Electronic Supplementary Information for

Rhodamine Dye Transfer from Hydrogel to Nanospheres for The Chemical Detection of Potassium Ions

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Parameters for the simulated curves in Figure 2.

For the two-phases based system:

$k_{12} = 10^{-3}$, $k_{12}' = 10^{-7}$, $k_{23} = 10^{-7}$, V_1 = 1 μL, V_2 = 10 mL, R_1^- = 1 μmol, R_3^- = 1 μmol, L_{tot}=3 μmol, D_{tot}^+=1 μmol, $[J^{n+}{}_{i \neq K+}]$=1 mM

For the three-phases based systems:

$k_{12} = 10^{-3}$, $k_{12}' = 10^{-7}$, $k_{23} = 10^{-7}$, $V_1 = V_3$ = 1 μL, V_2 = 10 mL, R_1^- = 1 μmol, R_3^- = 1 μmol, L_{tot}=3 μmol, D_{tot}^+=1 μmol, $[J^{n+}{}_{i \neq K+}]$=1 mM

The **Normalized Absorbance** was calculated according to Equation S1, where $[D^+]_0$ is the initial concentration of D^+ in phase 1.

$$\text{Normalized Absorbance} = (D_{tot}^+ - V_1 [D^+]_1)/(D_{tot}^+ - V_1 [D^+]_0) \quad \text{(S1)}$$

Fraction of D^+ was calculated according to $[D^+]_i V_i / D_{tot}^+$ for the *i*th phase.

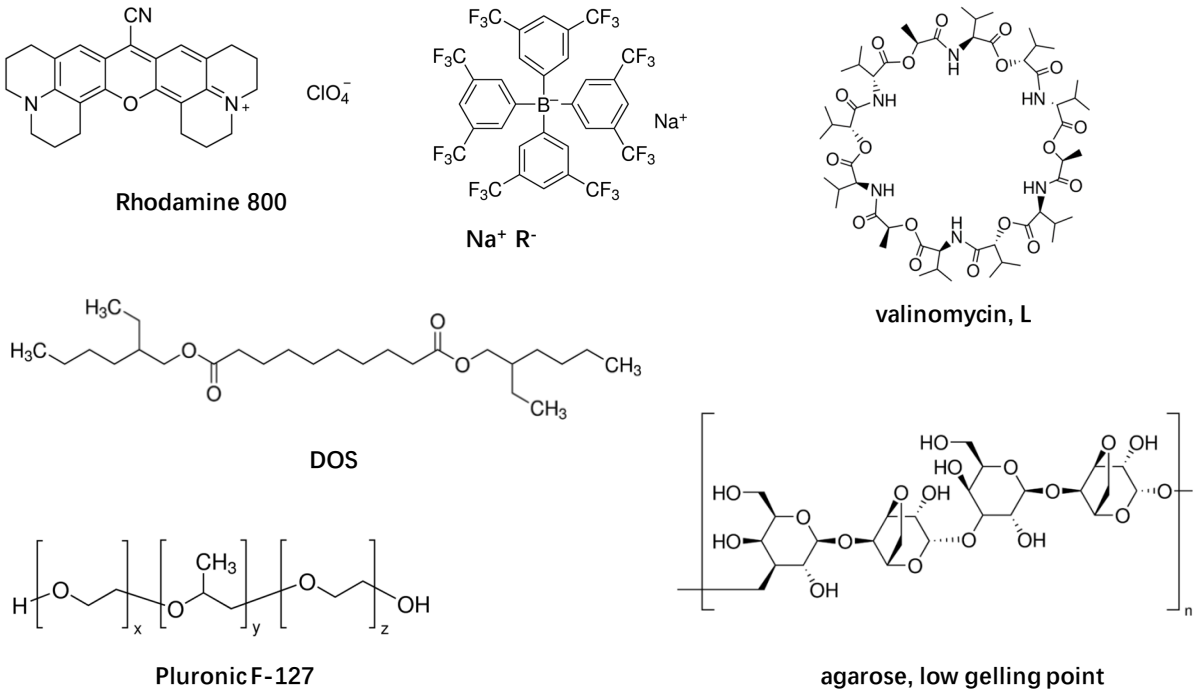

Figure S1. The chemical structures of the components used in the three-phases based detection system.

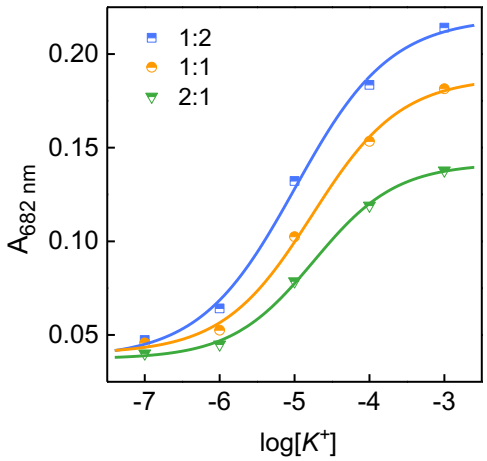

Figure S2. Calibration curves for the three-phases based system at different molar ratios of Na^+R^- in the hydrogel (phase 1) and the nanospheres (phase 3).

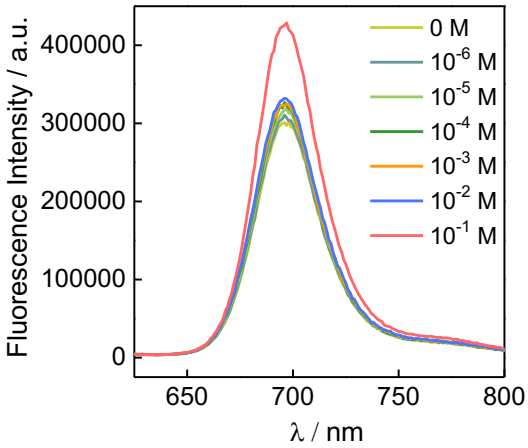

Figure S3. Fluorescence spectra of suspensions containing D^+ and R^- doped nanospheres at various concentrations of choline as indicated.

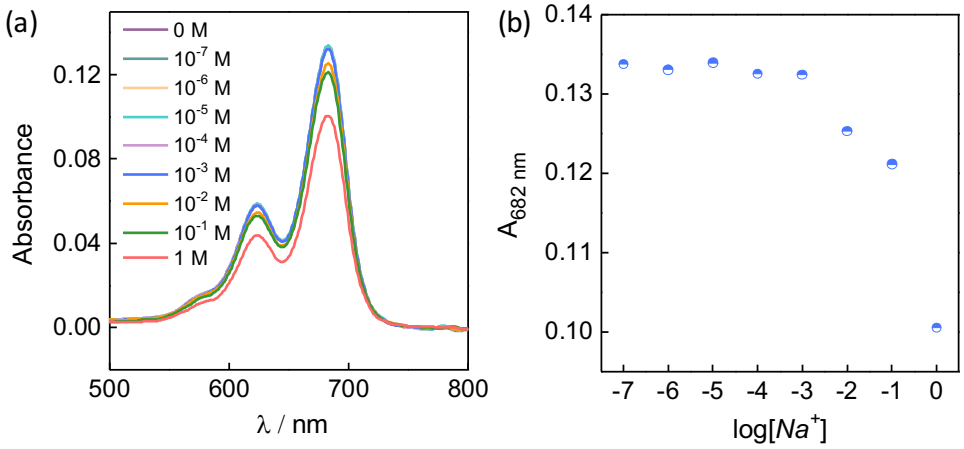

Figure S4. (a) Absorption spectra of the suspensions containing D^+ and R^- doped nanospheres at various concentrations of NaCl as indicated. (b) The absorbance maxima at different logarithmic Na^+ concentrations.

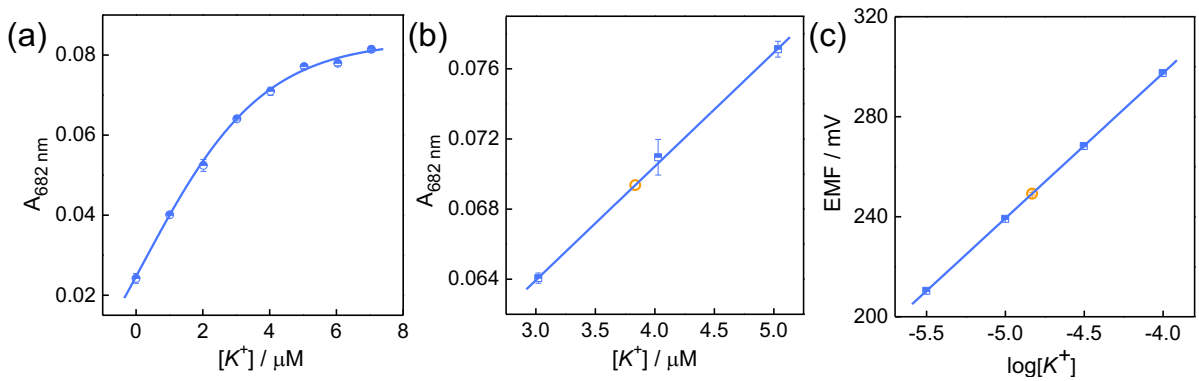

Figure S5. (a) Absorbance values at 682 nm as a function of K^+ concentration for the three-phases system. Calibration curves for the determination of K^+ level in Evian mineral water using the three-phases based method (b) and K^+ ISEs (c). The Evian mineral water was diluted 4 times for the three-phases based method and detected directly for the ISE method. Error bars represent standard deviations of 3 measurements.

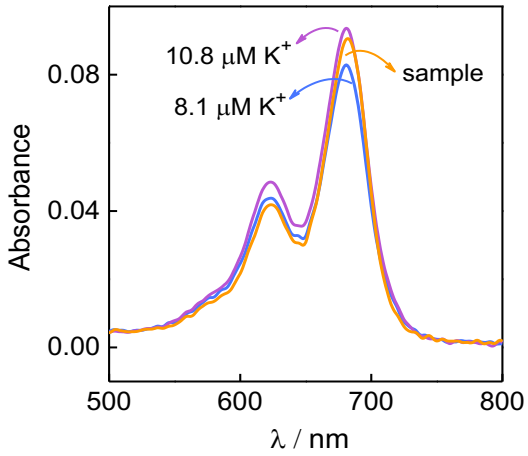

Figure S6. UV-vis absorption spectra of the liquid mixture in the three-phases based system after exposing the hydrogels to solutions containing the indicated K^+ concentrations or the mineral water sample for 30 min. For the absorbance spectrum of sample, 1 mL of Evian mineral water and 172 μL Na^+R^- doped nanospheres were added to the centrifuge tube with agarose hydrogel. The absorbance value of sample at 682 nm is lower than that of the solution containing 10.8 μM K^+.