Supporting Information

Multifunctional fluorescent ionic liquid crystals based on L-Tryptophan and gemini surfactants for Cu (II) and ascorbic acid detection in real samples

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Real sample preparation

A food sample consisting of 2.0 g each of coffee, green tea, and black tea was placed in a porcelain crucible and burned with a flame. The resulting three powder samples were calcined at 550 °C for about 5 hours. After cooling, 10 mL of concentrated HNO_3 and 5 mL of 30% hydrogen peroxide were added, and the mixture was heated until dry. Subsequently, 25 mL of water was added to the residue. Aliquots of these prepared solutions were used for analysis.[1] The fluorescent ILCs ($[C_{12}Im3OHImC_{12}]\cdot 2Trp$) were directly mixed with diluted 5 mL of the digested solution.

The standard addition method was utilized to determine the presence of ascorbic acid (AA) in real samples. The procedure involved taking 4 mL of various samples including orange, tomato, pomegranate juice, as well as human blood serum diluted tenfold, without any additional treatment. 2.5 mL of previously prepared GIL-12 was taken in a cuvette followed by the addition of known volume of aqueous stock solution of AA.[2] The fluorescence emission spectra were recorded using an excitation wavelength of 280 nm.

Determination of Cu^{2+} ions and ascorbic acid in real samples

The prepared real samples were spiked with Cu^{2+} and ascorbic acid at varying concentrations (10 and 20 μM). Fluorescence spectra were captured using an excitation wavelength of 280 nm. Each concentration was measured three times, and the results were used to calculate the percentage recovery.

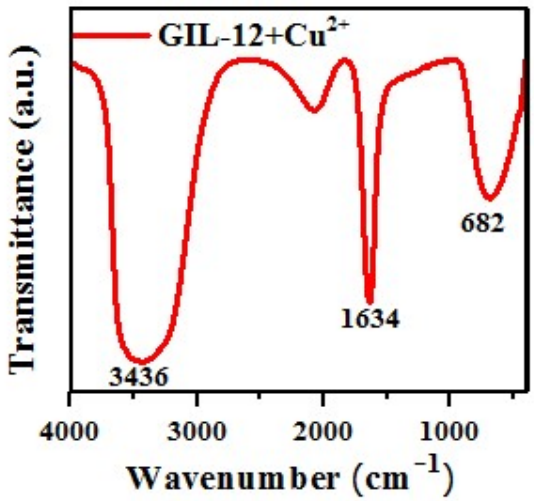
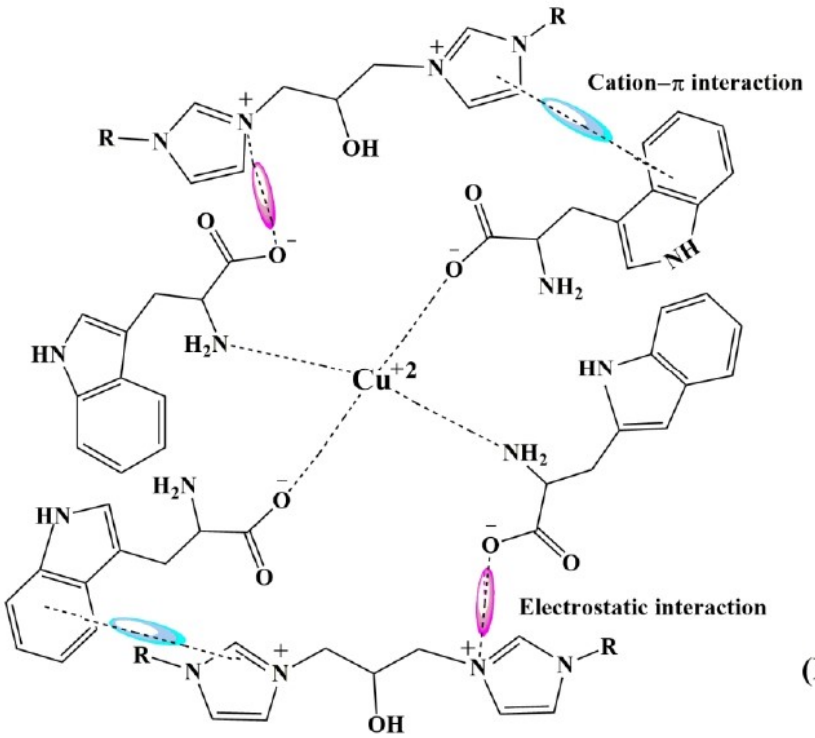


Fig. S1 FT-IR spectrum of GIL-12 with Cu^{2+} sensing



Scheme S1 Sensing mechanism of GIL-12 with Cu^{2+}

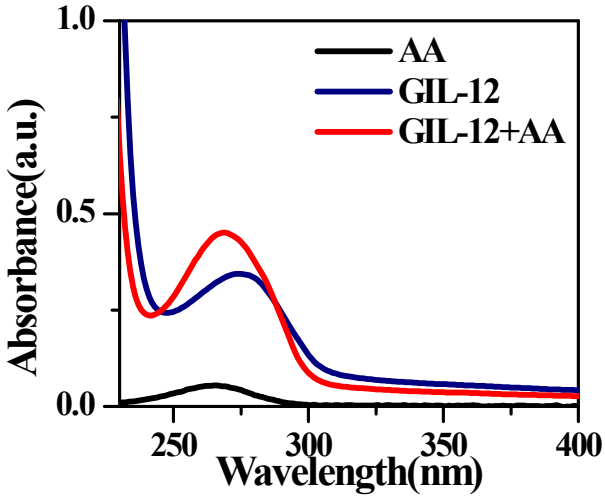


Fig. S2 UV-Visible spectra of GIL-12 with and without AA

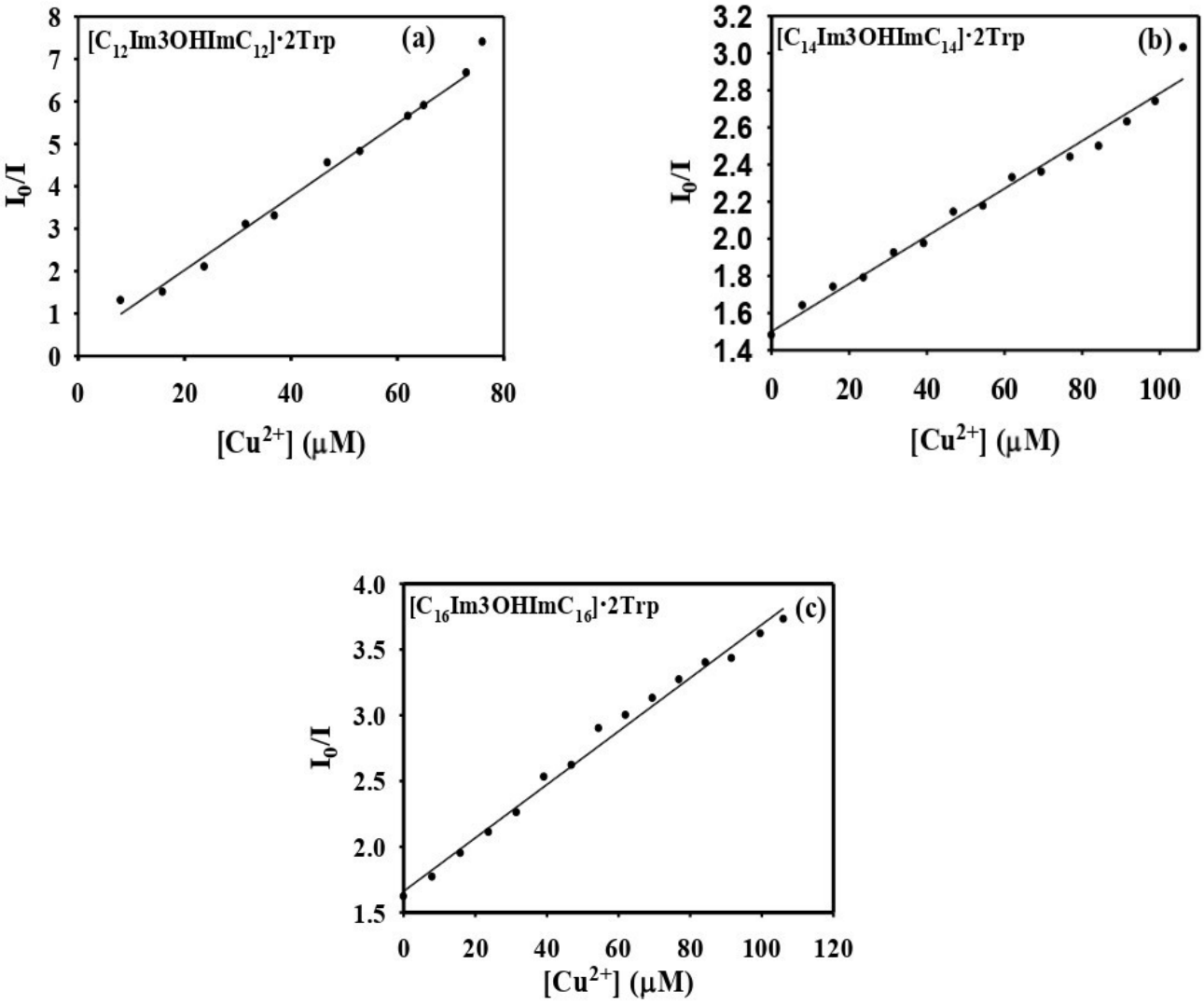


Fig. S3 Plot of I_0/I versus $[Cu^{2+}]$ for (a) $[C_{12}Im3OHImC_{12}]\cdot 2Trp$ (b) $[C_{14}Im3OHImC_{14}]\cdot 2Trp$ and (c) $[C_{16}Im3OHImC_{16}]\cdot 2Trp$ at wavelength of 350 nm.

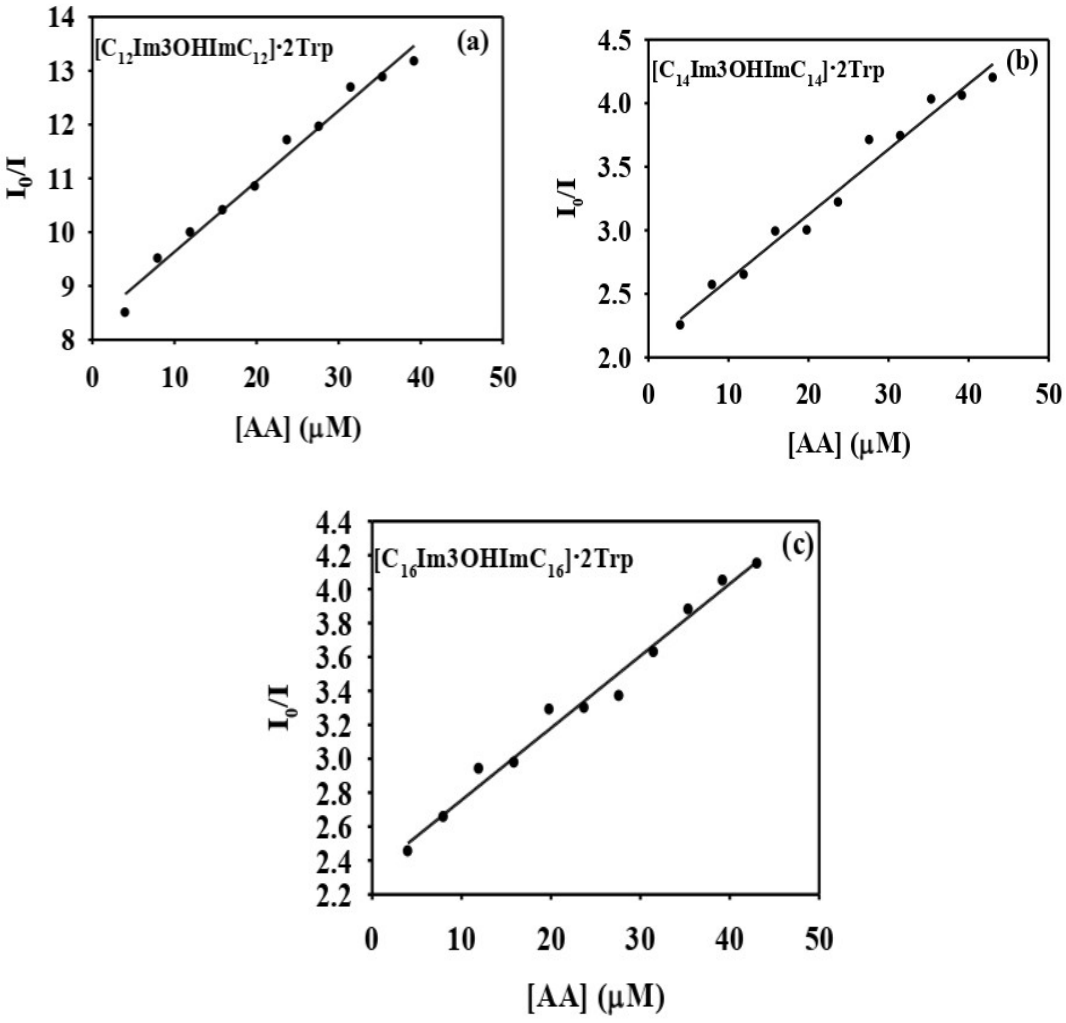


Fig. S4 Plot of I_0/I versus [AA] for (a) $[C_{12}Im3OHImC_{12}]\cdot 2Trp$ (b) $[C_{14}Im3OHImC_{14}]\cdot 2Trp$ and (c) $[C_{16}Im3OHImC_{16}]\cdot 2Trp$ at wavelength of 350 nm

Table S1 Comparison of the proposed and previously reported methods for Cu^{2+} determination

Sample	Method	Ions	LOD (μM)	Linear range	Ref.
PGE/PA/Cu-Car	Potentiometry	Cu^{2+}	2.00	5.0×10^{-6}-1.0×10^{-1} M	47
MALDI-TOF	Calorimetry	Cu^{2+}	2.80	20-45μM	48
Sulfur quantum dots (SQDs)	Fluorescence	Cu^{2+}	6.78	20-200μM	49
NANO-PAMAM-CHT	Fluorescence	Cu^{2+}	16.9	0-25 μM	50
[C_{12}Im3OHImC$_{12}$]·2Trp	Fluorescence	Cu^{2+}	4.59	7.97-76.92μM	This work
[C_{14}Im3OHImC$_{14}$]·2Trp	Fluorescence	Cu^{2+}	6.22	7.97-106μM	This work
[C_{16}Im3OHImC$_{16}$]·2Trp	Fluorescence	Cu^{2+}	5.11	7.97-105μM	This work

Table S2 Comparison of the proposed and previously reported methods for ascorbic acid (AA) determination

Sample	Method	Analyte	LOD (μM)	Linear range (μM)	Ref.
GSH-AuNCs	Fluorescence	AA	200	350-700	51
SAIL-capped ZnS QDs	Fluorescence	AA	63.11	50-476	52
Co_2P hybrid	DPV	AA	17.80	100-4500	53
C_{12}Im3OHImC$_{12}$]·2Trp	Fluorescence	AA	3.42	3.99-40.00	This work
C_{14}Im3OHImC$_{14}$]·2Trp	Fluorescence	AA	4.11	3.99-35.36	This work
C_{16}Im3OHImC$_{16}$]·2Trp	Fluorescence	AA	3.55	3.99-35.36	This work

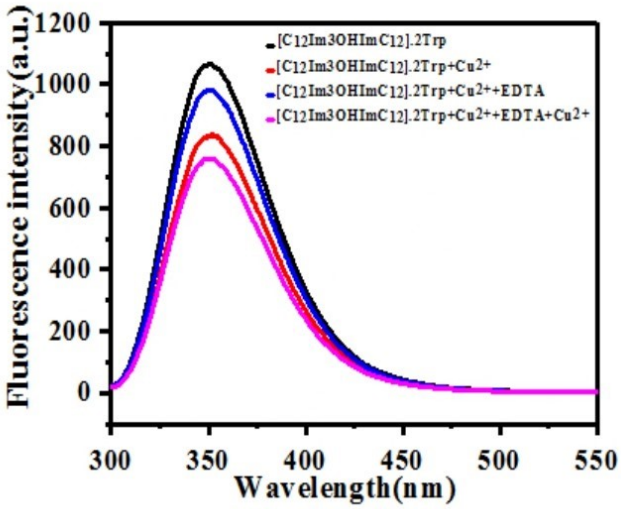


Fig. S5 Fluorescence intensity of $[C_{12}Im3OHImC_{12}]\cdot 2Trp$ (10 μM) during alternating additions of Cu^{2+} and EDTA.

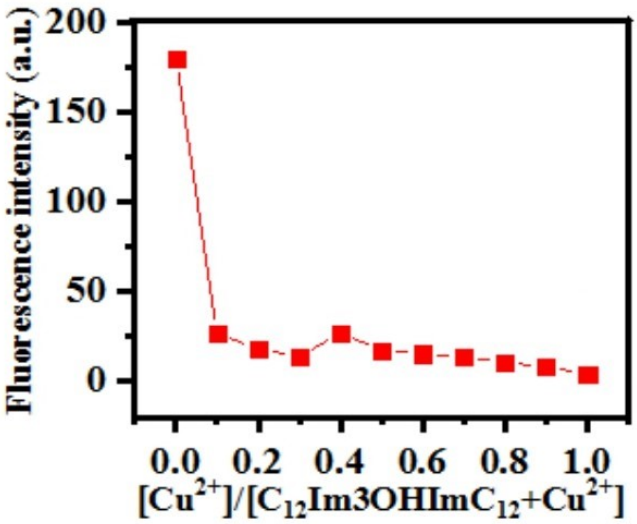


Fig. S6 Job's plot for $[C_{12}Im3OHImC_{12}]\cdot 2Trp$ and Cu^{2+} with a combined total concentration of [ILC] + $[Cu^{2+}]$ = 20 μM.

References

1 Z. Ghubish, R. Kamal, H. R Mahmoud, M. Saif, H. Hafez, and M. El-Kemary, *RSC advances*, 2021, **11**, 18552-18564.

2 Y. Li, J. J Xia, J. Z Lu., Z. L Wang, and M. T. Wang, *Dyes and Pigments*, 2024, **227**, 112197.