Supporting Information

Organic-inorganic hybrid nanoflower of copper phosphate coated with tetra imidazolyl-phenanthroline derivatized calix[4]arene: Synthesis, characterization and its application as peroxidase mimic catalyst

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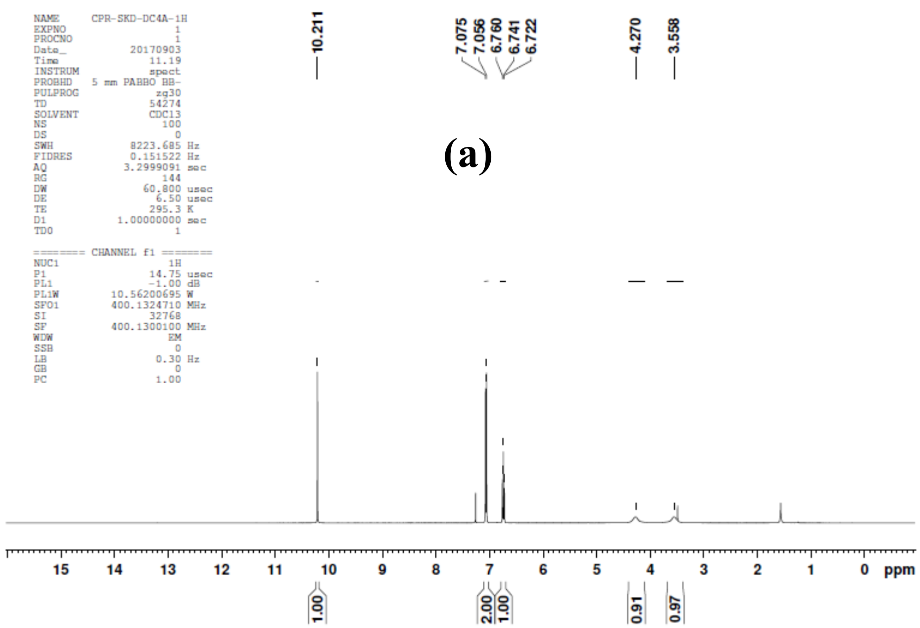
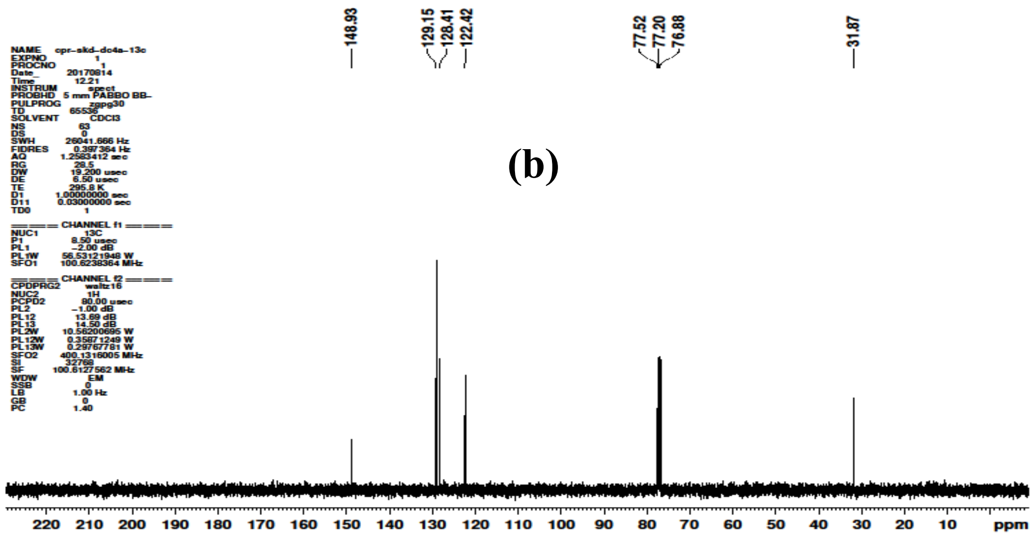
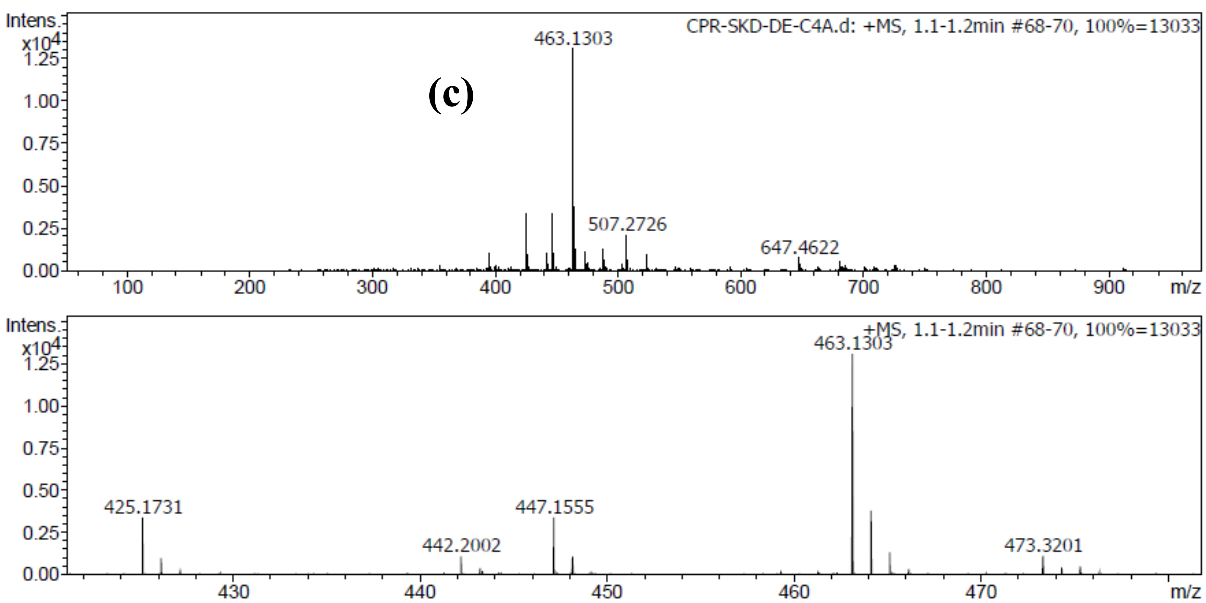
S1. Characterization Data of P_2

The $\mathbf{P_2}$ has been synthesized according to the literature reported procedure.[1][C. D. Gutsche, J. A. Levine, P. K. Sujeeth, Functionalized Calixarenes: The Claisen Rearrangement Route, *J. Org. Chem*. 1985, **50**, 5802– 5806] **^{1}H NMR (400 MHz, $CDCl_3$) $\delta_{(ppm)}$**: 10.2 (s, 4H), 7.06 (d, *J*= 7.6 Hz, 8H), 6.74 (t, *J* = 7.6 Hz, 4H), 4.27 (br s, 4H), 3.55 (br s, 4H); **^{13}C NMR (100 MHz, $CDCl_3$) δ**: 148.9, 129.1, 128.4, 122.4, 31.8; **ESI-MS (HRMS)**: Chemical formula $C_{28}H_{24}O_4$, $[M+K]^+$ calculated m/z at 463.1303, observed m/z at 463.1306.





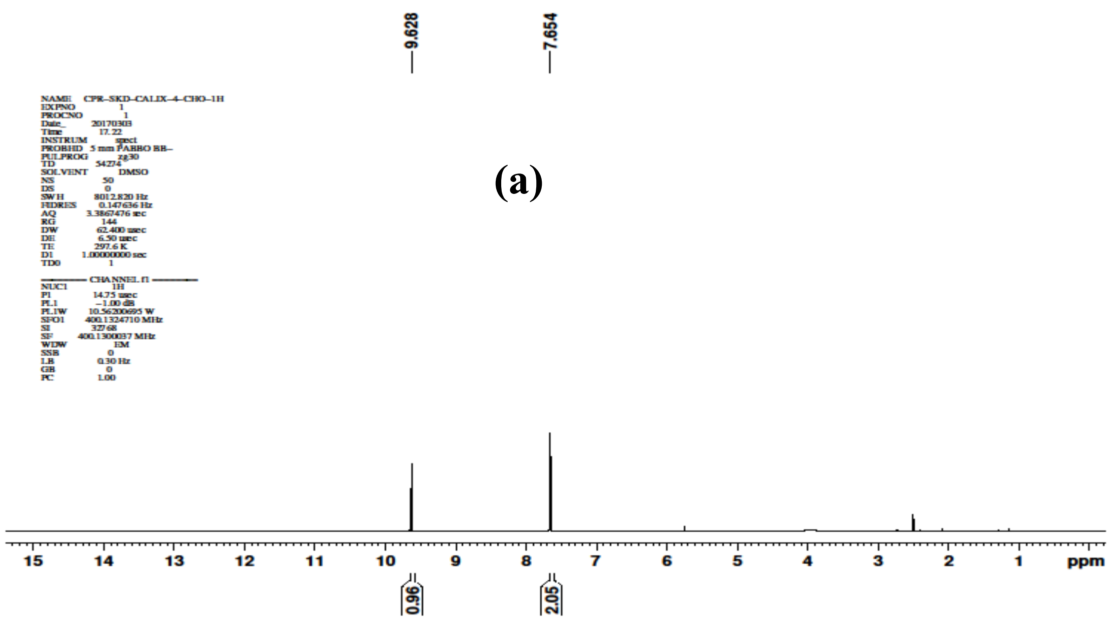


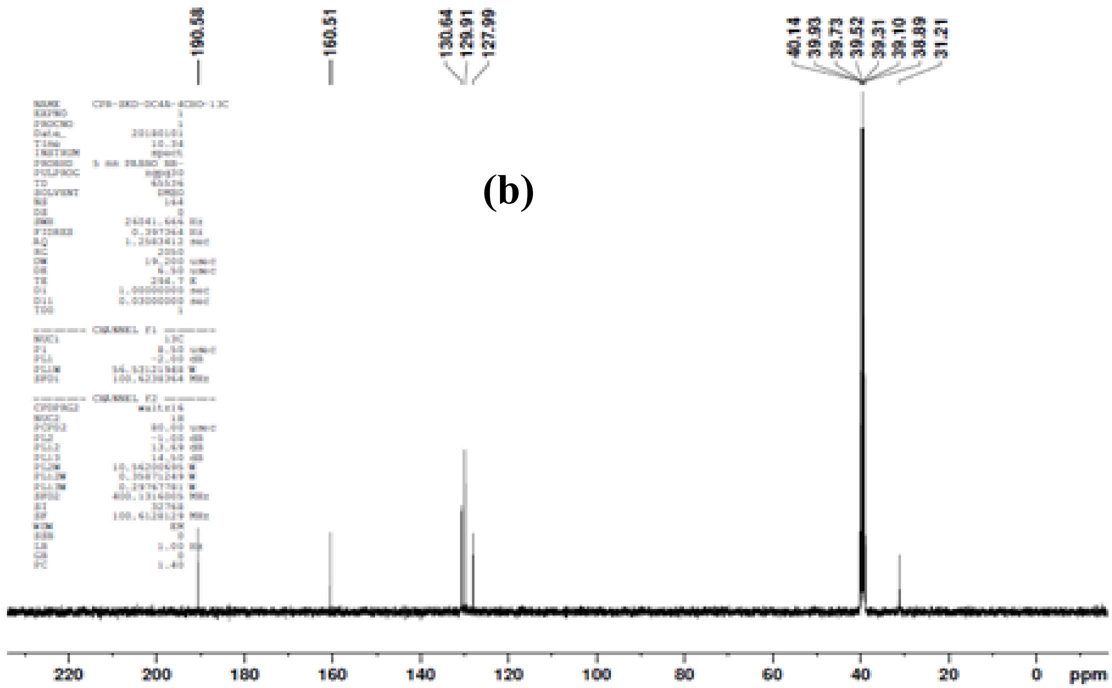
Meas. m/z	#	Ion Formula	m/z	err [ppm]	mSigma	# Sigma	Score	rdb	e⁻ Conf	N-Rule
463.1303	1	C28H24KO4	463.1306	0.6	14.6	1	100.00	16.5	even	ok

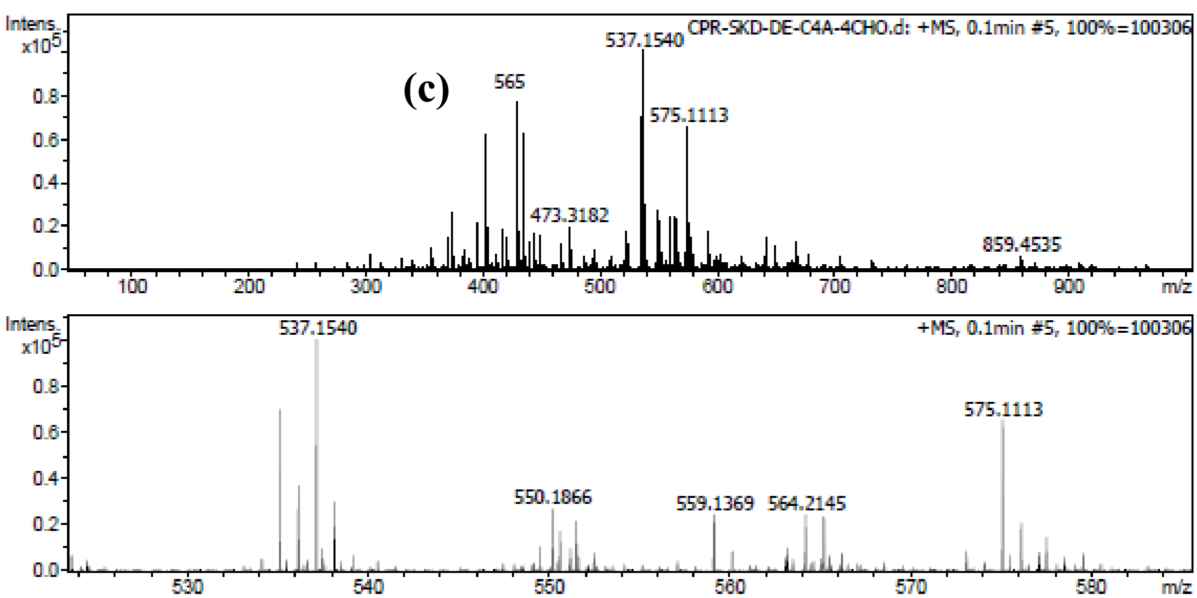
Fig. S1. Spectral data of $\mathbf{P_2}$: (a) ^{1}H NMR in $CDCl_3$, (b) ^{13}C NMR in $CDCl_3$ and (c) ESI-MS (HRMS)

S2. **Characterization Data of P_3**

The $\mathbf{P_3}$ has been synthesized according to the literature reported procedure.[2] [K. Samanta, and C. P. Rao, A Bifunctional Thioether Linked Coumarin Appended Calix[4]arene Acquires Selectivity Toward Cu^{2+} Sensing on Going from Solution to SAM on Gold, *ACS Appl. Mater. Interfaces*, 2016, **8**, 3135] **^{1}H NMR (400 MHz, DMSO-d$_6$) δ(ppm)**: 9.6 (s, 4H), 7.65 (s, 8H); **^{13}C NMR (100 MHz, DMSO-d$_6$) δ**: 190.6, 160.5, 130.7, 129.7, 127.9 and 31.2; **ESI-MS (HRMS)**: Chemical formula $C_{32}H_{24}O_8$ $[M+H]^+$ calculated m/z at 537.1540, observed m/z at 537.1544.



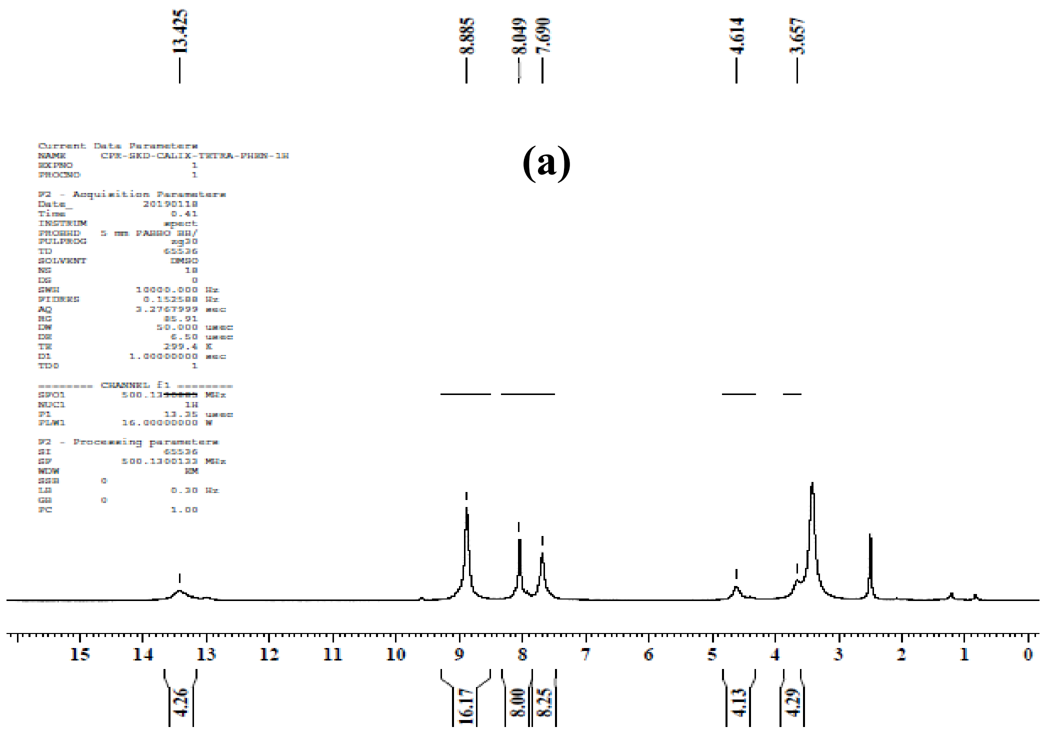


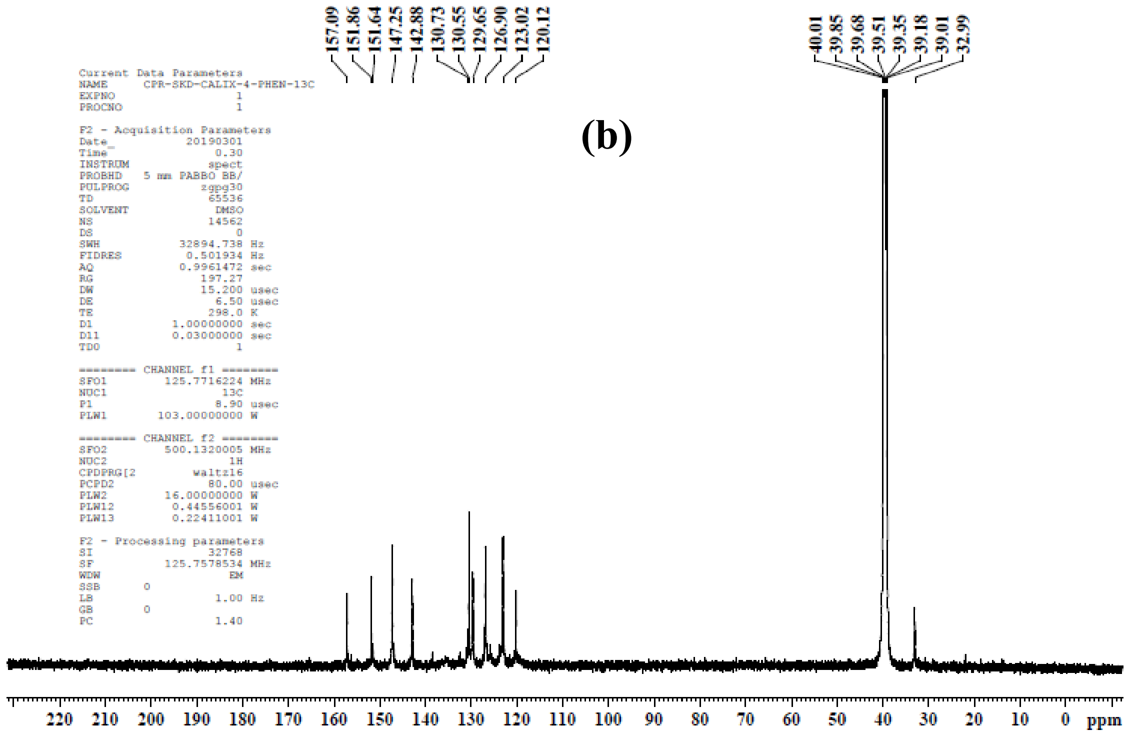


Meas. m/z	#	Ion Formula	m/z	err [ppm]	mSigma	# Sigma	Score	rdb	e⁻ Conf	N-Rule
537.1540	1	C32H25O8	537.1544	0.7	26.7	1	100.00	20.5	even	ok

Fig. S2. Spectral data of **P$_3$**: (a) ^{1}H NMR in CDCl$_3$, (b) ^{13}C NMR in CDCl$_3$ and (c) ESI-MS (HRMS)

S3. Characterization Data of L





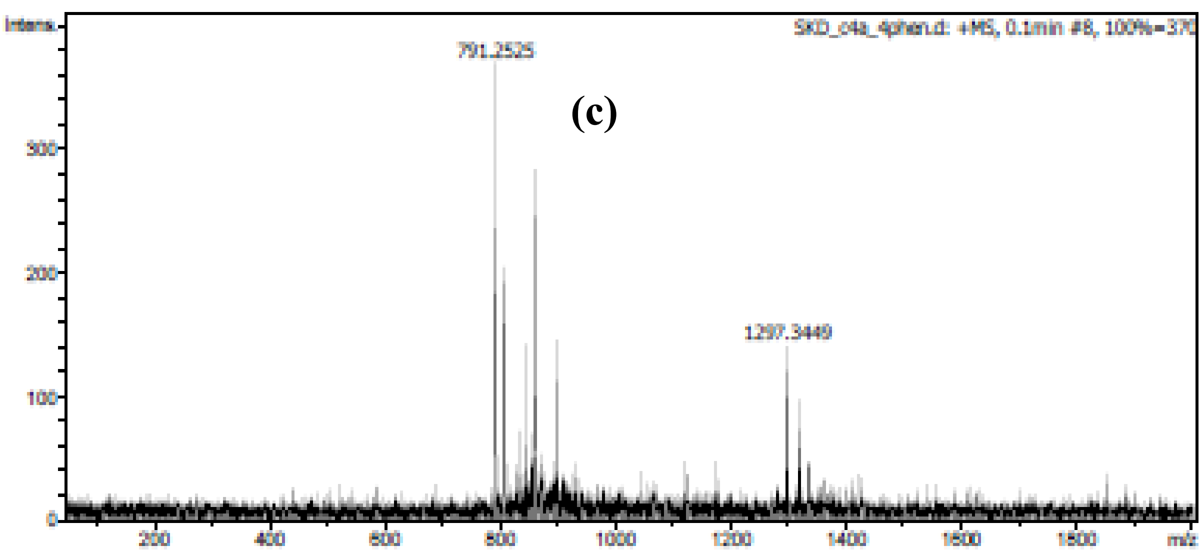


Fig. S3. Spectral data for **L** (a) ^{1}H NMR in DMSO-d_6 (500 MHz); (b) ^{13}C NMR in DMSO-d_6 (125 MHz) and (c) ESI-MS.

S4. UV-Visible spectra of peroxidase mimetic activity of L with different substates

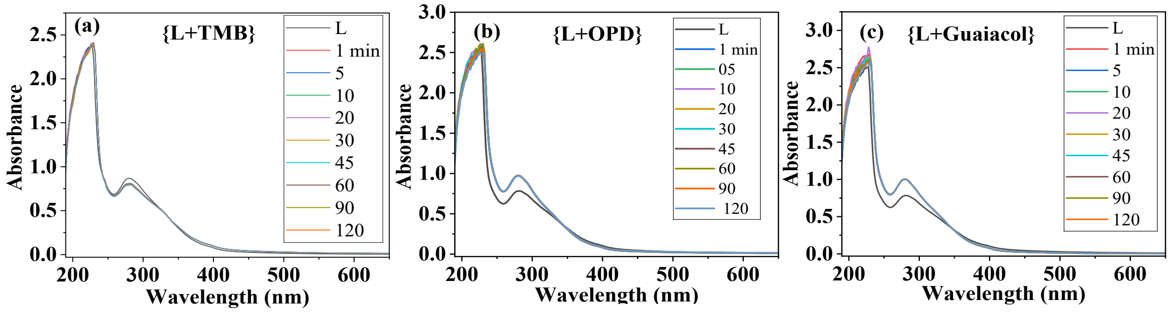


Fig. S4. UV-Visible spectra of peroxidase mimetic activity of (a) TMB, (b) OPD and (c) Guaiacol (0.2 mM) in the presence of H_2O_2 (2 mM) and **L** (0.1 g/ml) at different time intervals in PBS buffer (10 mM, pH 5.0).

S5. ESI-MS Spectrum of oxidized product of TMB

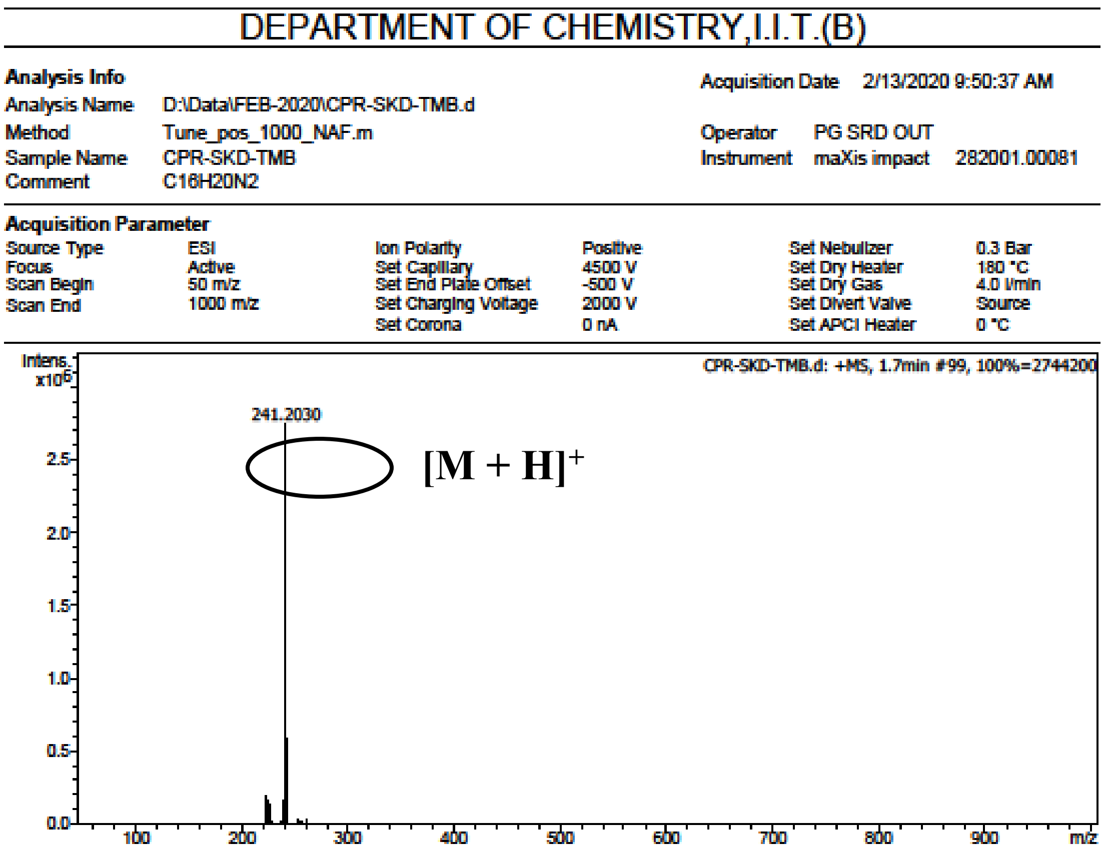


Fig. S5. ESI-MS Spectrum of oxidized product of TMB

S6. ESI-MS Spectrum of oxidized product of OPD

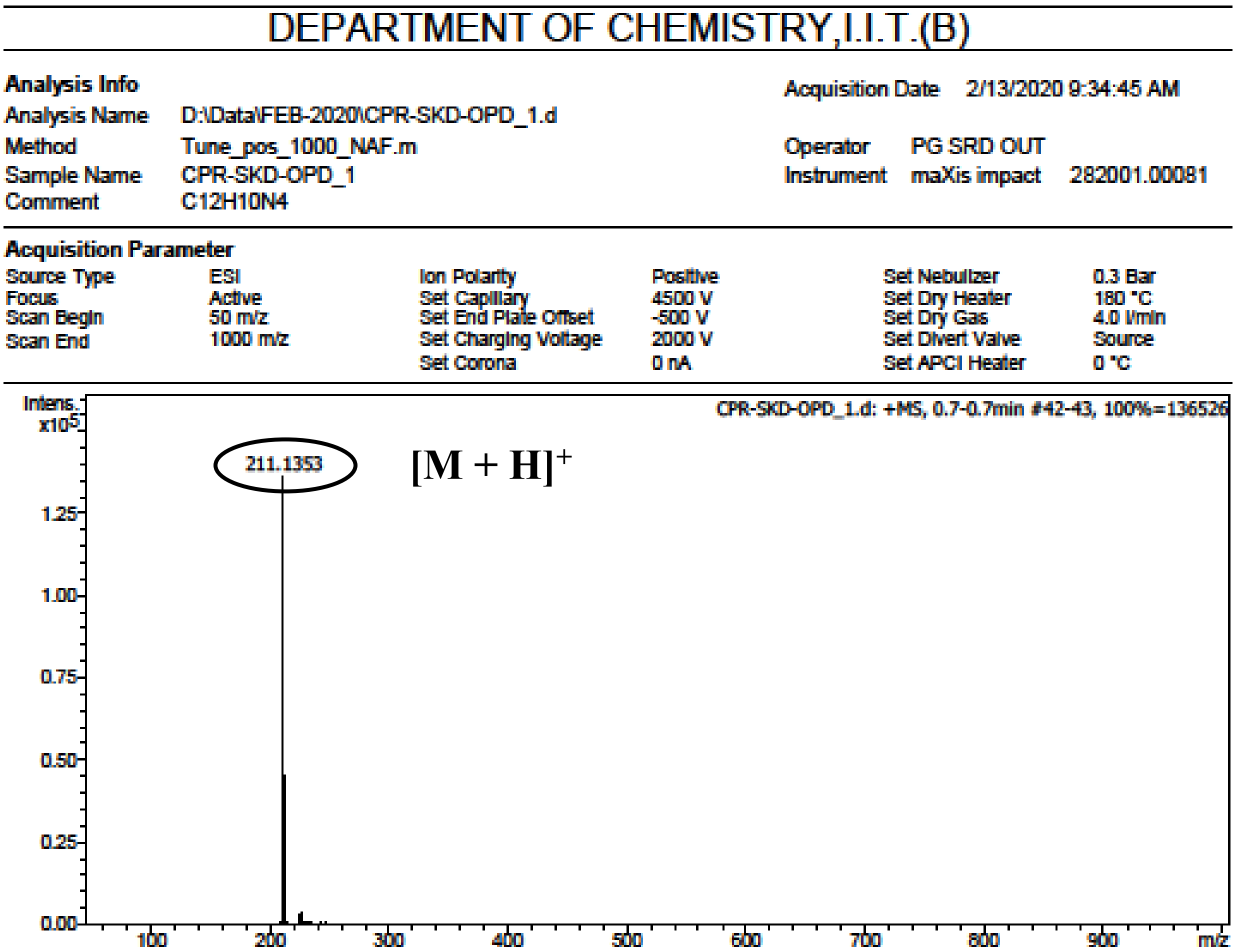


Fig. S6. ESI-MS Spectrum of oxidized product of OPD

S7. ESI-MS Spectrum of oxidized product of Guaiacol

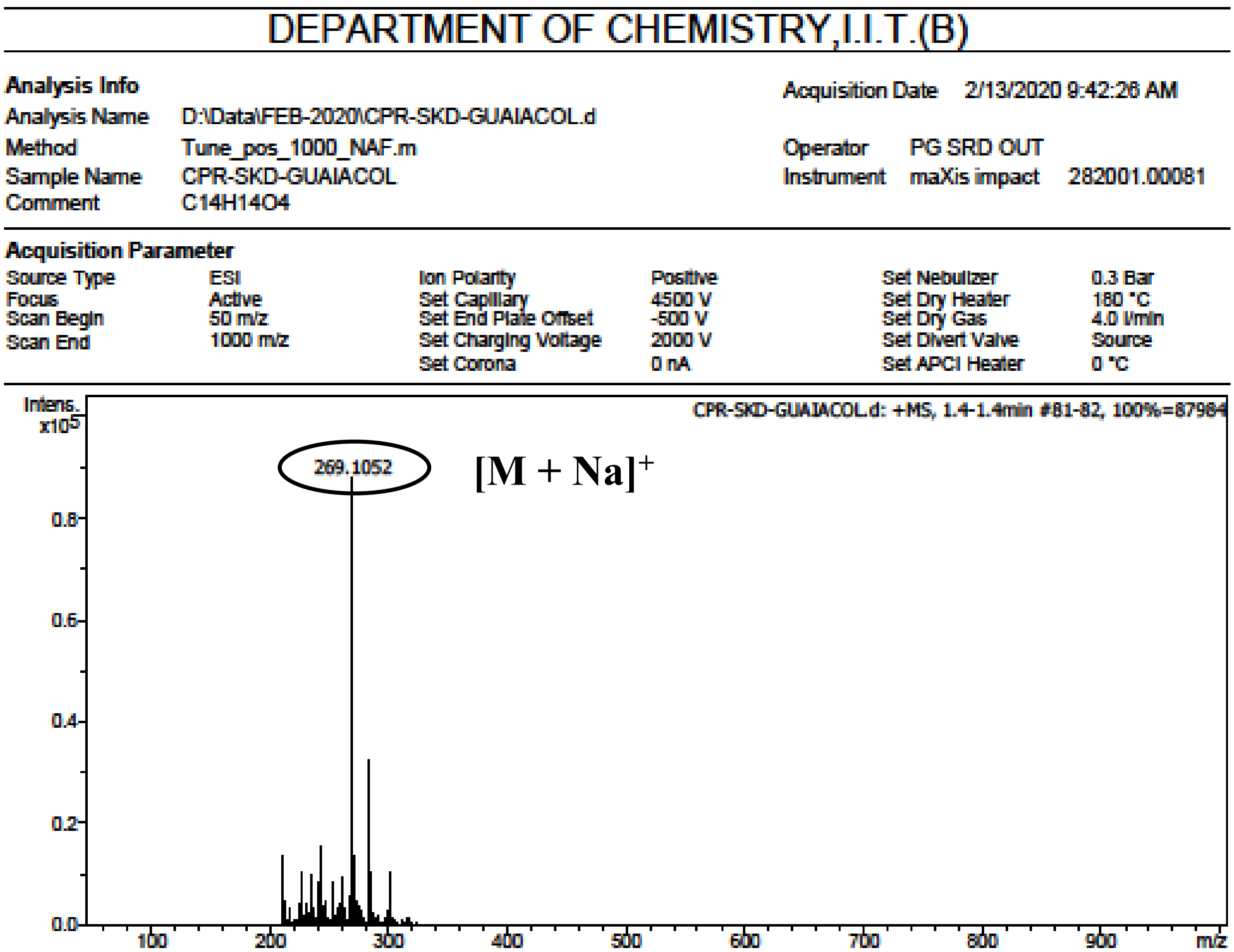


Fig. S7. ESI-MS Spectrum of oxidized product of guaiacol

S8. Table S1: Data pertinent to the literature reported copper phosphate nanoflower based peroxidase mimics

	Oxidation of 3,3,5,5-tetramethylbenzidine (TMB)				
Sr. no	Composite bybrid	Size (µm)	Reaction conditions	Reaction time (min)	Reference
1	ChOx@HRP hybrid nanoflowers	20	PBS buffer, pH=7.4, 37°C	10	*J. Nanosci. Nanotechnol.* 2018, **18**, 6555–6561
2	AuNPs@PMo12 Nanohybrid	19.8	pH=3, 37°C	5	*RSC Adv.*, 2020, **10**, 35949–35956
3	GOx@$Mn_3(PO_4)_2$ hybrid	NA	20 mM KMnO4 & 1mM H2O2,	30	*RSC Adv.*, 2019, **9**, 1889–1894
4	Calix[4]arene conjugate @CuPNF	8-12	PBS (10 mM, pH 5.0), 0.1mM H_2O_2, 37°C	10	***Present study***
	***Oxidation of ortho-phenylenediamine* (OPD)**				
5	Pyrenyl@CuPNF	93	H_2O_2 =50 mM, PBS at pH=7.4, 37°C	30	*J. Mater. Chem. B*, 2021, **9**, 3523–3532
6	POM-Calix hybrid	40	100mM H_2O_2, 37°C	15	*Inorg. Chim. Acta*, 2018, **483**, 337–342
7	RuNPs		3mM H_2O_2, PBS=7.4, 37°C	35	*RSC Adv.*, 2017, **7**,52210–52217
8	Calix[4]arene conjugate @CuPNF	8-12	PBS (10 mM, pH 5.0), 0.1mM H_2O_2, 37°C	25	***Present study***
	Oxidation of Guaiacol				
9	LPO–Copper phosphate HNFs	15	22 mM H2O2, PBS (pH 4, 0.1 M KH_2PO_4, 25 °C)	60	*Int. J. Biol. Macromol.*, 2016, **84**, 402–409
10	HRP–Cu^{2+} hybrid nanoflowers	10	22 mM H2O2, pH 6.8, 0.1 M KH_2PO4,25°C	45	*Dalton Trans.*, 2015, **44**, 13845–13852
11	Amino acid-copper hybrid nanoflowers	09	22 mM H2O2, PBS, pH 7, 35°C	130	*Chem Biodivers*. 2023, **20(8)**, e202300743
12	Calix[4]arene conjugate @CuPNF	8-12 µm	PBS (10 mM, pH 5.0), 0.1mM H_2O_2, 37°C	50 min	***Present study***

S9. UV-Visible spectra of peroxidase mimetic activity of different substates with copper precursors

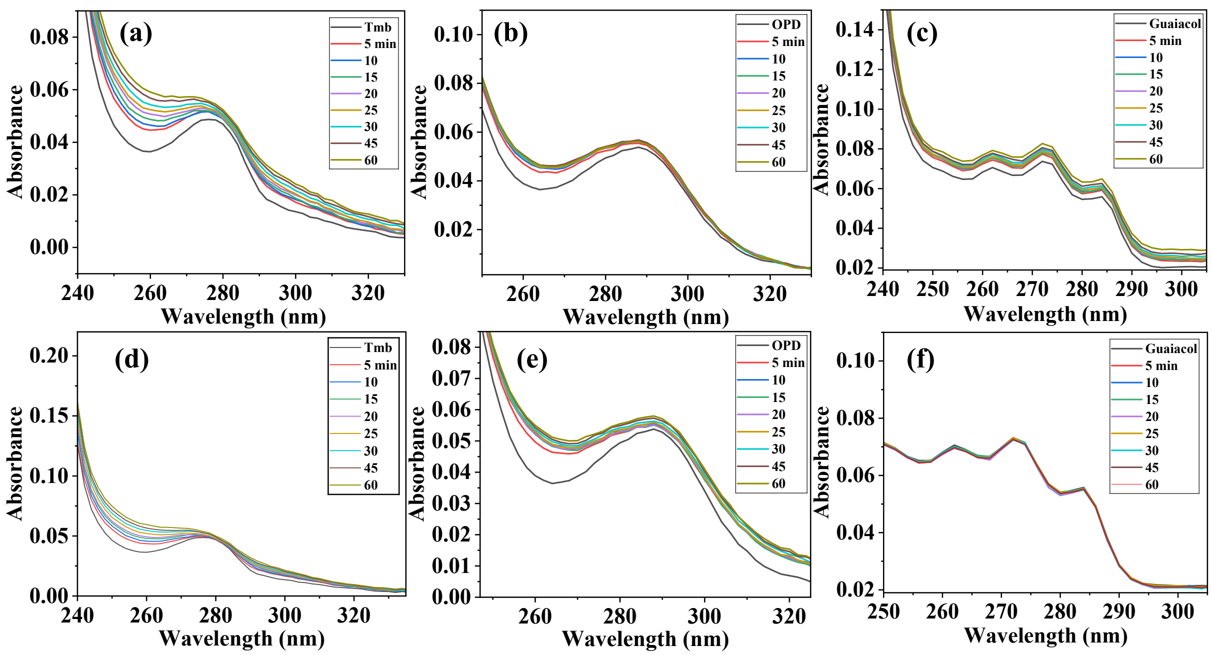


Fig. S9. UV-Visible spectra of peroxidase mimetic activity of (a) TMB, (b) OPD and (c) Guaiacol with $CuSO_4$ and (d) TMB (e) OPD and (f) Guaiacol with $Cu(acac)_2$ in the presence of H_2O_2 at different time intervals in PBS buffer (10 mM, pH 5.0).