Supplementary Information for

Differentiation of multi-metal ions based on Fluorescent Dual–Emission Carbon Nanodots

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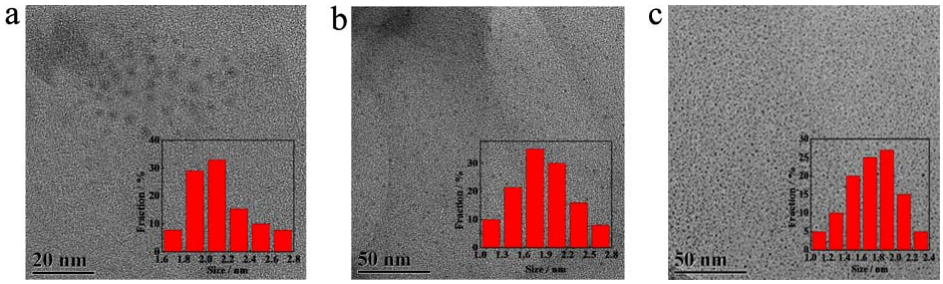

Figure S1. TEM images of DECNDs synthesized in other alcohol-water binary systems (a, methanol-water; b, ethanol-water; c, ethylene glycol-water). The diameters of DECNDs synthesized in other alcohol-water binary systems were 2.2 nm for methanol-water, 1.8 nm for ethanol-water, and 1.81 nm for ethylene glycol -water.

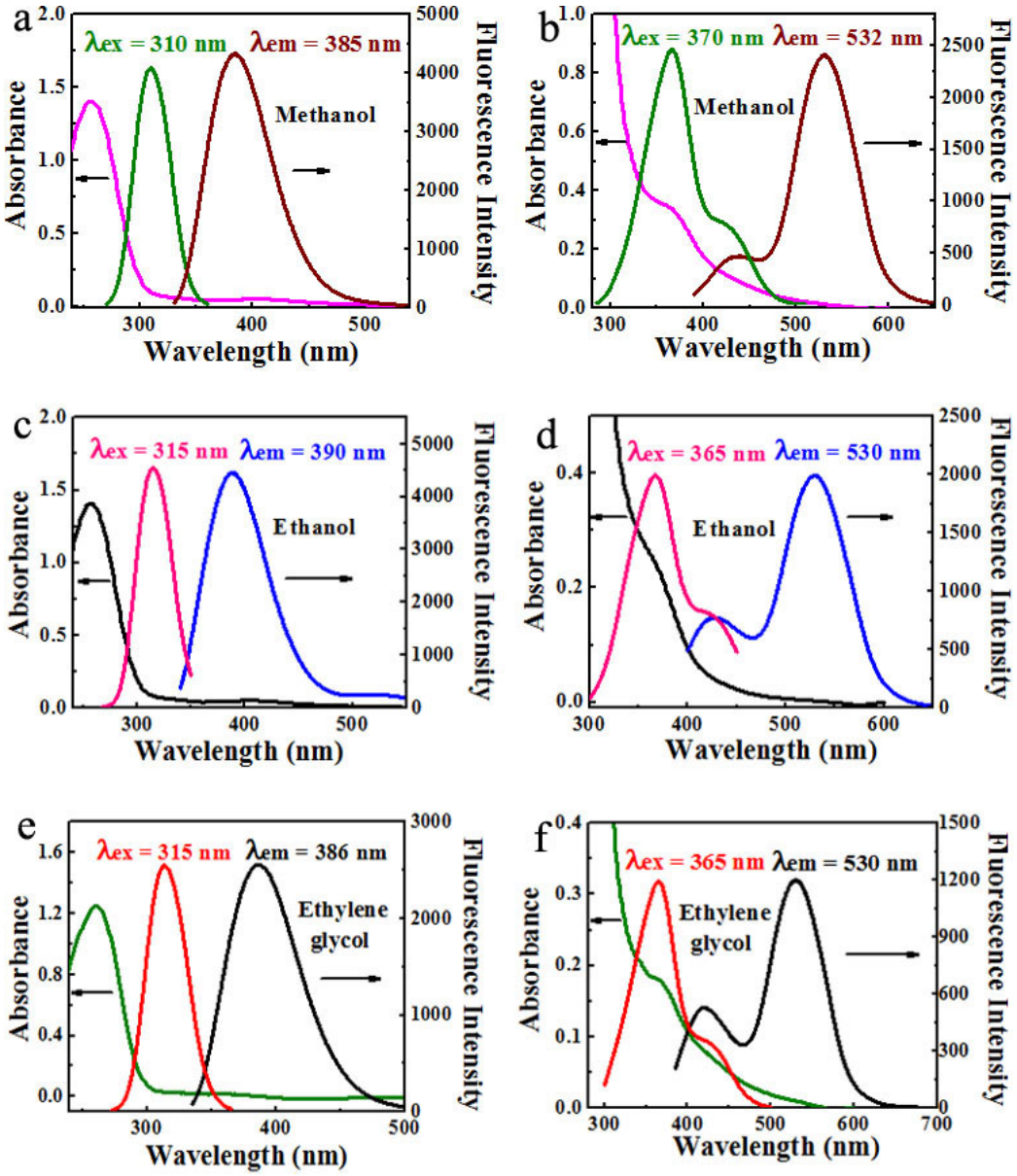

Figure S2. UV-vis absorption and fluorescence spectra of blue emitters (a, c, e) and yellow emitters (b, d, f) synthesized in other alcohol-water binary systems (a, b: methanol-water; c, d: ethanol-water; e, f: ethylene glycol-water).

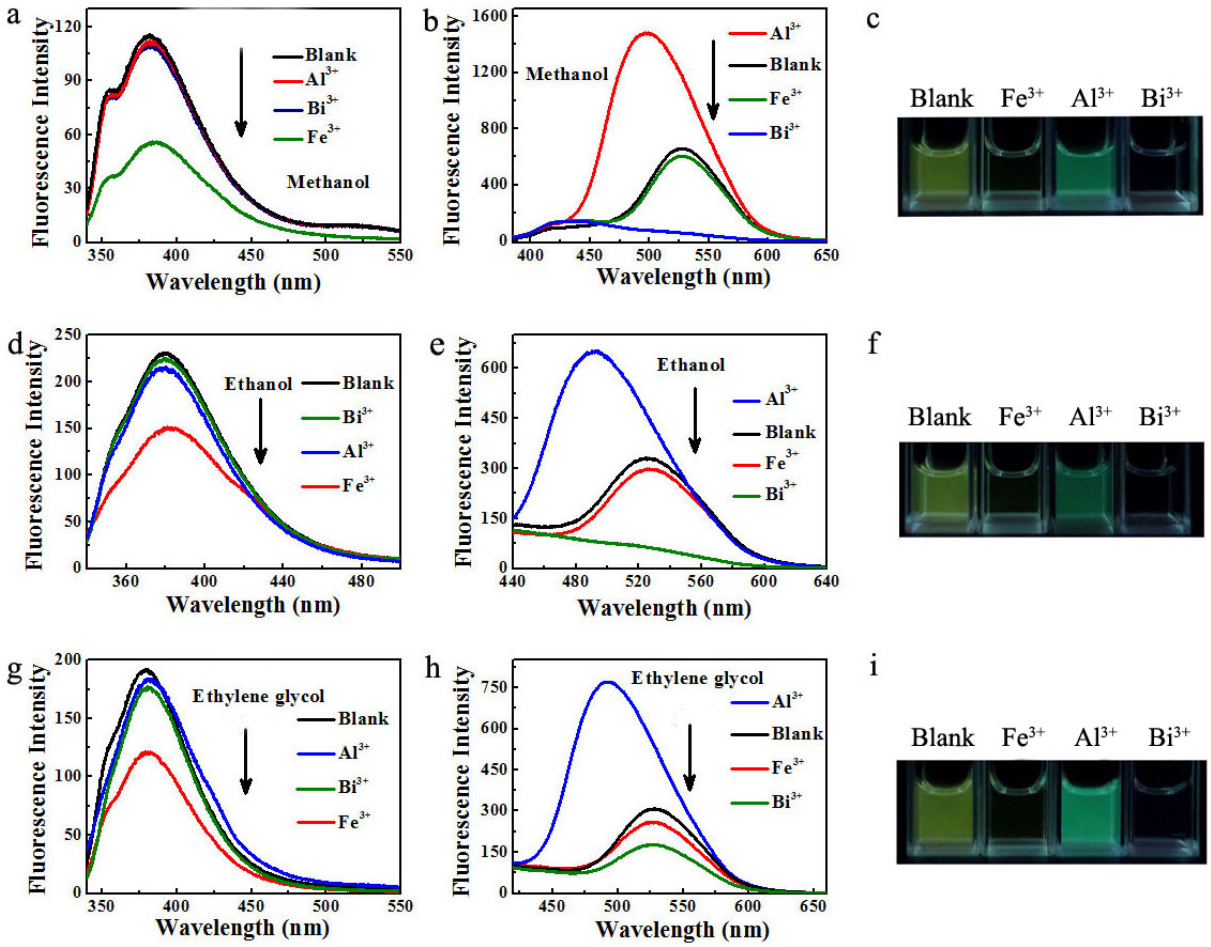

Figure S3. Fluorescence spectra (a, d, g, blue emitters; b, e, h, yellow emitters) and the fluorescence color changes of DECNDs synthesized in other alcohol-water binary systems with the addition of Fe^{3+}, Al^{3+} and Bi^{3+} under UV light at 365 nm (c, f and i). a, b and c was DECNDs synthesized in methanol-water system; d, e and f was DECNDs synthesized in ethanol-water system; g, h and i was DECNDs synthesized in ethylene glycol-water system. Concentrations: a, Fe^{3+}, Bi^{3+} and Al^{3+} were 100 μM; b, c, e, f, h and i, Fe^{3+} was 100 μM, and Bi^{3+} / Al^{3+} was 30 μM; d and g, Fe^{3+} was 50 μM, and Bi^{3+} / Al^{3+} was 100 μM.

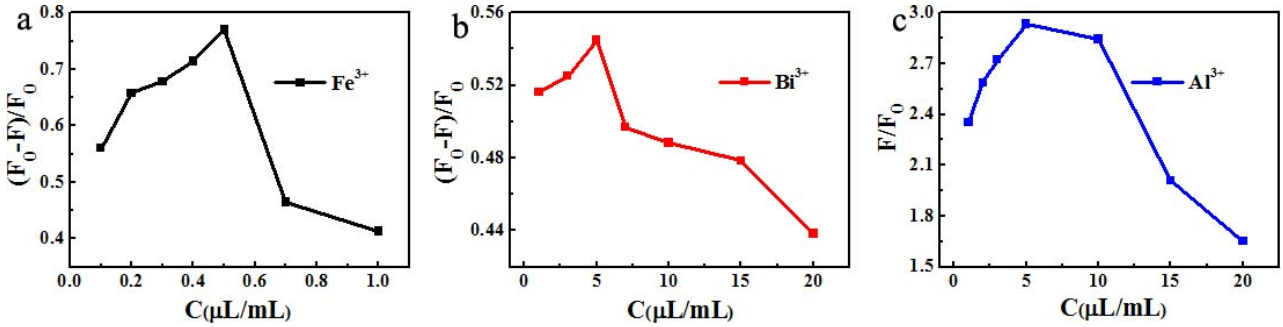

Figure S4. The influence of probe concentration on the detection of Fe^{3+} (a, 200 μM), Bi^{3+} (b, 20 μM) and Al^{3+} (c, 30 μM).

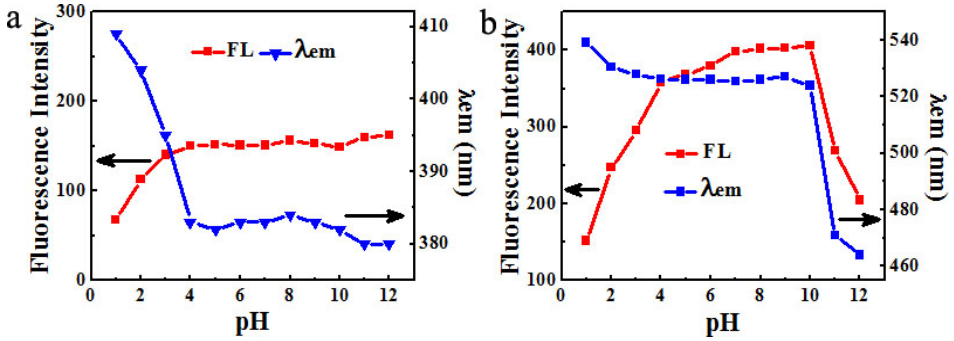

Figure S5. Influence of pH values on the fluorescence of DECNDs. The different pH values were adjusted by adding HCl or NaOH from pH 1 to 12 (a, blue emitters; b, yellow emitters).

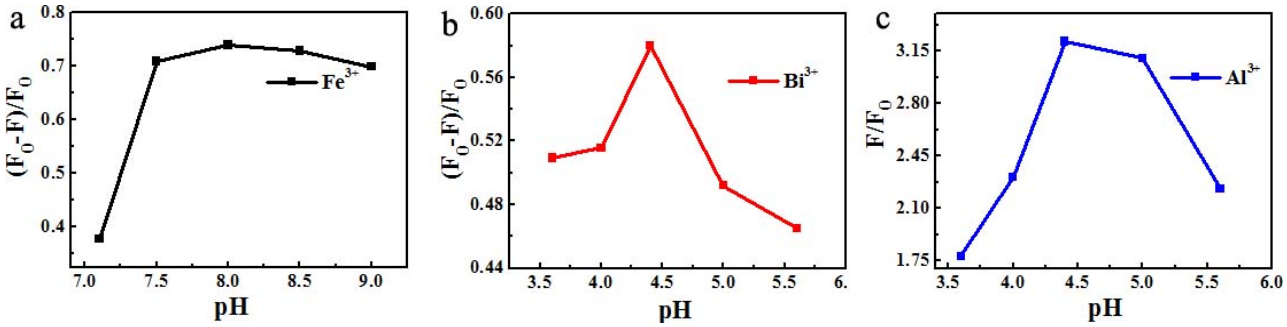

Figure S6. The influence of pH values on the detection of Fe^{3+}, Bi^{3+} and Al^{3+} (a, the concentration of Fe^{3+} was 200 μM in 0.1 M Tris-Hcl buffer; b, the concentration of Bi^{3+} was 20 μM in 0.2 M HAC-NaAC; c, the concentration of Al^{3+} was 30 μM in 0.2 M HAC-NaAC).

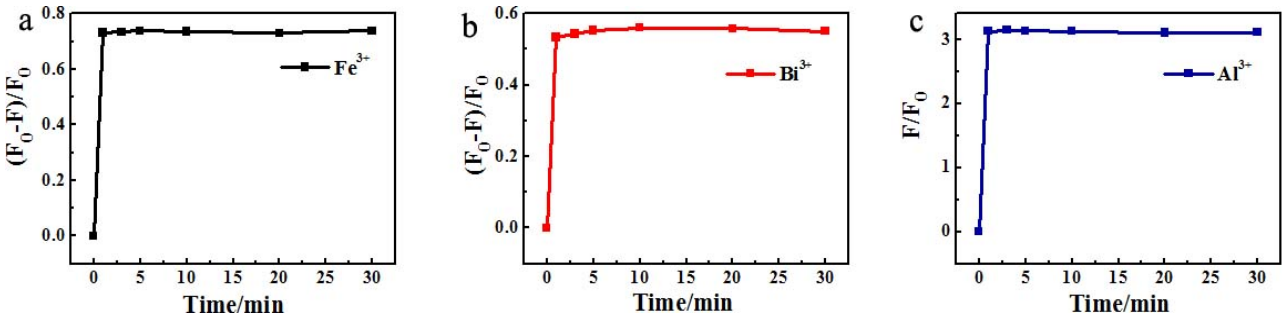

Figure S7. The influence of reaction time on the detection of Fe^{3+} , Bi^{3+} and Al^{3+} (a, 200 μM Fe^{3+}; b, 20 μM Bi^{3+}; c, 30 μM Al^{3+}).

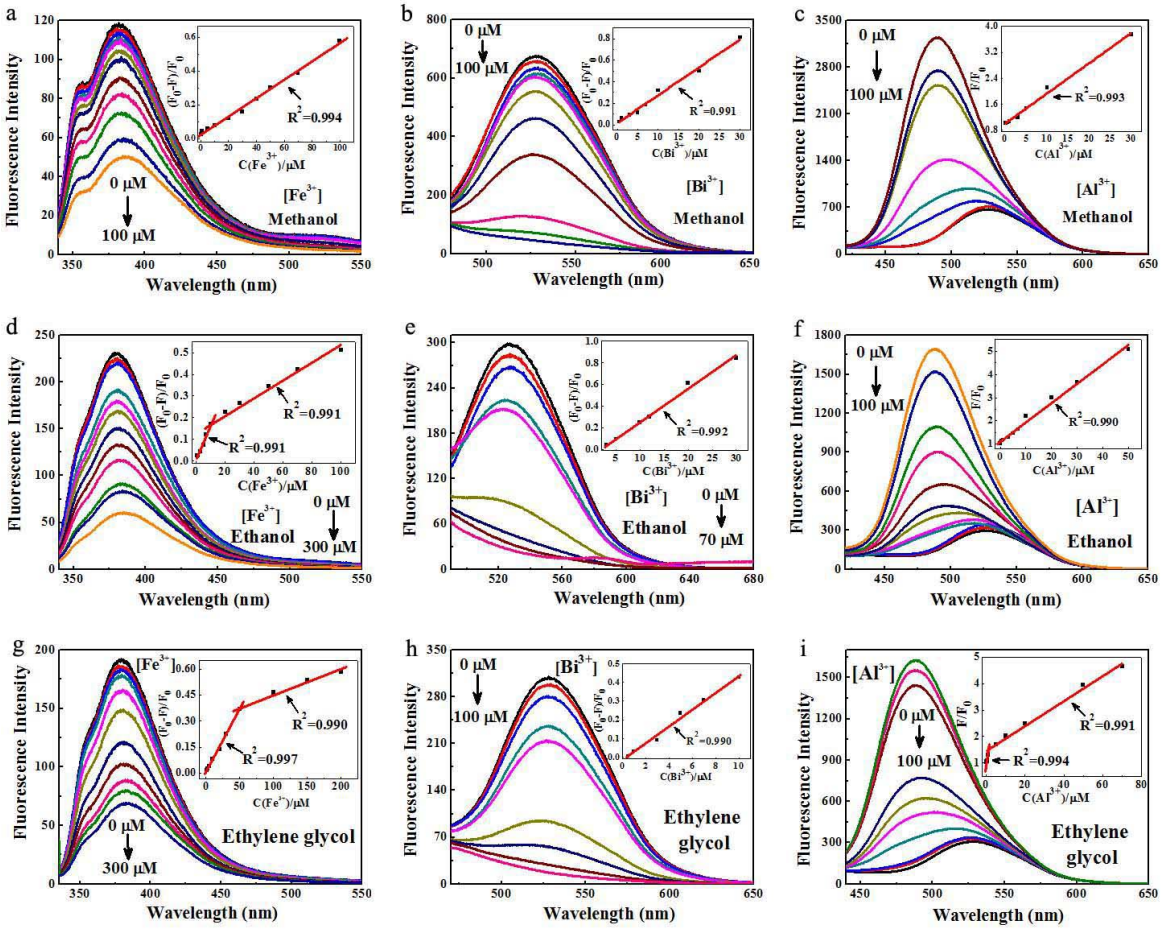

Figure S8. Fluorescence spectra of DECNDs synthesized in other alcohol-water binary systems (a, b and c: methanol-water; d, e and f: ethanol-water; g, h and i: ethylene glycol-water) with addition of various amounts of Fe^{3+}, Bi^{3+} and Al^{3+} and the corresponding linear ranges (inset).

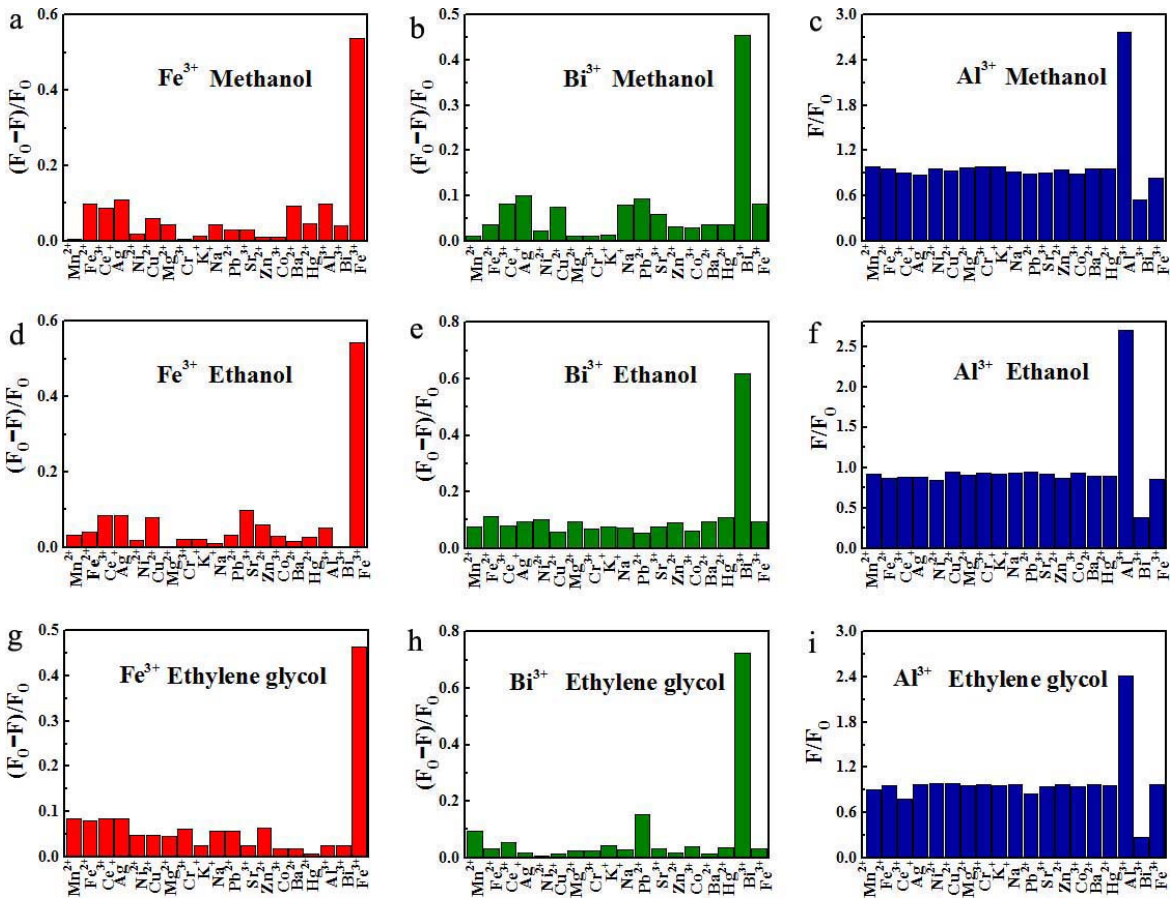

Figure S9. Selectivity of DECNDs synthesized in other alcohol-water binary systems for the detection of Fe^{3+}, Bi^{3+} and Al^{3+} (a, b and c, methanol-water; d, e and f, ethanol-water; g, h and i, ethylene glycol-water): a, d and g, the concentrations of all the metal ions were 100 μM; b, e and h, the concentrations of Ce^{3+}, Mg^{2+}, Sr^{2+}, Zn^{2+}, Fe^{2+}, Cu^{2+}, Ni^{2+}, Ag^{+}, Co^{2+} were 50 μM and Cr^{3+}, Na^{+}, Mn^{2+}, K^{+}, Ba^{2+}, Pb^{2+}, Hg^{2+} were 100 μM, except for Bi^{3+} was 20 μM ; c, f and i, the concentrations of Al^{3+} and Bi^{3+} were 20 μM and other metal ions were 100 μM.

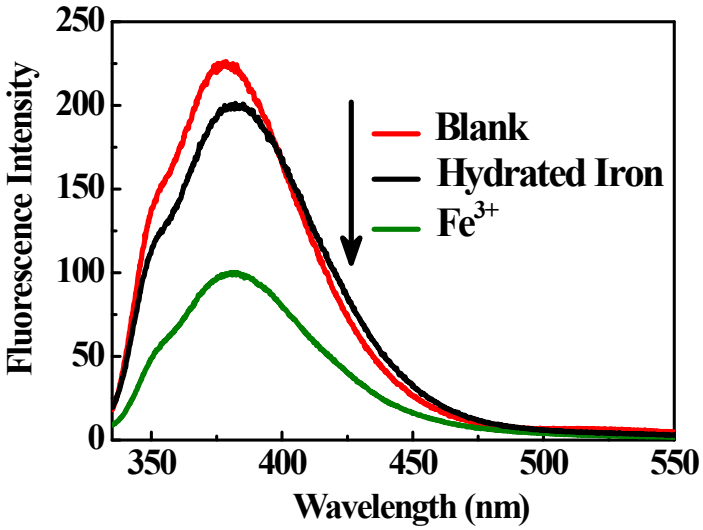

Figure S10. Fluorescence spectra of DECNDs in absence (blank) and presence of Fe^{3+} and hydrated iron. The concentrations of Fe^{3+} and hydrated iron were 100 μM.

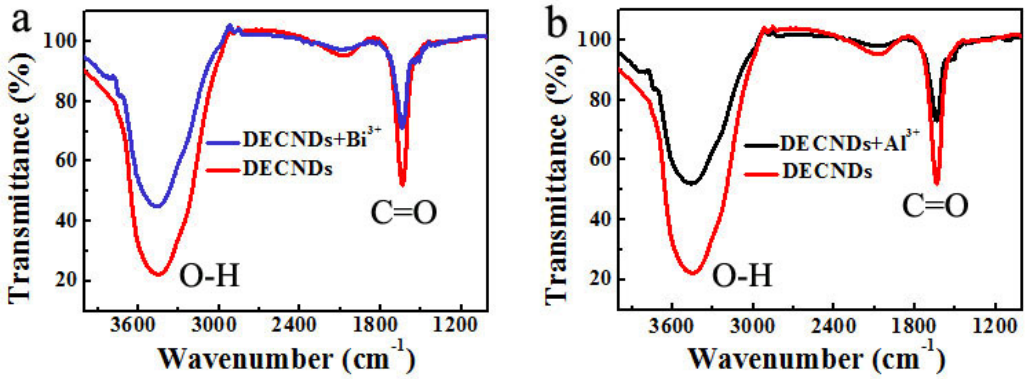

Figure S11. FT-IR spectra of the DECNDs in absence and presence of Bi^{3+} (a), and Al^{3+} (b).

Table S1. Comparison of linear ranges and LODs of Fe^{3+}, Bi^{3+} and Al^{3+} by DECNDs synthesized in alcohol-water binary systems.

Alcohol-water binary systems	Metal ions	Linear range	Excitation wavelength	LOD
methanol-water	Fe^{3+}	0.5 μM - 100 μM	315 nm	150 nM
	Bi^{3+}	0.5 μM - 30 μM	365 nm	220 nM
	Al^{3+}	0.1 μM - 30 μM	365 nm	60 nM
ethanol-water	Fe^{3+}	1 μM - 100 μM	315 nm	771 nM
	Bi^{3+}	3 μM - 30 μM	365 nm	710 nM
	Al^{3+}	0.01 μM - 50 μM	365 nm	4 nM
n-propanol-water	Fe^{3+}	0.5 μM - 250 μM	315 nm	200 nM
	Bi^{3+}	0.5 μM - 30 μM	365 nm	150 nM
	Al^{3+}	0.3 μM - 30 μM	365 nm	100 nM
ethylene glycol-water	Fe^{3+}	1 μM - 200 μM	315 nm	300 nM
	Bi^{3+}	0.5 μM - 10 μM	365 nm	200 nM
	Al^{3+}	0.05 μM - 70 μM	365 nm	20 nM