

## Supplementary Material:

### Tables

**Table S1.** Comparison between fluorescent detection of  $S^{2-}$  using different probes.

Fluorescent probe	DL ( $\mu\text{M}$ )	Linear range ( $\mu\text{M}$ )	Ref.
PEI-FITC- $\text{Cu}^{2+}$	1.2	10-100	43
CDs- $\text{Ag}^+$	0.43	0-100	44
TPI-H- $\text{Cu}^{2+}$	0.156	-	45
Au nanoclusters	0.38	0.5-80	46
Lys- $\text{Ag}$ NCs	1.1	5-100	47
GQDs- $\text{Cu}^{2+}$	0.1	0.2-20	48
Cu nanoclusters	0.01	0.02–0.8	49
Cu nanoclusters	0.042	0.2–50	50
Au nanoclusters-Ce(III)	0.015	0-2	51
AgNPs-CDs	0.01	0.01-0.9	52
IL-CNRs	0.085	0.1-1.0, 1.0-300	This work

CDs- $\text{Ag}^+$ , carbon dots- $\text{Ag}^+$ ; PEI-FITC, covalent linking fluorescein isothiocyanate with branched-polyethylenimine; TPI-H, triarylimidazole chromophore; Lys- $\text{Ag}$  NCs, lysozyme-stabilized silver nanoclusters;  $\text{Eu}^{3+}$ -BHHCT-BPED, AgNPs-CDs, silver nanoparticles capped with carbon dots; GQDs, graphene quantum dots.

**Table S2.** Detection of  $S^{2-}$  in tap water samples.

Sample <sup>a</sup>	Concentration of $S^{2-}$ ( $\mu\text{M}$ )		RSD (n=3, %)	Recovery (%)
	Added	Determined by IL-CNRs		
1	0.80	0.83	2.3	103.8
2	10.00	9.37	2.5	93.7
3	50.00	48.44	1.9	96.9

<sup>a</sup>  $S^{2-}$  in the original tap water is not detected. Recovery=determined concentration/added value $\times$ 100%.

## Figures

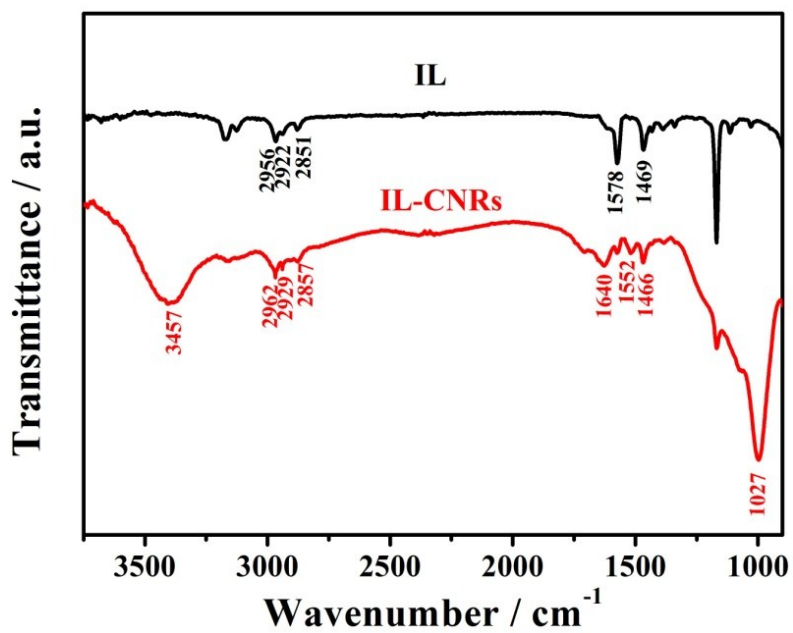


Fig. S1. FTIR spectra of IL and IL-CNRs.

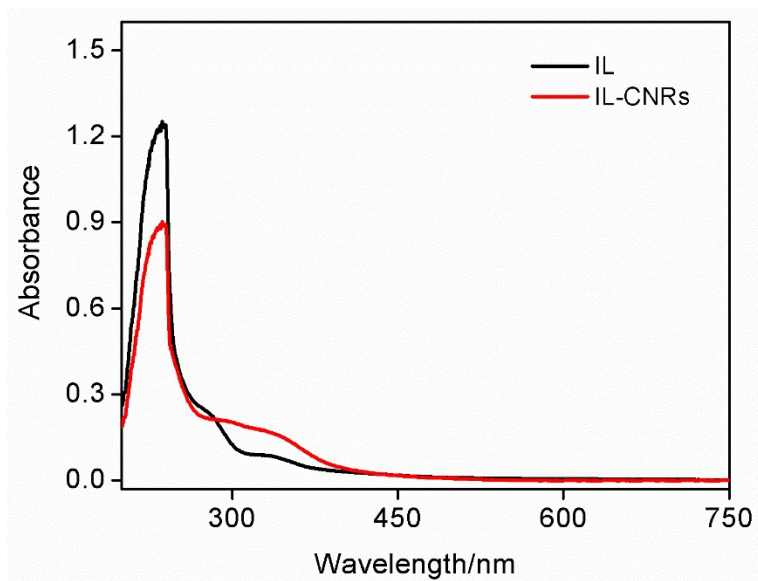
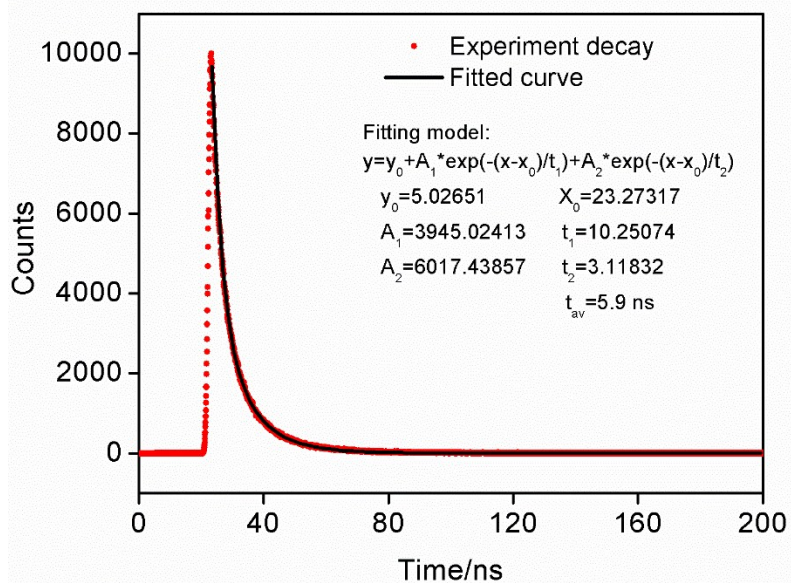
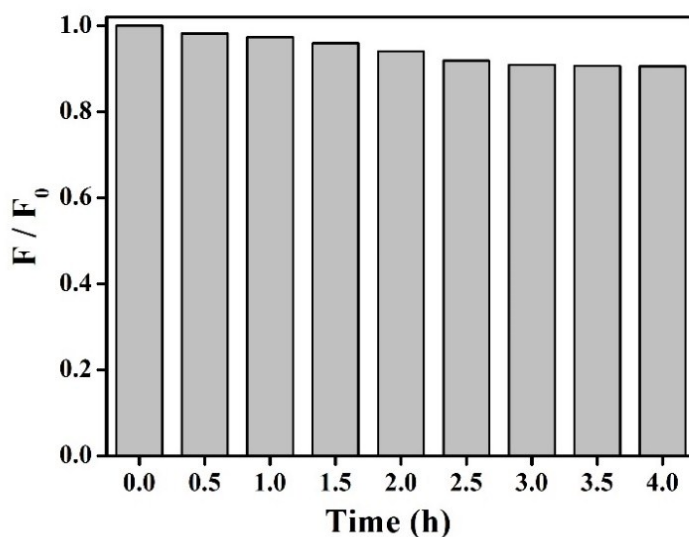


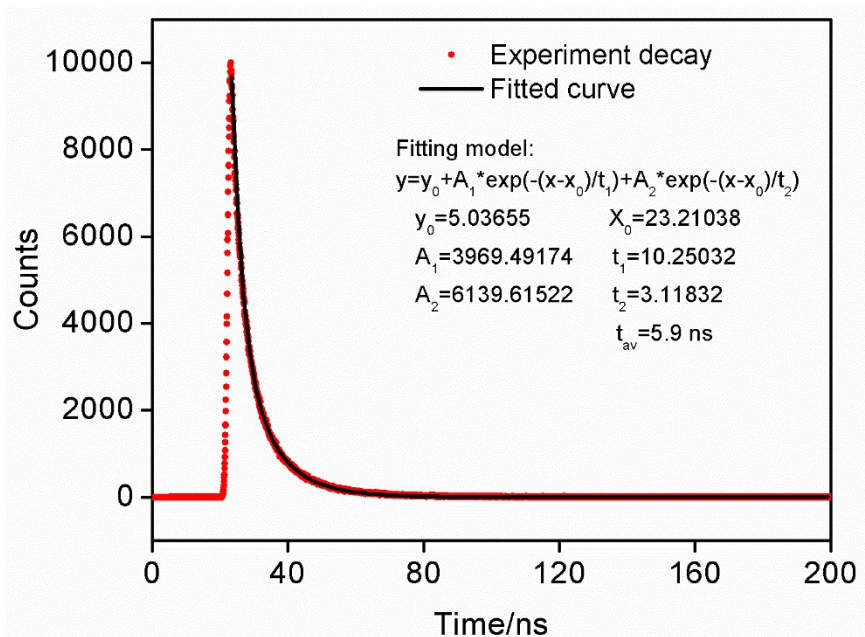
Fig. S2. UV-Vis spectra of IL and IL-CNRs.



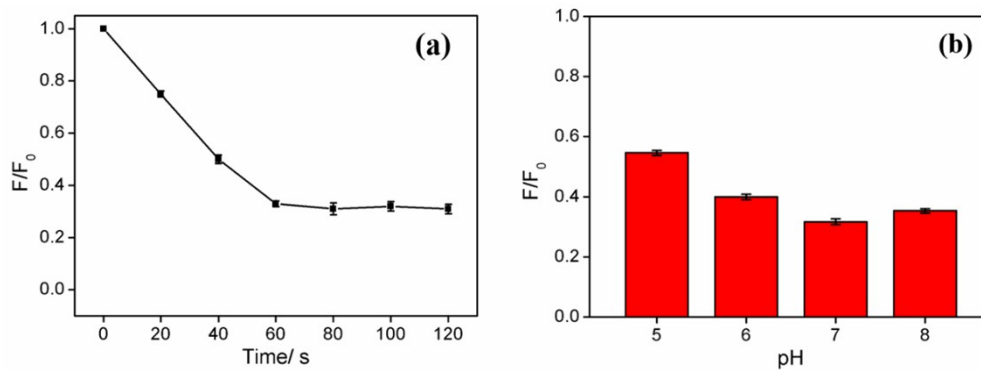
**Fig. S3.** Fluorescence lifetime spectrum of IL-CNRs.



**Fig. S4.** The fluorescence intensity ratio of IL-CNRs under UV light (365 nm) irradiation for different time.  $F_0$  and  $F$  were the fluorescence intensity of IL-CNRs before and after UV light irradiation, respectively.



**Fig. S5.** Fluorescence lifetime spectrum of IL-CNRs in presence of  $S^{2-}$ .



**Fig. S6.** The effects of incubation time and pH on the fluorescence intensity ratio by  $S^{2-}$ .