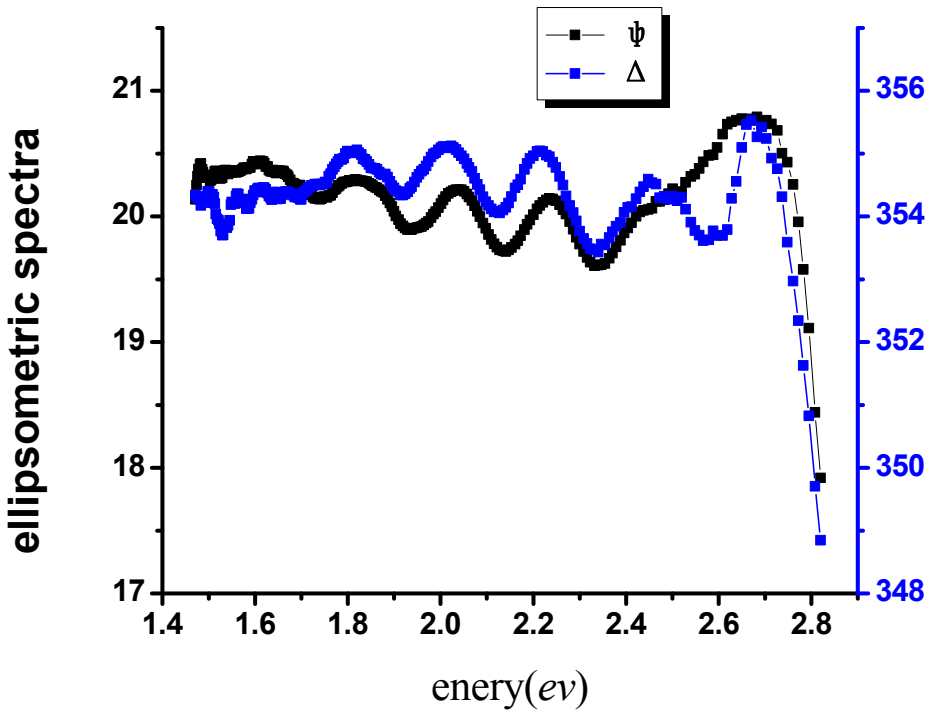


Fig. S3. Plot of ellipsometric parameters Ψ (amplitude ratio) and Δ (phase difference) as the function of photon energy (in eV) for the multilayered film (before deposition of receptor layer).

Table S1. Determined thickness for the multilayered film as a result of fitting.

Layer	Thickness (nm)	Standard deviation
Support	116.5	± 9.3
Donor	0.90	± 0.18
Spacer	2.8	± 0.8

Note: To simplify the data analysis, we used sample with no receptor layer for thickness evaluation.

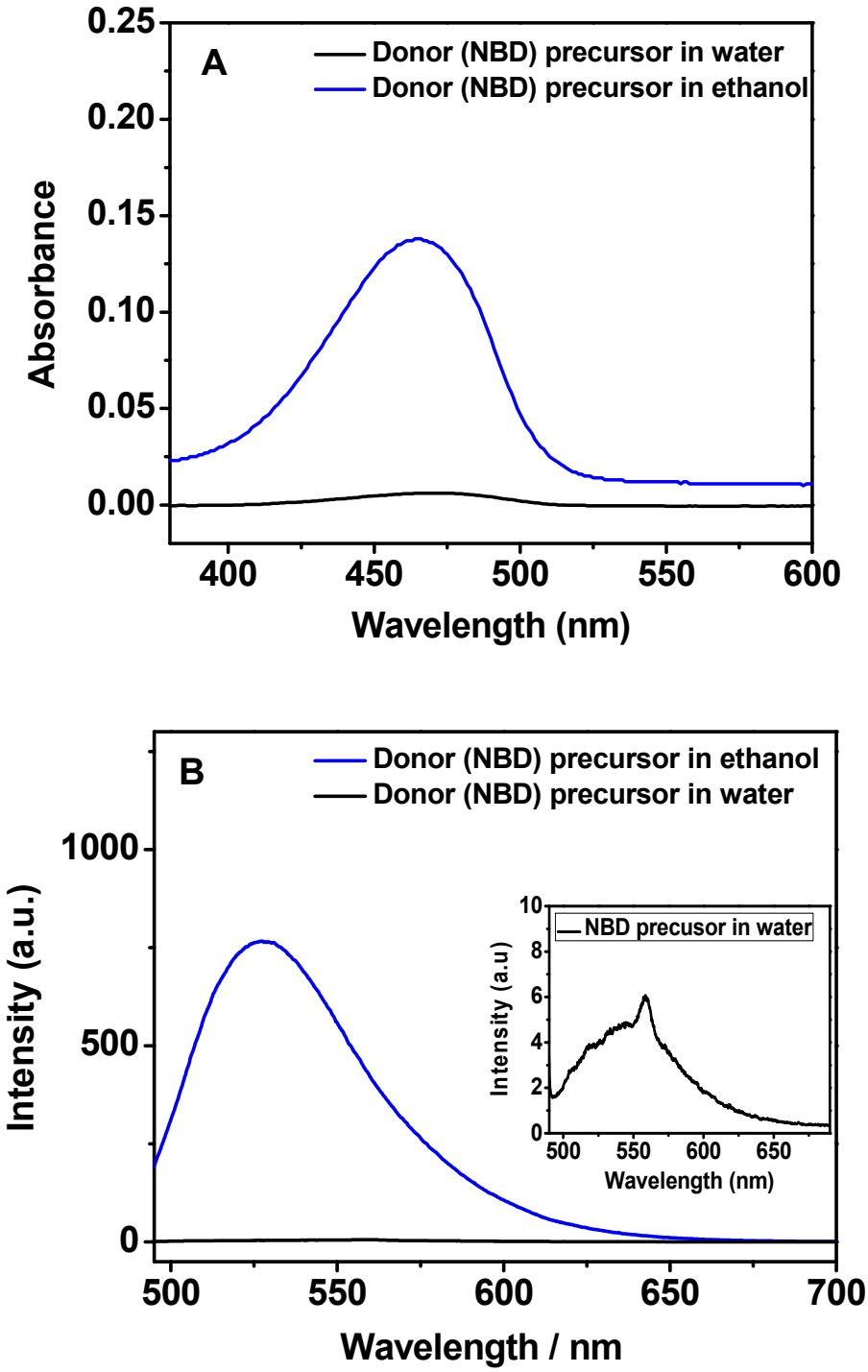


Fig. S4. Absorption (A) and fluorescence (excited at 430 nm) (B) spectra for NBD precursor in saturated water solution and in ethanol solution. Inset in B: enlargement for the fluorescence spectra of NBD precursor in saturated water solution.

Calculation of Förster Critical Radius (R_0) [1-2]

Calculation of the Förster radii (R_0)[1-3] and determination of experimental energy transfer efficiency

The Förster's distance or critical distance R_0 is the characteristic distance, at which the efficiency of energy transfer is 50%. The magnitude of R_0 is dependent on the spectral properties of the donor and the acceptor molecules. If the wavelength λ is expressed in nanometers, then $J(\lambda)$ is in units of $M^{-1}cm^{-1}nm^4$ and the Förster critical radius (distance), R_0 in angstroms (Å), is expressed as follows [Eq. (1)]:

$$R_0 = 0.2108 \times \left[\kappa^2 \times \Phi_D \times n^{-4} \times J(\lambda)\right]^{1/6} \qquad \text{[Eq. (1)]}$$

K^2 is the orientation factor for the emission and absorption dipoles and its value depends on their relative orientation, n is the refractive index of the medium and Φ_D is the quantum yield of the donor. $J(\lambda)$ is the overlap integral of the fluorescence emission spectrum of the donor and the absorption spectrum of the acceptor [Eq. (2)].

$$J(\lambda) = \int_0^\infty F_D(\lambda) \times \varepsilon_A(\lambda) \times \lambda^4 \times d\lambda \qquad \text{[Eq. (2)]}$$

$F_D(\lambda)$ is the fluorescence intensity of the donor in the absence of acceptor normalized so that $\int_0^\infty F_D(\lambda)d\lambda = 1$; $\varepsilon_A(\lambda)$ is molar extinction coefficient of the acceptor, λ is wavelength. In current experimental conditions, for the multilayered film system, the $J(\lambda)$ was calculated to be 3.89×10^{15} $M^{-1}cm^{-1}nm^4$. The Förster critical radius (R_0) has been calculated assuming random orientation of the donor and acceptor molecules taking K^2= 2/3, n =1.54 (silica), and determined Φ_D =0.82.

For NBD (donor) and SRhB/Hg^{2+} (acceptor) in current experimental situation, by using a

commercial software Origin 8.0 as the integral tool, we calculated R_0 =30.5Å. Energy transfer will be effective for 15.2 Å$\leq d \leq$ 45.8 Å ($R_0 \pm 50\% R_0$).

Reference:

(1) Gouanve, F.; Schuster, T.; Allard, E.; Meallet-Renault, R.; Larpent, C. *Adv. Funct. Mater.* **2007**, *17*, 2746-2756.

(2) Valeur, B. *Molecular Fluorescence: Principles and Applications*: Wiley-VCH**:** NewYork, **2002.**