Supporting Information

Water-soluble and fluorescence adjustable copolymers containing a hydrochromic dye: synthesis, characterization and properties

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1. NMR and IR spectra of AM-Rh and poly(AM-Rh<sub>x</sub> co NIPAM<sub>y</sub>)s

Figure S1. <sup>1</sup>H NMR and <sup>13</sup>C NMR of AM-Rh.

Figure S2. Infrared spectrum of P0, AM-Rh, P1/50 and mixture of P0 & AM-Rh.
Figure S3. $^1$H NMR spectrums of P1/50, P1/100, P1/200, P1/345, P0.

Figure S4 Schematic diagram for calculating values of x, y, and x / y.
2. Test and calculation of molar absorption coefficient of AM-Rh

Figure S5. a) The UV-Vis spectra of AM-Rh in methol with concentration ranging from $1 \times 10^{-6}$ mol L$^{-1}$ to $2 \times 10^{-5}$ mol L$^{-1}$. b) Absorbance values plotted against concentration in MeOH, molar absorption coefficient ($\varepsilon$) of AM-Rh was calculated as 111850 L mol$^{-1}$ cm$^{-1}$.

3. GPC raw data

Figure S6. The raw GPC data of polymer.
4. The contrast between halochromism of AM-Rh and hydrochromism

**Figure S7.** The UV-Vis spectra of AM-Rh (C = 1 × 10^{-5} mol L^{-1}) in DMF with gradually adding CF_{3}COOH.

**Figure S8.** Normalized UV-Vis spectra of the solution of P1/100 (0.2 mg / mL) in water and in DMF with addition of CF_{3}COOH.
5. The solubility of P0 in DMF-H2O mixed systems

**Figure S9.** The UV-Vis spectra of the solution of P0 (0.2 mg / mL) in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90% at 25 °C.

**Figure S10.** Photographs of P0 (0.2 mg / mL) in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90% at 25 °C.
6. Halochromism of P1/100 and hydrochromic of AM-Rh in mixtures of DMF-H$_2$O

Figure S11. The UV-Vis spectra of P1/100 (0.2 mg / ml) in DMF with adding CF$_3$COOH.

Figure S12. a) UV-Vis spectra of the solution of AM-Rh (C = 1 × 10$^{-5}$ mol L$^{-1}$) in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90%. b) The corresponding photographs of AM-Rh in different water contents.
7. Halochromism and florescence of AM-Rh in DMF with adding CF₃COOH

Figure S13. a) The UV-Vis spectra of AM-Rh (C = 1 × 10⁻⁵ mol L⁻¹) in DMF before (gray) and after (magenta) adding CF₃COOH. b) Fluorescence of AM-Rh (C = 1 × 10⁻⁵ mol L⁻¹) in DMF before (gray) and after (orange) adding CF₃COOH (λ<sub>ex</sub> = 530 nm; slit width: 3, 1.5).

8. Hydrochromic and florescence of NH₂-Rh in mixtures of DMF-H₂O

Figure S14. a) UV-vis spectra of the solution of NH₂-Rh (C = 1 × 10⁻⁵ mol L⁻¹) in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90%. b) The fluorescence spectra of the solution of NH₂-Rh in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90% at 25 °C (C = 1 × 10⁻⁵ mol L⁻¹, λ<sub>ex</sub> = 530 nm; slit width: 3, 1.5).
9. Fluorescence of AM-Rh in mixtures of DMF-H₂O

Figure S15. a) The fluorescence spectra of the solution of AM-Rh in variable mixtures of DMF and water with increasing percentage of water by volume from 0 to 90% at 25 °C (C = 1 × 10⁻⁵ mol L⁻¹, λₑₓ = 530 nm; slit width: 3, 1.5). b) The corresponding fluorescence photographs of AM-Rh in different water contents.

10. Fluorescence of AM-Rh vary with temperature

Figure S16. a) The fluorescence spectra of the solution of AM-Rh (C = 1 × 10⁻⁵ mol L⁻¹) in H₂O with varying temperature from 15 to 55 °C (λₑₓ = 530 nm; slit width: 3, 1.5). b) Fluorescence changes of AM-Rh (C = 1 × 10⁻⁵ mol L⁻¹) in H₂O with varying temperature from 15 to 55 °C.