Supporting Information

Liquid Photonic Crystal Detection Reagent for Reliable Sensing of Cu^{2+} in Water

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1. OM and SEM images of liquid PCs.

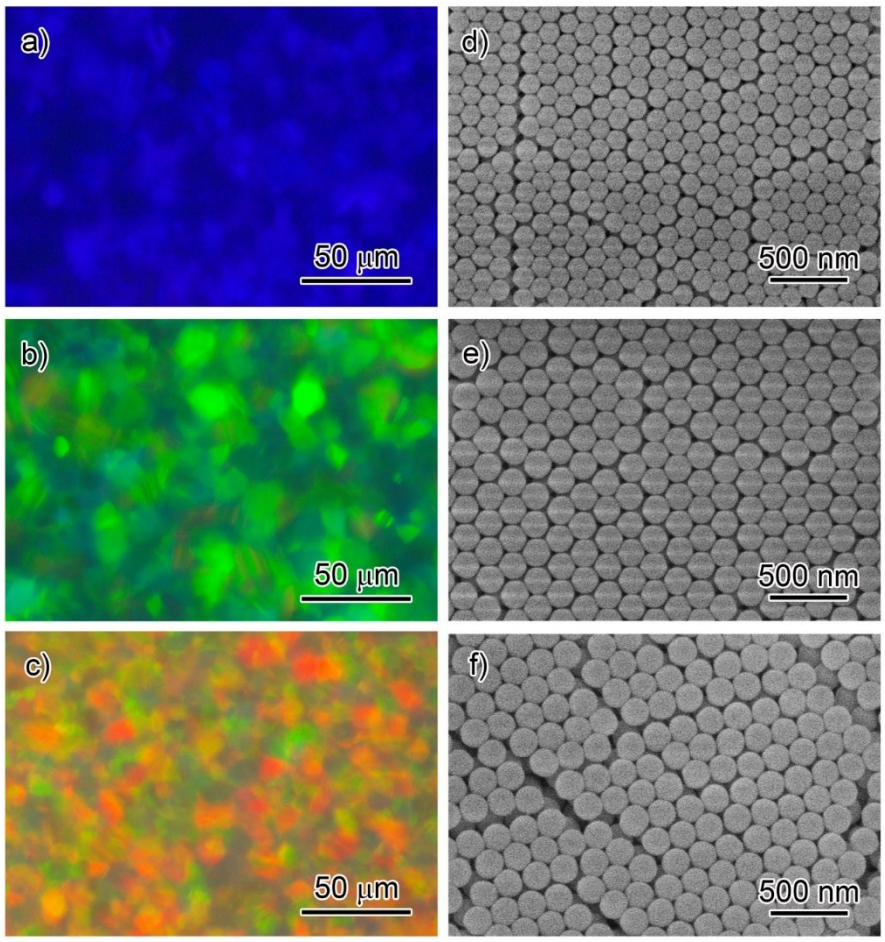

Figure S1. Optical microscope images and scanning electron microscope images of liquid colloidal photonic crystals with a, d) blue, b, e) green, and c, f) red structural colors.

2. Influence of the introduction of Sal upon reflection signals.

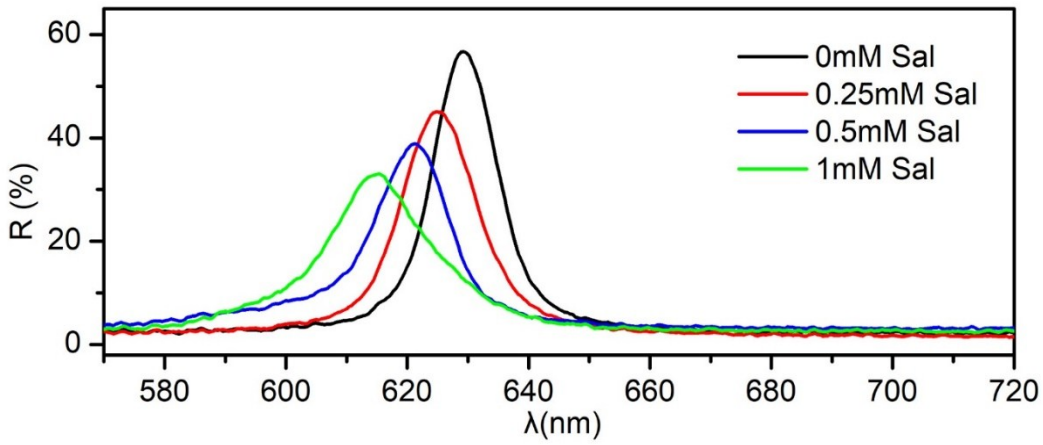

Figure S2. Reflection spectra of liquid photonic crystal after introducing Sal with different concentrations.

3. Influence of the introduction of Cu^{2+} upon reflection signals.

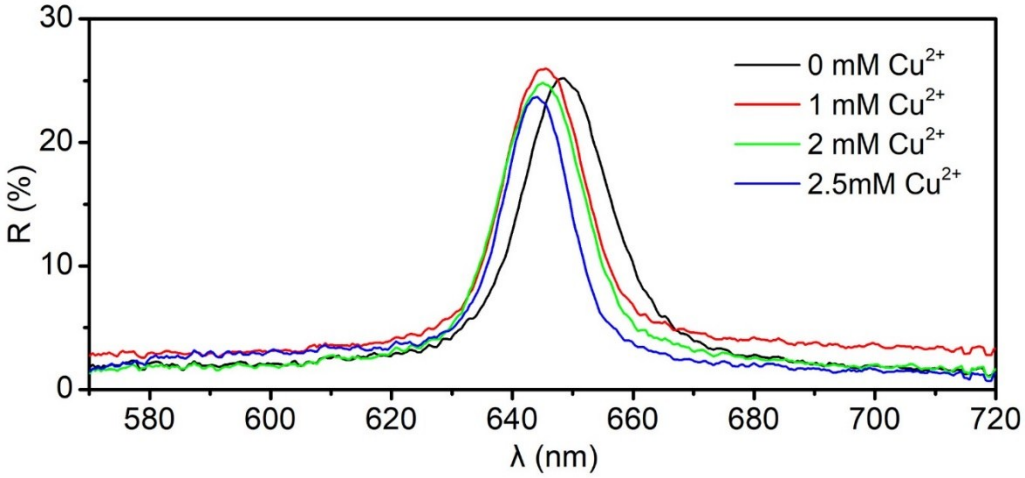

Figure S3. Reflection spectra of liquid photonic crystal (without Sal) after introducing the aqueous solution of Cu^{2+}.

4. Response of Liquid PC detection reagents with different particle volume fraction.

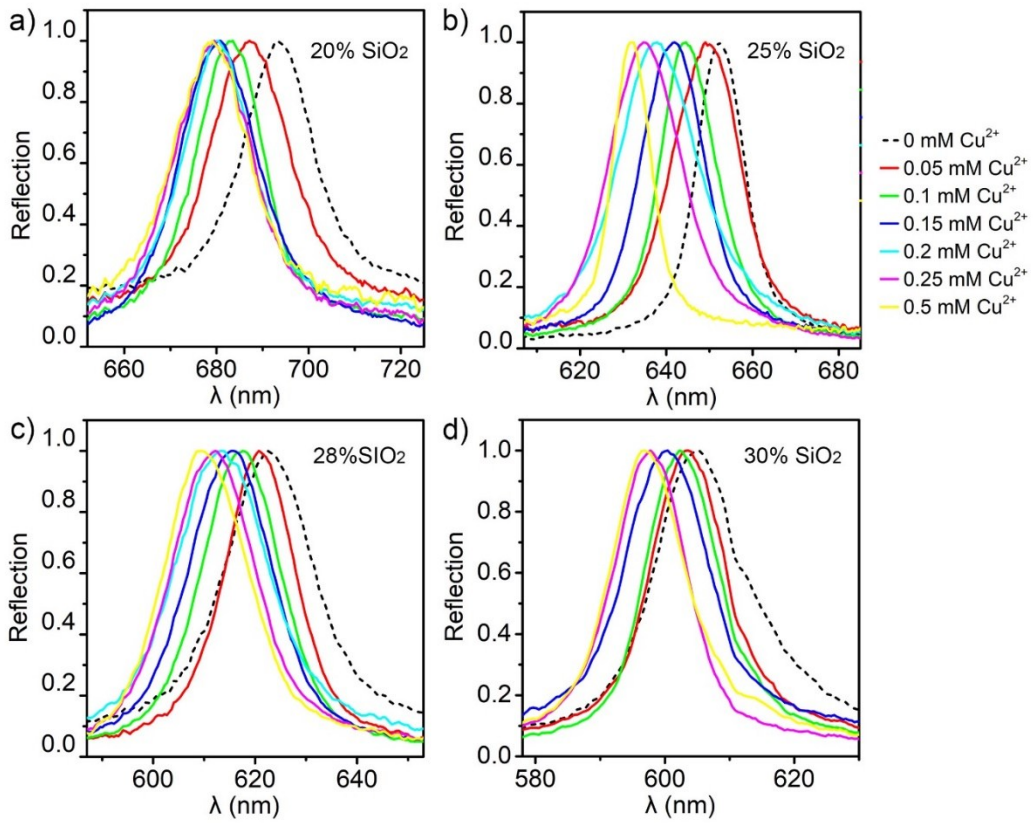

Figure S4. Reflection change of liquid photonic crystals with particle volume fraction of a) 20%, b) 25%, c) 28%, and d) 30% after mixing with aqueous solution of Cu^{2+}.

5. Reproducibility of optical response for liquid PC detection reagents prepared in different batches.

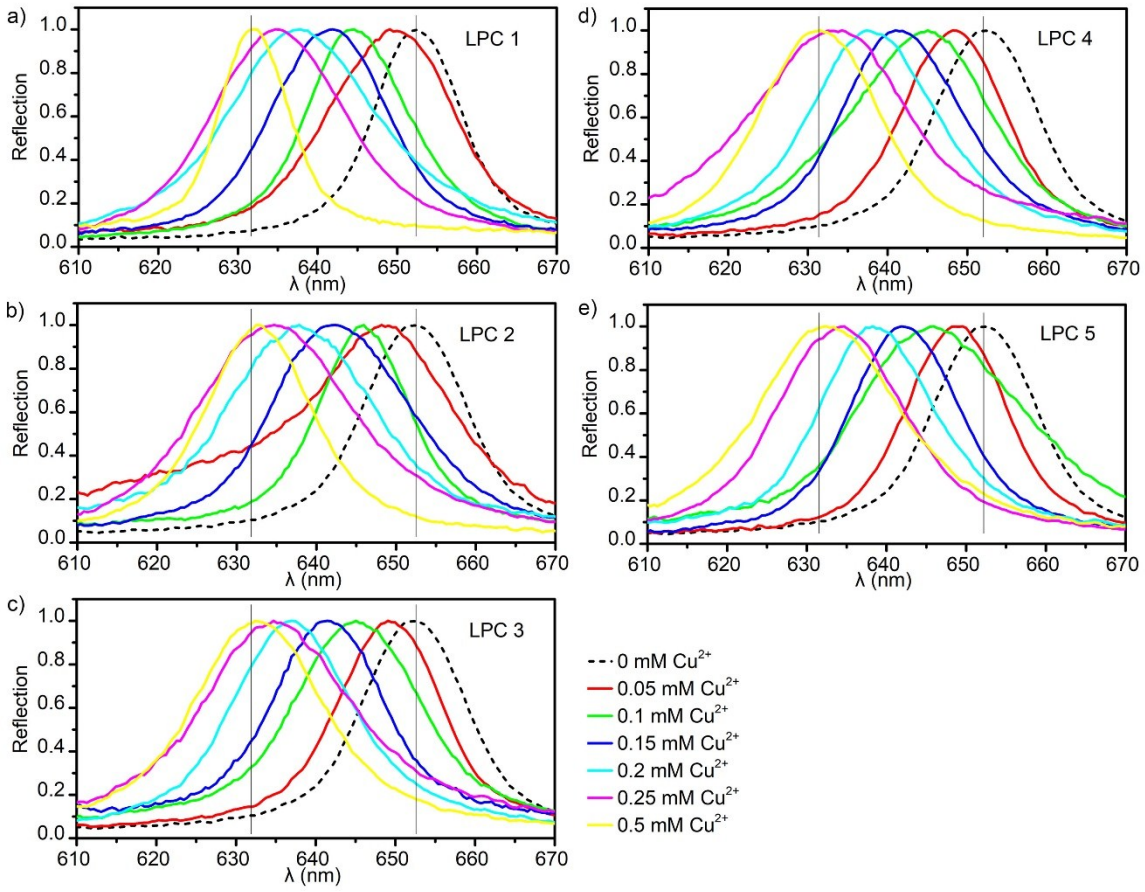

Figure S5. Optical response of same liquid PC detection reagents but prepared in different batches to the aqueous solution of Cu^{2+}.

6. Reproducibility of optical response for liquid PC detection reagents prepared by different SiO_2 particles.

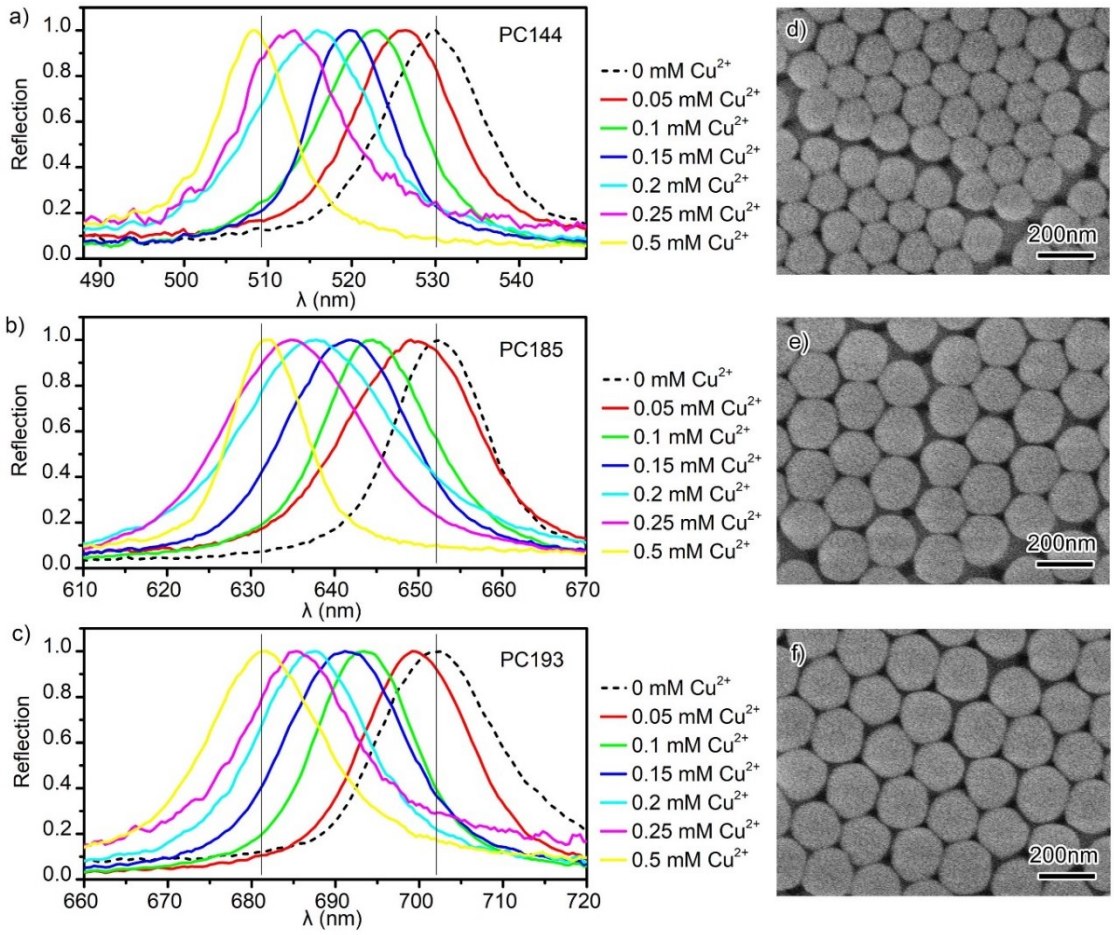

Figure S6. Optical response of liquid PC detection reagents prepared by SiO_2 particles with different sizes to the aqueous solution of Cu^{2+}.

7. Reproducibility of optical response for liquid PC detection reagents used in 5 days

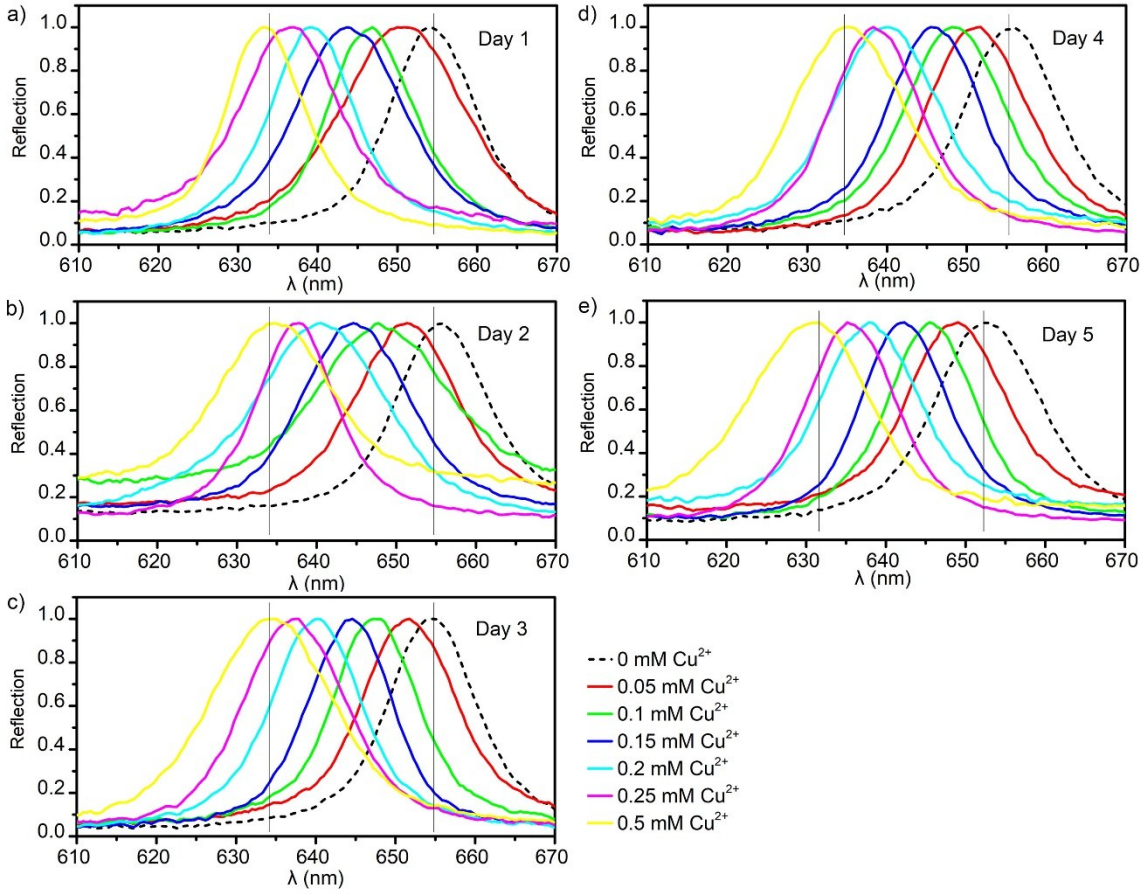

Figure S7. Optical response of the same liquid PC detection reagents to the aqueous solution of Cu^{2+} in 5 continuous days.

8. Reproducibility of optical response for liquid PC detection reagents used at different humidities.

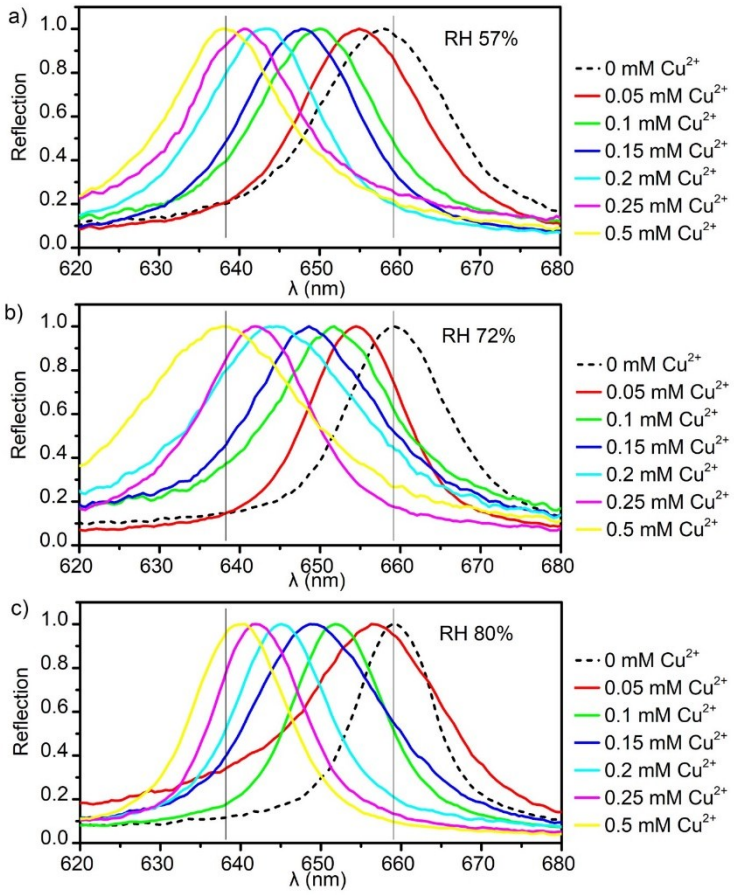

Figure S8. Optical response of the same liquid PC detection reagent to the aqueous solution of Cu^{2+} at different humidities.

9. Chemical composition of liquid PC detection reagents.

Table S1. The volume, concentration, and chemical composition of liquid PC detection reagents and aqueous solution of Cu^{2+} used in this work.

Sample	f_{SiO2} (%)	d_{SiO2} (nm)	C_{Sal} (mM)	Solvent (μL)	V_{LPC} (μL)	$C_{Metal\ ions}$ (mM)	V_{H2O} (μL)	Citation in this work
1	30	140	0	70/PC	100	0	0	Fig 1a,1b Fig S1
2	30	174	0	70/PC	100	0	0	Fig 1a,1b Fig S1
3	30	185	0	70/PC	100	0	0	Fig 1a,1b Fig S1
4	30	180	0	70/EG	100	0	0	Fig 1c-h
5	25	185	1	75/PC	100	0, 0.05, 0.1, 0.5 Cu^{2+}	10	Fig 2d
6	25	185	0,0.25, 0.5,1	75/PC	100	0	0	Fig S2
7	25	185	0	75/PC	100	0, 1, 2, 2.5 Cu^{2+}	10	Fig S3
8	25	185	0.05	75/PC	100	0, 0.01, 0.02, 0.04, 0.06, 0.08, 0.1Cu^{2+}	10	Fig 4a, Fig 5a
9	25	185	0.1	75/PC	100	0, 0.01, 0.02, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3 Cu^{2+}	10	Fig 4b, Fig 5b
10	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 4c, Fig 5c
11	25	185	0.5	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5, 0.75 Cu^{2+}	10	Fig 4d, Fig 5d
12	20	185	0.25	80/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 6a, Fig S4a
10	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 6b, Fig S4b
13	28	185	0.25	72/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 6c, Fig S4c

14	30	185	0.25	70/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.5 Cu^{2+}	10	Fig 6d, Fig S4d
15	25	185	0.25	75/PC	100	0.5 Cu^{2+}, Al^{3+}, Cd^{2+}, Co^{2+}, Cr^{3+}, Fe^{3+}, Mg^{2+}, Ni^{2+}, Pb^{2+}, Zn^{2+}	10	Fig 7a-c
16	25	185	0.25	75/PC	100	0.5 Cu^{2+}, 0.5 Cu^{2+}+0.5 Zn^{2+}, 0.5 Cu^{2+}+0.5 Zn^{2+}+0.5 Ni^{2+}	10	Fig 7d
10	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8a, Fig S5a
17	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8a, Fig S5b
18	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8a, Fig S5c
19	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8a, Fig S5d
20	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8a, Fig S5e
21	25	144	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8b, Fig S6a, S6d
10	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8b, Fig S6b, S6e
22	25	193	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8b, Fig S6c, S6f
23	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8c, Fig S7a
24	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8c, Fig S7b
25	25	185	0.25	75/PC	100	0, 0.05, 0.1,	10	Fig 8c,

						0.15, 0.2, 0.25, 0.5 Cu^{2+}		Fig S7c
26	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8c, Fig S7d
27	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8c, Fig S7e
28	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8d, Fig S8a
29	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8d, Fig S8b
30	25	185	0.25	75/PC	100	0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.5 Cu^{2+}	10	Fig 8d, Fig S8c

10. Formation constants of metal-salicylic acid complex.

Table S2. Formation constants of metal-salicylic acid complex

	Cu^{2+}	Al^{3+}	Cd^{2+}	Co^{2+}	Cr^{3+}	Fe^{3+}	Mg^{2+}	Ni^{2+}	Pb^{2+}	Zn^{2+}
lgK_1	10.60	14.11	5.55	6.72	8.4	16.48	4.7	6.95		6.85
lgK_2	18.45	/	/	11.42	15.3	28.12	/	11.75		/

11. Disassociation of Sal promoted by metal cation in aqueous and non-aqueous solution.

Table S3. pH value of water-included Sal solution[1] and non-aqueous Sal solution[2] containing 0.5 mM of Cu^{2+}, Fe^{3+}, Al^{3+}.

	Cu^{2+}	Fe^{3+}	Al^{3+}
Sal Solution 1	4.69	3.28	3.65
Sal Solution 2	2.96	4.87	4.67

[1] Sal solution: EtOH 29.2%, propylene carbonate 62.5%, H_2O 8.3%; C_{Sal} = 0.25 mM; C_{M+} = 0.5 mM

[2] Sal solution: EtOH 0.55%, propylene carbonate 98.9%, H_2O 0.56%; C_{Sal} = 0.25 mM; C_{M+} = 0.5 mM