Electronic supplementary information

A hybrid nanosensor based on novel fluorescent iron oxide nanoparticles for highly selective determination of Hg^{2+} ion in environmental samples

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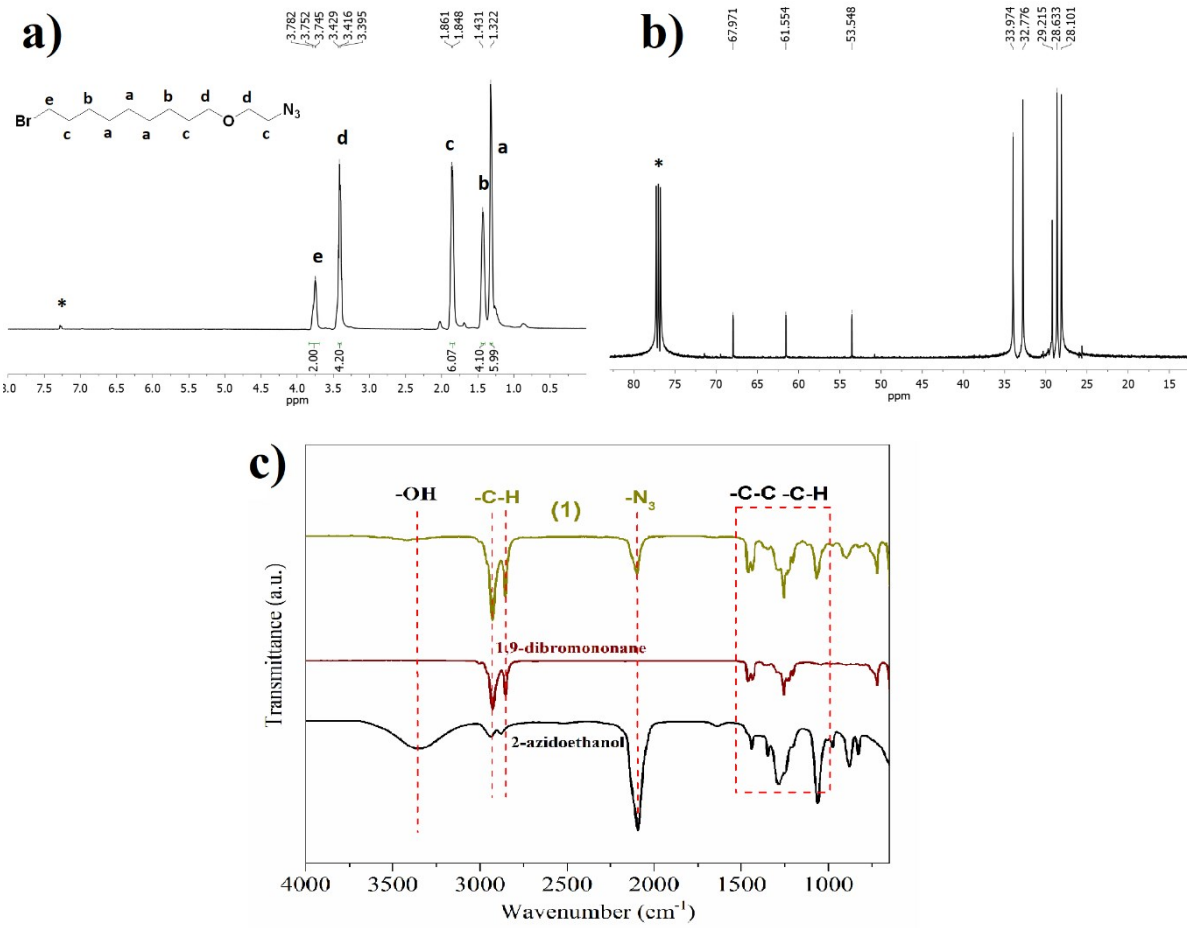

Figure S1: a) ^{1}H NMR, **b)** ^{13} C NMR and **c)** FTIR spectra of compound **1**. (NMR spectra were recorded in $CDCl_3$).

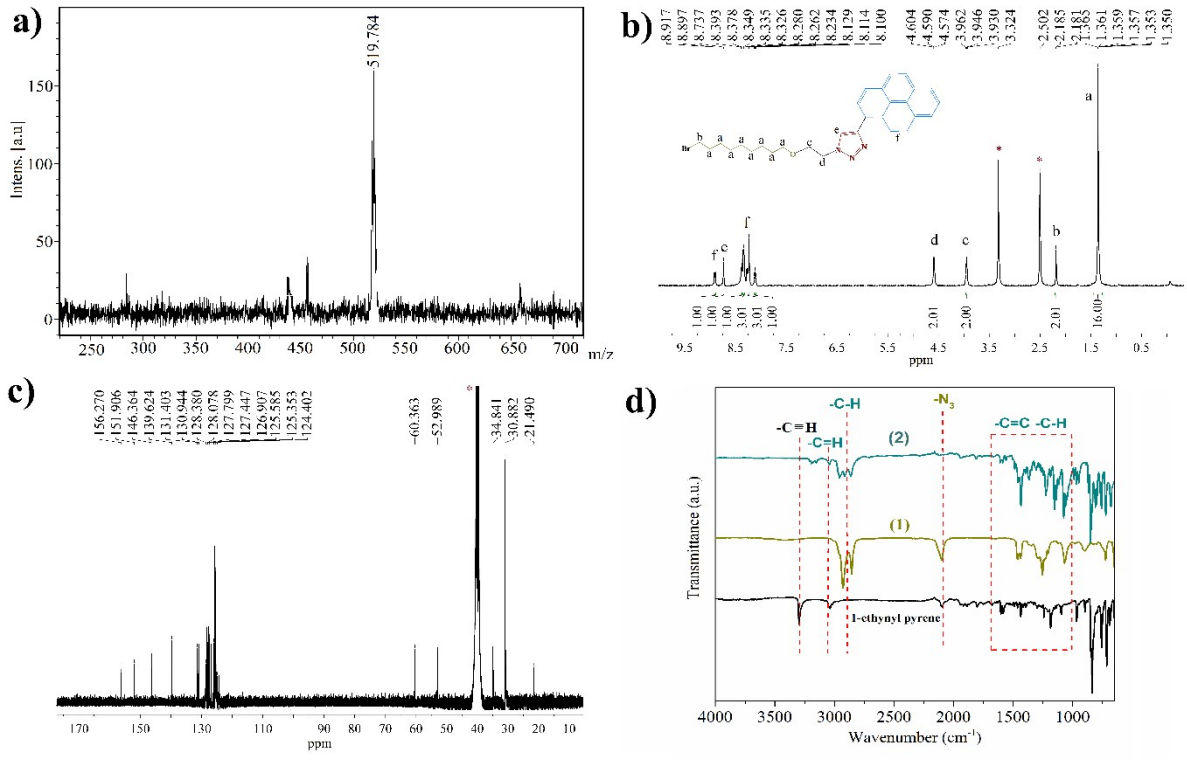

Figure S2: a) MALDI-TOF **b)** ^{1}H NMR, **c)** ^{13} C NMR and **d)** FTIR spectra of compound **2**. (MALDI-MS spectrum was obtained with dithranol matrix and NMR spectra were recorded in DMSO-d_6).

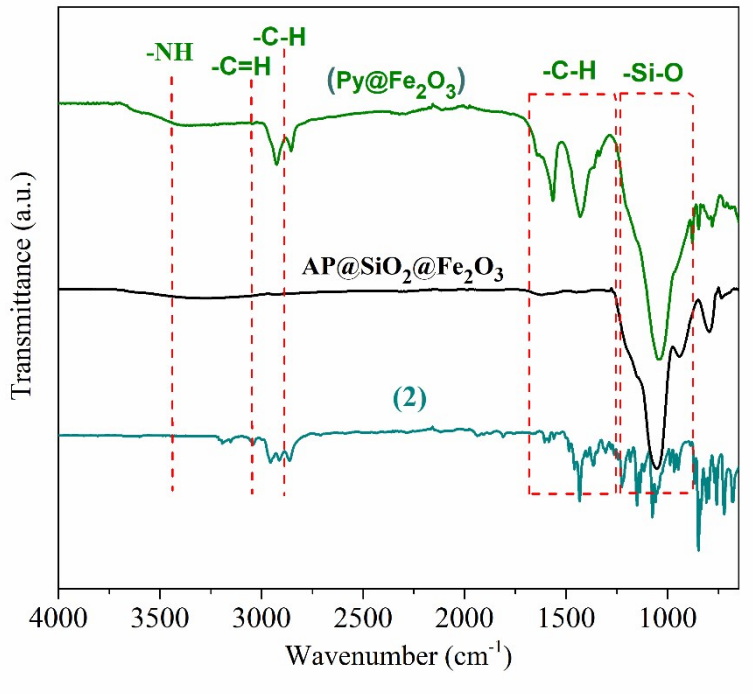

Figure S3: FTIR spectra of compound **2**, AP@SiO_2@Fe_2O_3, **Py@Fe_2O_3** hybrid nanosensor.

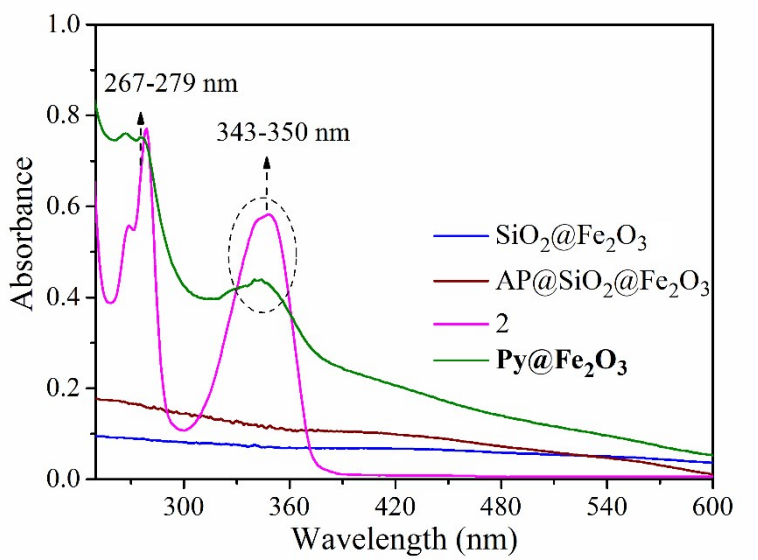

Figure S4: UV-Vis spectra of compound **2**, $SiO_2@Fe_2O_3$, $AP@SiO_2@Fe_2O_3$, **$Py@Fe_2O_3$** hybrid nanosensor.

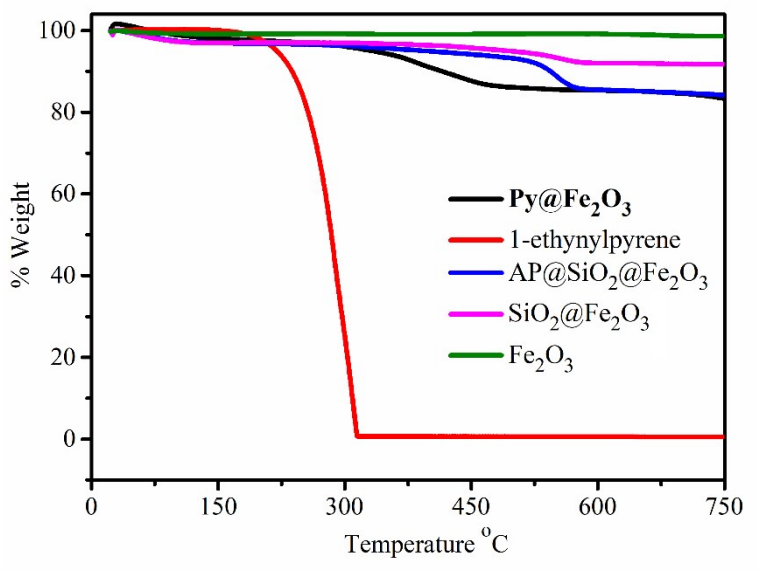

Figure S5: TGA thermograms of compound **2**, Fe_2O_3, $SiO_2@Fe_2O_3$, $AP@SiO_2@Fe_2O_3$, **$Py@Fe_2O_3$** hybrid nanosensor.

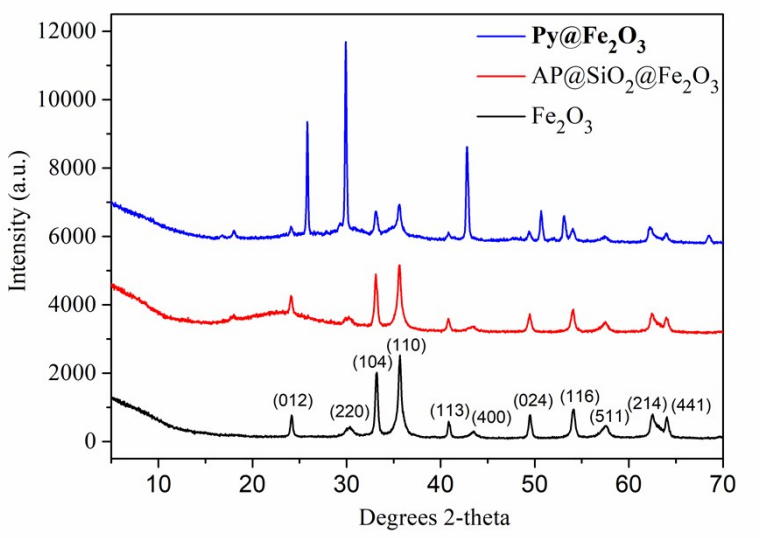

Figure S6. XRD patterns of Fe_2O_3, AP@SiO_2@Fe_2O_3, **Py@Fe_2O_3**.

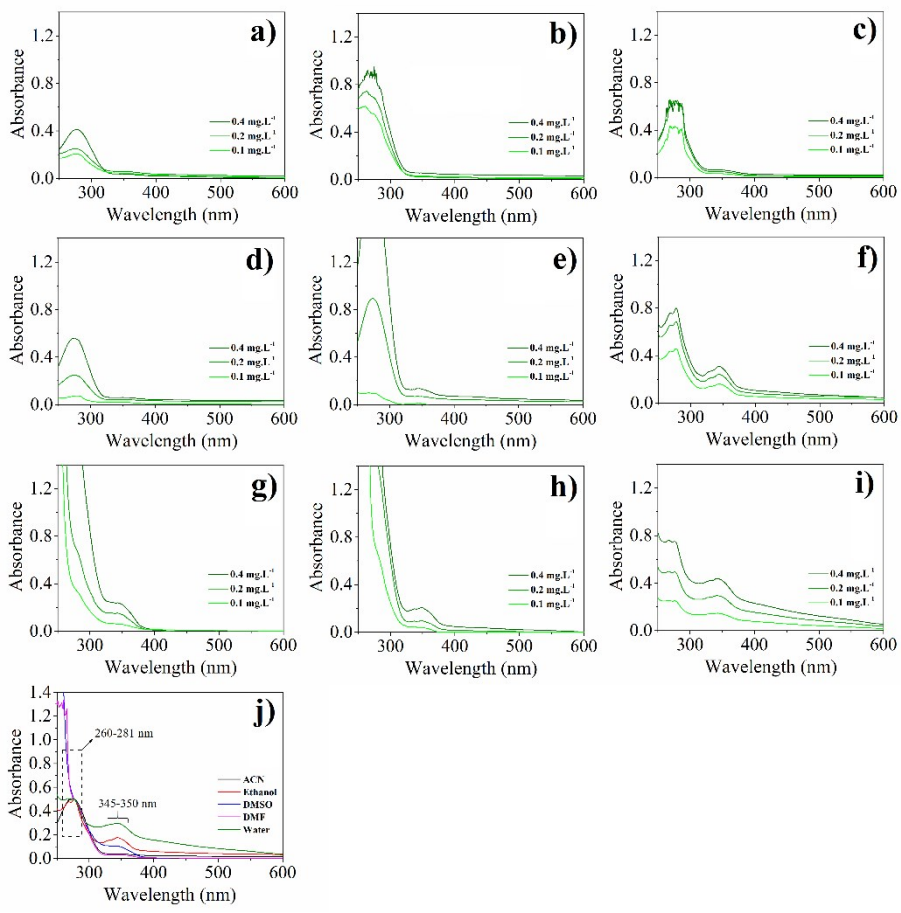

Figure S7. UV-Vis absorption of **Py@Fe_2O_3** in **a)** hexane, **b)** 1,4-dioxane, **c)** THF, **d)** dichloromethane, **e)** ACN, **f)** ethanol, **g)** DMSO, **h)** DMF, **i)** water in different concentration and **j)** normalized absorption spectra of **Py@Fe_2O_3** in different solvents.

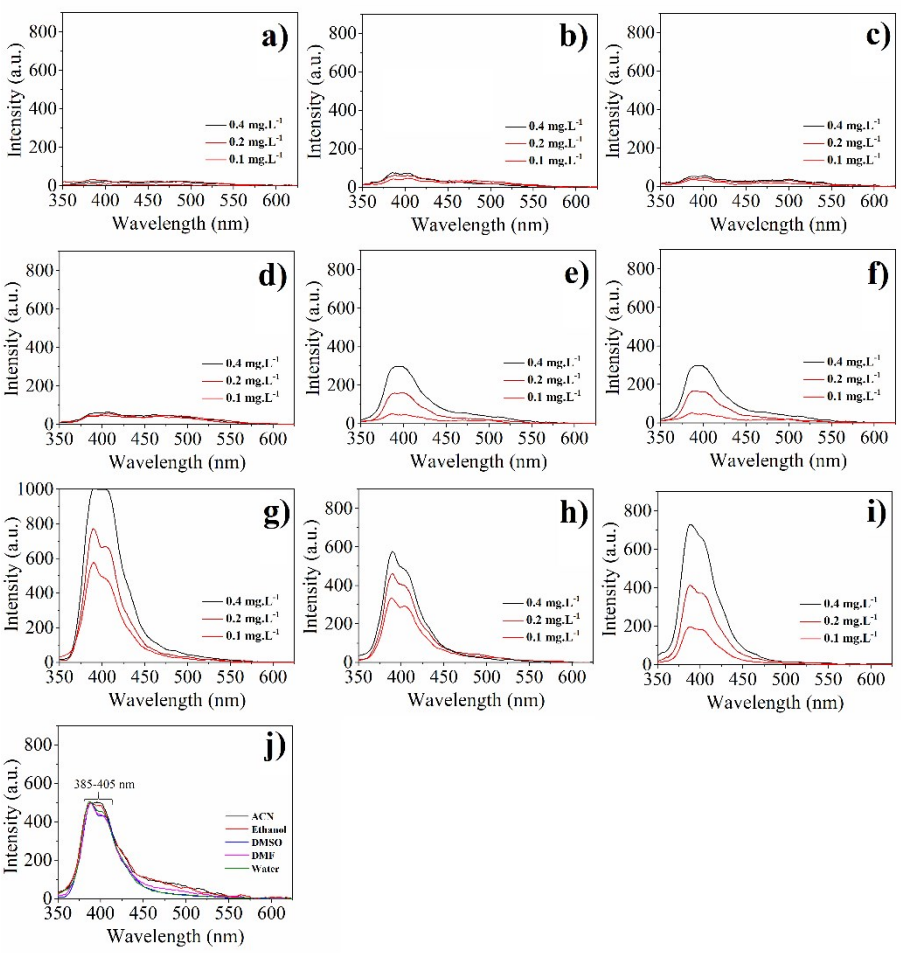

Figure S8. Fluorescence spectra of **Py@Fe_2O_3** in **a)** hexane, **b)** 1,4-dioxane, **c)** THF, **d)** dichloromethane, **e)** ACN, **f)** ethanol, **g)** DMSO, **h)** DMF, **i)** water in different concentration and **j)** normalized fluorescence spectra of **Py@Fe_2O_3** in different solvents.

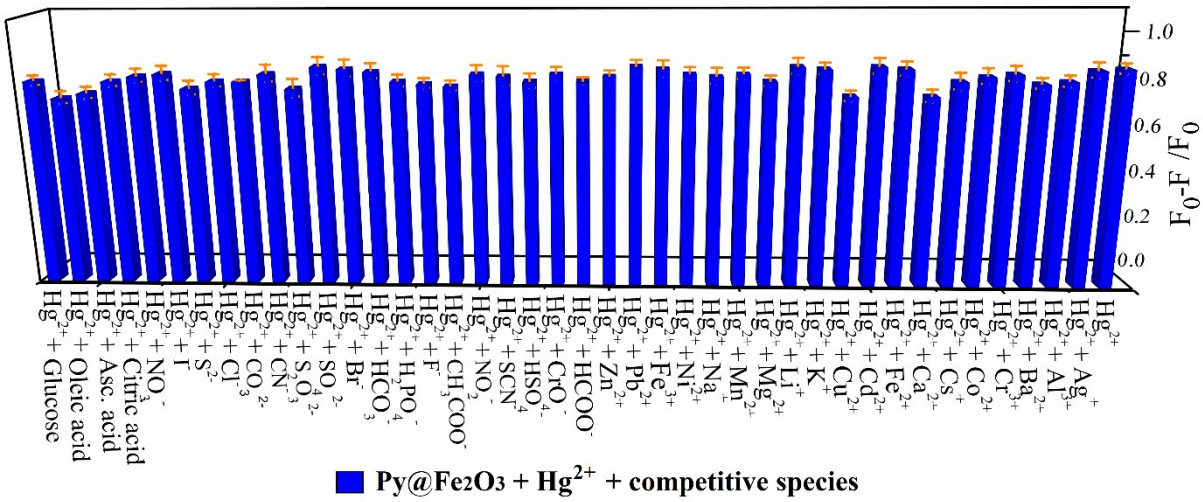

Figure S9. Interfering studies for 0.4 mg.mL^{-1} **Py@Fe_2O_3** in presence of 1.0 µmol.L^{-1} Hg^{2+} after addition of 10 µmol.L^{-1} various competitive species (pH of 8.0, λ_{ex}=325 nm, and slit width = 5 nm).

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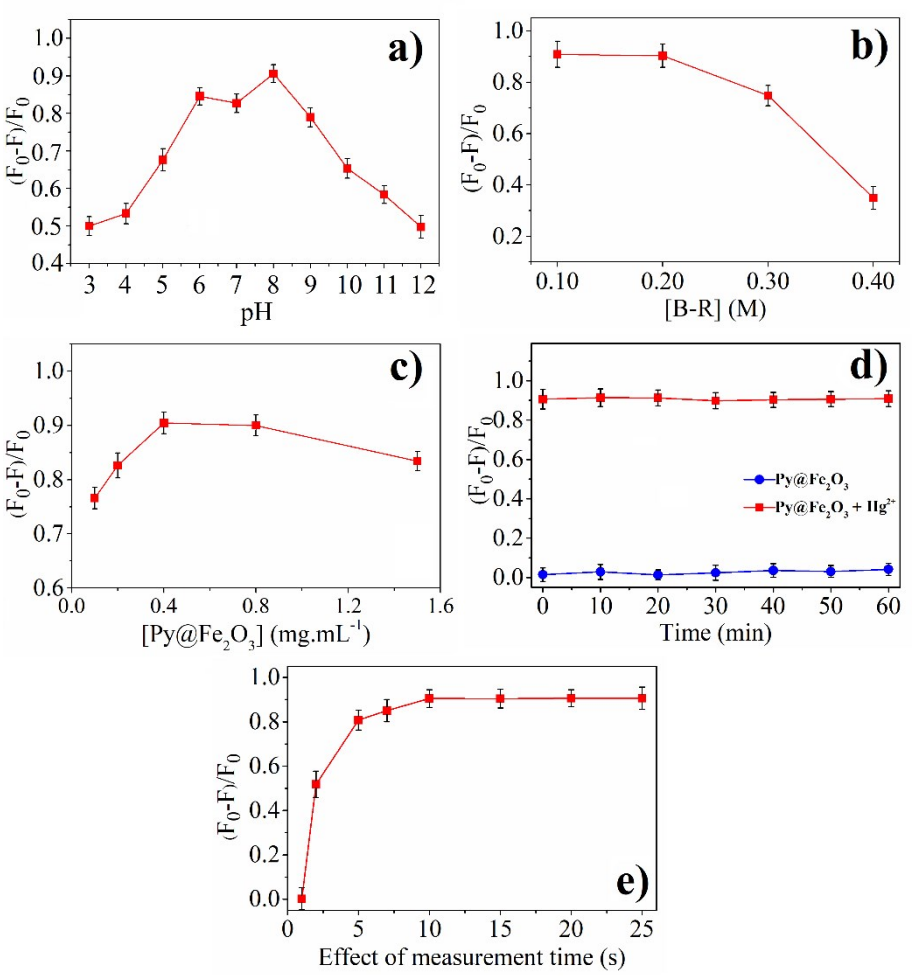

Figure S10. Effect of **a)** pH, **b)** buffer concentration, **c)** **Py@Fe_2O_3** concentration, **d)** photostability and **e)** measurement time at pH of 8.0, λ_{ex}=325 nm, 0.4 mg.mL^{-1} of **Py@Fe_2O_3** and 1.0 µmol.L^{-1} Hg^{2+}, and slit width = 5 nm).

Table S1: Photophysical parameters of **Py@Fe_2O_3**.

ε ($mL.g^{-1}.cm^{-1}$) x10^3												
***Water**	**DMF**	**DMSO**	**DCM**	**EtOH**	**ACN**	**THF**	**Dxn**	**Hxn**	**λ_{abs} (nm)**	**λ_{ems} (nm)**	**τ_0 (ns)**	**Φ_F**
1.465	0.465	0.745	0.206	1.205	0.345	0.250	0.119	0.288	272 345	388	0.343±0.08	0.230

*Hxn, n-hexane; Dxn, 1,4-dioxane; THF, tetrahydrofuran; DCM, dichloromethane; ACN, acetonitrile; EtOH, ethanol; DMSO; dimethyl sulfoxide, DMF; dimethylformamide.

Table S2. Optimum conditions of **Py@Fe_2O_3** for spectrofluorimetric determination of iron.

Parameter	Value
Exc. (nm)	325
Ems. (nm)	388
LOD (nmol.L^{-1})	3.650
LOQ (nmol.L^{-1})	10.960
Linear range (µmol.L^{-1})	0.010-1.000
pH	8.0
Sensor concentration (mg.mL^{-1})	0.4
Final volume (mL)	5
Working media	water
Interaction time (second)	10
R^2	0.9976
RSD%	3.52

Table S3. Student t-test for statistical evaluation of accuracy.

Hg^{2+}	s	X_R	$\overline{X}$	$t_{exp.}=\frac{\lvert X_R-\overline{X}\rvert}{s/\sqrt{N}}$	$t_{ref.}$	Results
River water	2.59	1.819	2.006	0.13	4.3	0.13<4.3 (acceptable)
Mineral water	2.33	1.581	1.504	0.06	4.3	0.06<4.3 (acceptable)
Wastewater	2.08	12.280	12.030	0.21	4.3	0.21<4.3 (acceptable)