Supporting Information

A Water Soluble Fluorescent Sensor for the Reversible Detection of Tin (IV) Ion and Phosphate Anion

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Determination of quantum yields

The quantum yield of DQS ($\Phi_0$) and DQS-Sn$^{4+}$ ($\Phi_1$, in the present of 5 equiv of Sn$^{4+}$ ions) were determined according to the literature.$^1$

\[
\Phi_{\text{Sample}} = \Phi_{\text{0}} \cdot \frac{A_{\text{0}} \cdot F_{\text{Sample}} \cdot \lambda_{\text{ex0}} \cdot \eta_{\text{Sample}}^2}{A_{\text{Sample}} \cdot F_{\text{0}} \cdot \lambda_{\text{exSample}} \cdot \eta_{\text{0}}^2}
\]

Where $\Phi$ is quantum yield; $A$ is absorbance at the excitation wavelength; $F$ is integrated area under the corrected emission spectra; $\lambda_{\text{ex}}$ is the excitation wavelength; $\eta$ is the refractive index of the solution; the Sample and QS refer to the sample and the standard, respectively. We chose quinine sulfate in 0.1N H$_2$SO$_4$ as standard, which has the quantum yield of 0.546.$^2$

Other Photophysical properties of DQS

![Absorption spectra of DQS (10 μM) in water solution in the present of Sn$^{4+}$, Fe$^{3+}$, and Cr$^{3+}$ (1 equiv), respectively.](Figure S1)

**Figure S1.** Absorption spectra of DQS (10 μM) in water solution in the present of Sn$^{4+}$, Fe$^{3+}$, and Cr$^{3+}$ (1 equiv), respectively.
**Figure S2.** Job’s plot of sensor DQS, the total concentration of the sensor and Sn$^{4+}$ is 25.0 μM.

**Figure S3.** Effect of the pH on the fluorescence emission of DQS (5.0 μM).
Figure S4. Effect of the pH on the fluorescence emission of DQS-Sn$^{4+}$ complex (5.0 μM of DQS in the presence of 20 equiv of Sn$^{4+}$).

Figure S5. Fluorescence spectra of DQS (5 μM) in water in the presence of different concentrations of Fe$^{3+}$ (0-90 μM) ($\lambda_{ex} = 360$ nm). Inset: fluorescence intensity changes as a function of Fe$^{3+}$ concentration.
Figure S6. Job’s plot of sensor DQS, the total concentration of the sensor and Fe$^{3+}$ is 25.0 µM.

Figure S7. Fluorescence spectra of DQS (5 µM) in water in the presence of different concentrations of Cr$^{3+}$ (0-100 µM) ($\lambda_{ex}$ = 360 nm). Inset: fluorescence intensity changes as a function of Cr$^{3+}$ concentration.
The apparent binding constant \((K_S)\) of \(\text{DQS}\) with \(\text{Sn}^{4+}\) was determined using the nonlinear least-squares analysis base on a 1:1 complex expression:\(^3\)

\[
\frac{F}{F_0} = 1 + \frac{F_{\text{obs}} - 1}{2F_0} \left[ 1 + \frac{C_M}{C_L} + \frac{1}{K_SC_L} - \sqrt{\left( 1 + \frac{C_M}{C_L} + \frac{1}{K_SC_L} \right)^2 - 4 \frac{C_M}{C_L} } \right]
\]

Where \(F_0\) or \(F\) is the fluorescence emission intensities in the absence or presence of \(\text{Sn}^{4+}\) ions, \(C_M\) and \(C_L\) are the concentrations of \(\text{Sn}^{4+}\) and \(\text{DQS}\), and \(K_S\) is the stability constant.
Figure S9. A proposed structure of DQS-Sn\textsuperscript{4+} complex.

The characterization data of all compounds

\textsuperscript{1}H NMR of compound 1
$^1$H NMR of compound 2 (DQS)

$^{13}$C NMR of compound 2 (DQS)
HRMS of compound 2 (DQS)

![Qualitative Analysis Report](image)

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References