Electronic supplementary information (ESI)

Nanoclay-based sensor composite for facile detection of molecular antioxidants

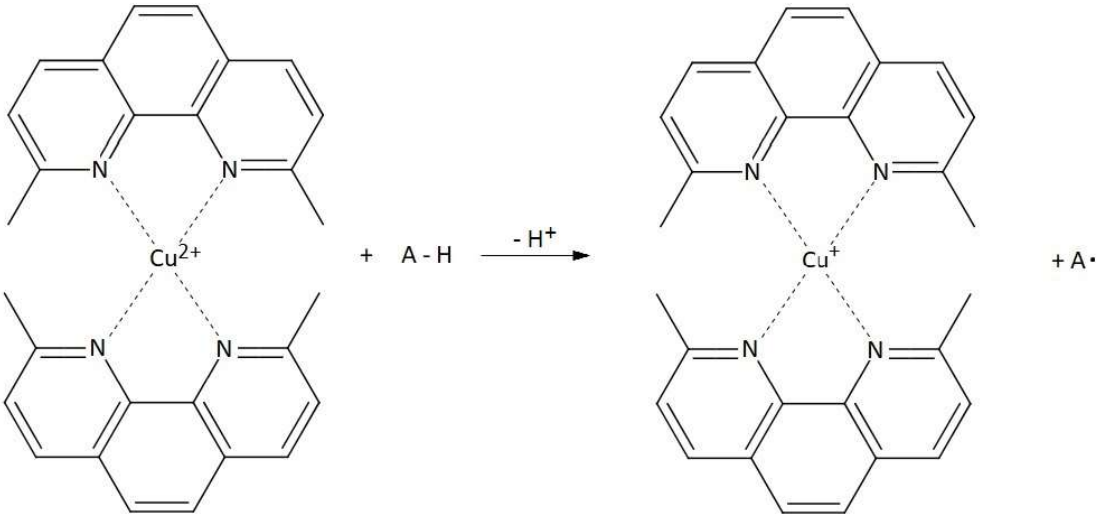
Adél Szerlauth,[ab] Lilla Szalma,[b] Szabolcs Muráth,[ab] Szilárd Sáringer,[ab] Gábor Varga,[a] Li Li,[c] and István Szilágyi*[ab]

[a]*MTA-SZTE Lendület Biocolloids Research Group, University of Szeged, H-6720 Szeged, Hungary*

[b]*Department of Physical Chemistry and Materials Science, University of Szeged, H-6720 Szeged, Hungary*

[c]*Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, Brisbane, QLD-4072, Australia*

*Corresponding author: szistvan@chem.u-szeged.hu (IS)



Scheme S1. Generic reaction scheme between $Cu(Nc)_2$ and antioxidants.

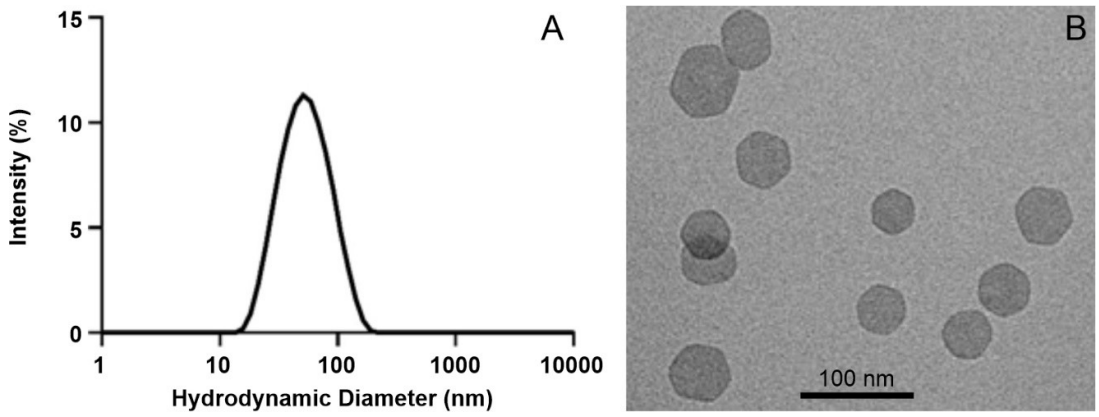


Fig. S1 The size and morphology of dLDH nanosheets: the particle size distribution (A) and the TEM image (B).

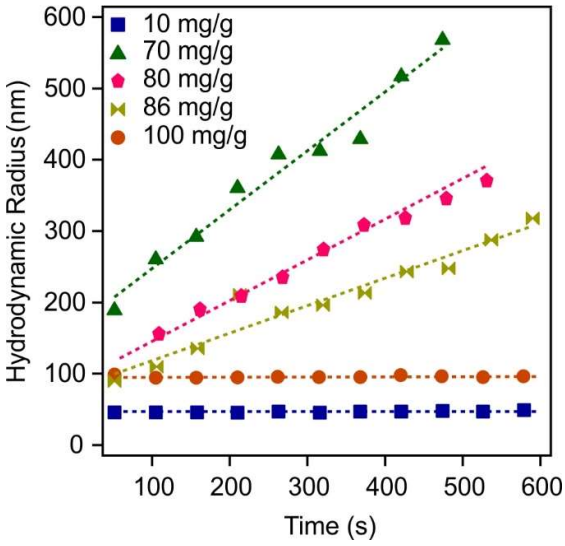


Fig. S2 Hydrodynamic radius versus time at different NaAlg doses and constant dLDH concentrations at 1 mM ionic strength and pH 9.

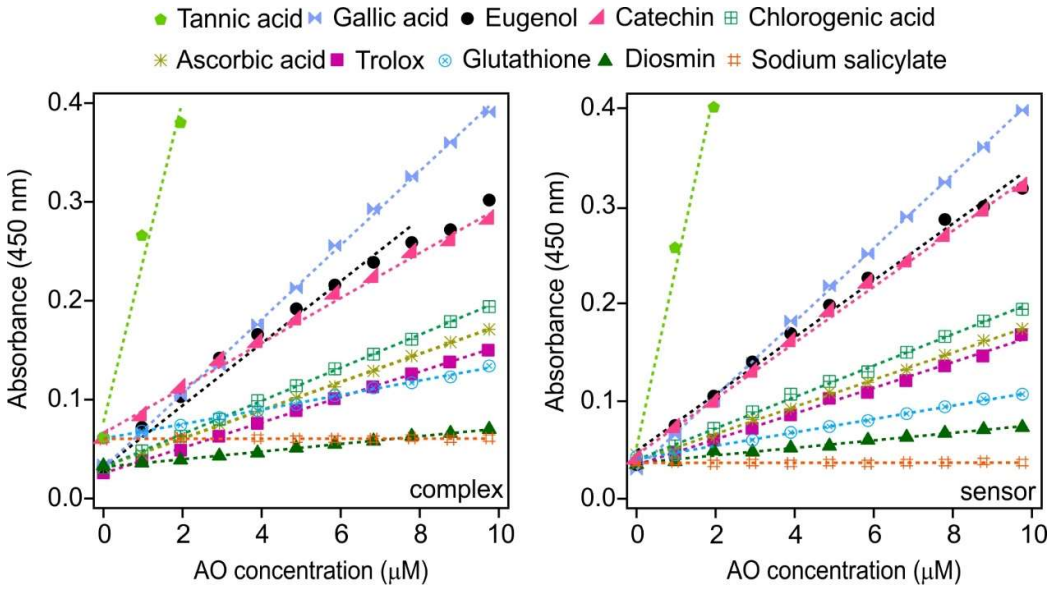


Fig. S3 Concentration dependent absorbance values measured with different antioxidants.

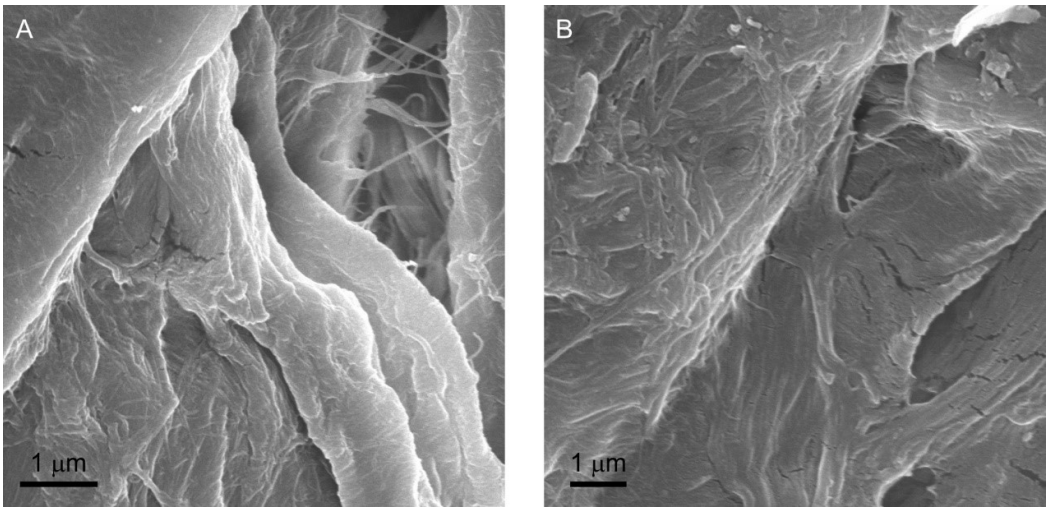


Fig. S4 SEM image of the paper (A) and P-Cu(Nc)$_2$ (B).

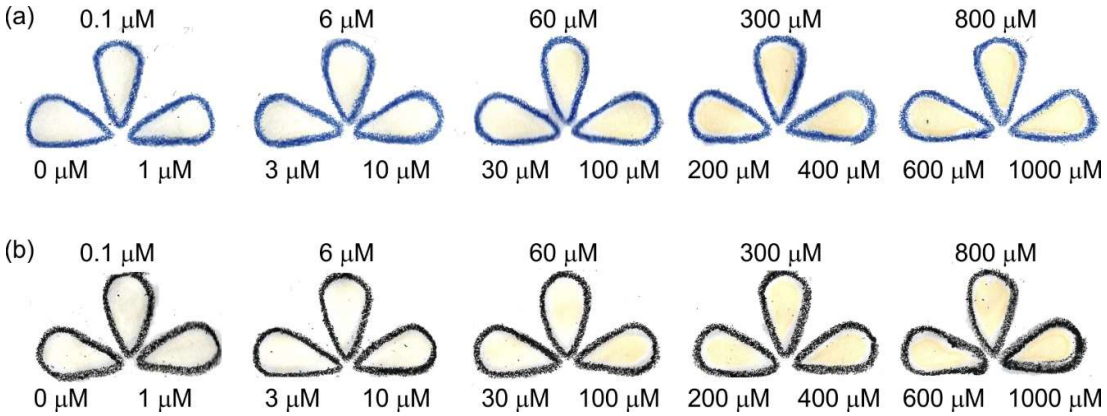


Fig. S5 Photos of paper-based sensors after the measurements of the ascorbic acid contents with P-Cu(Nc)$_2$ (a) and P-dLDH-Alg-Cu(Nc)$_2$ (b).

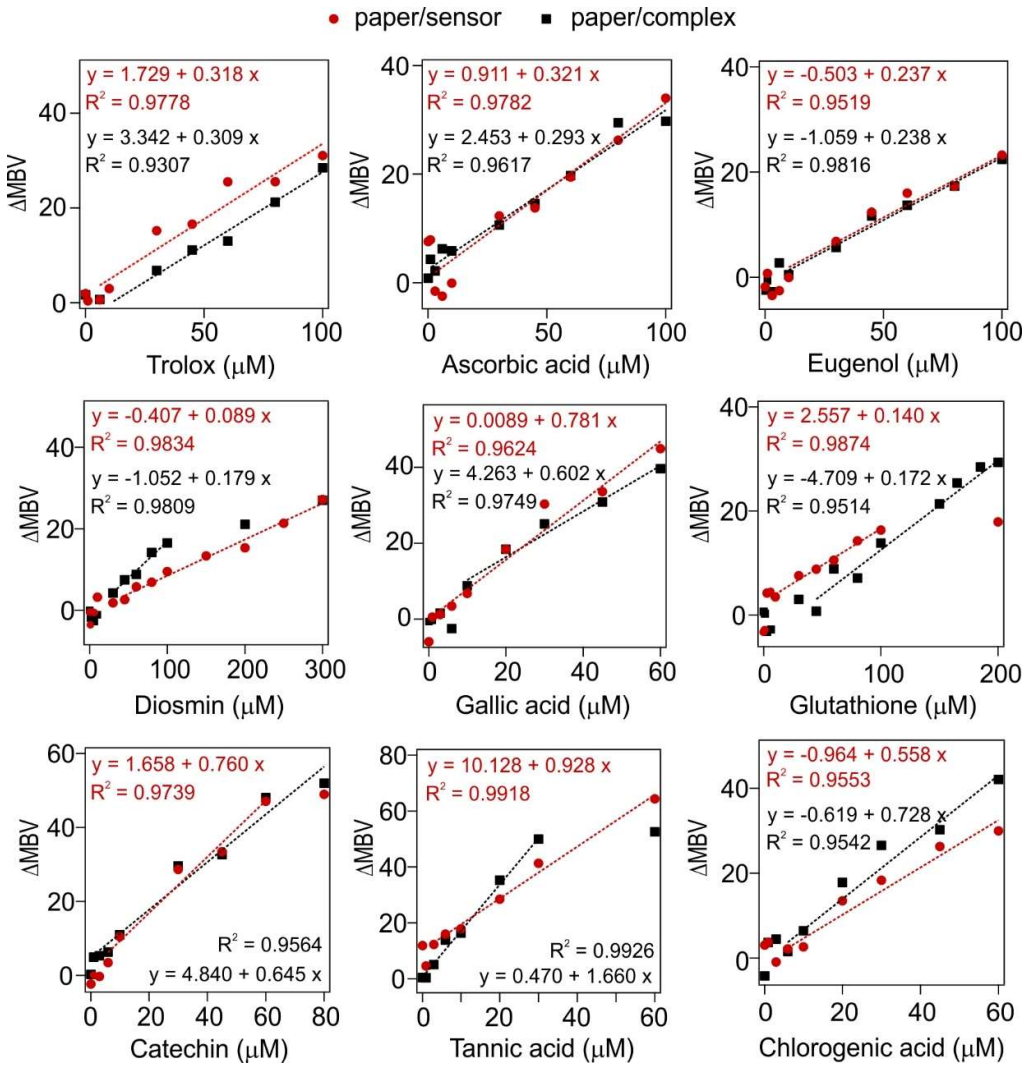


Fig. S6 Calibration curves for different antioxidants. The equations of the fitted lines and the confidence intervals are shown on the graphs. P-Cu(Nc)$_2$:paper/complex and P-dLDH-Alg-Cu(Nc)$_2$: paper/sensor.

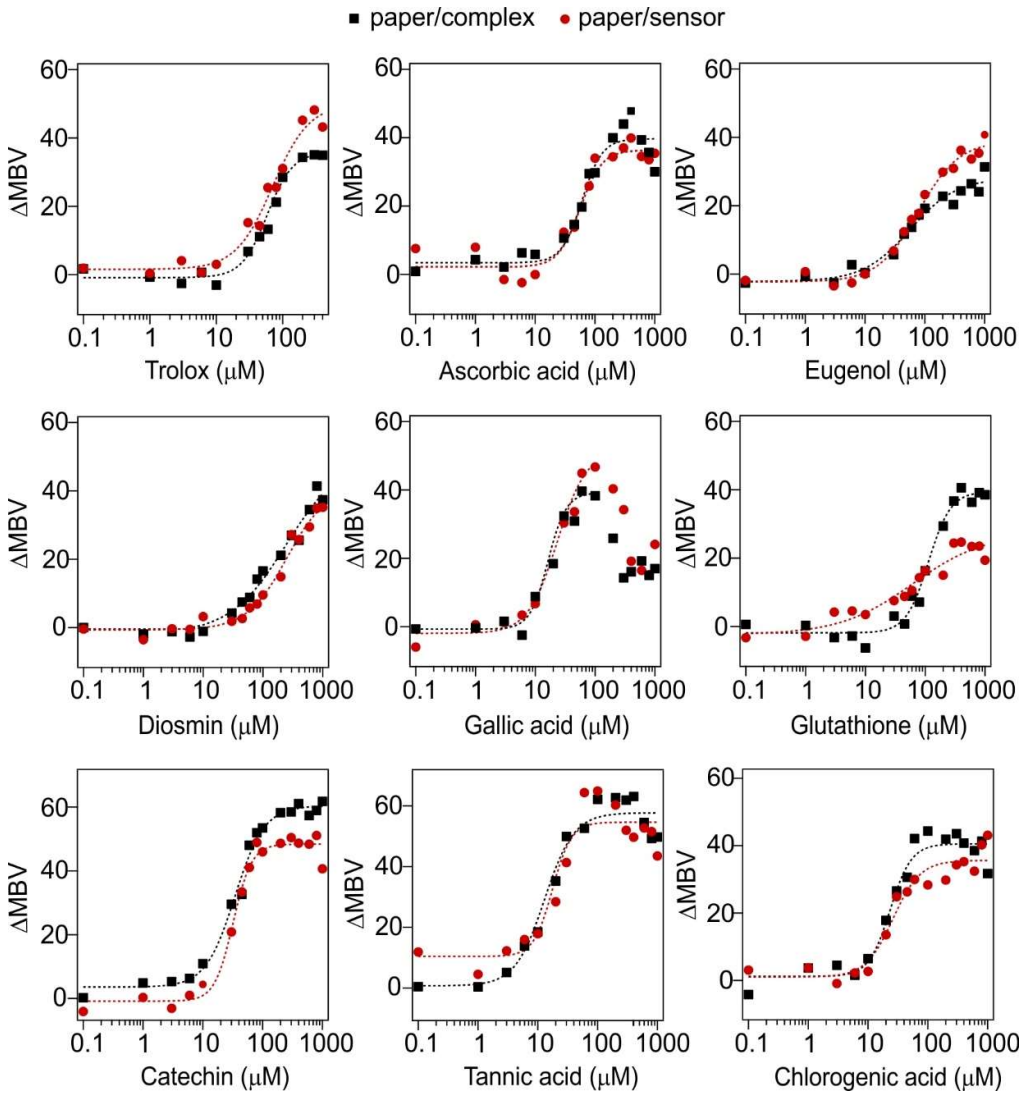
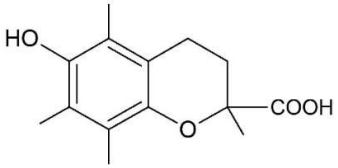
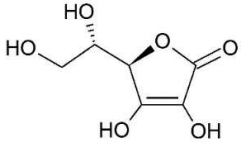
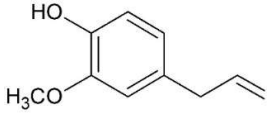


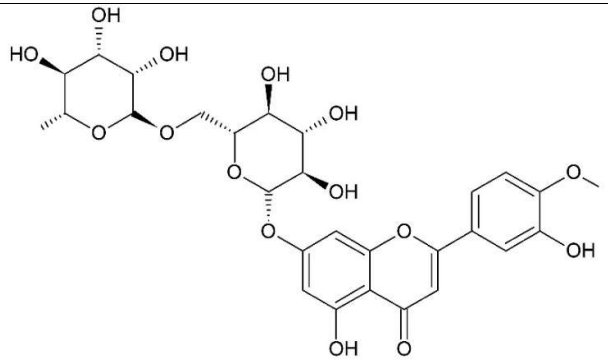
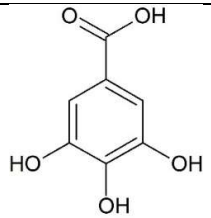
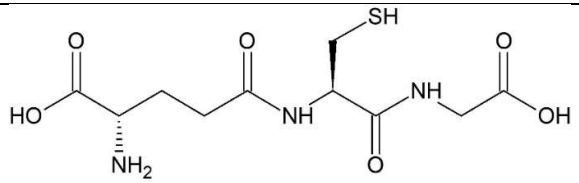
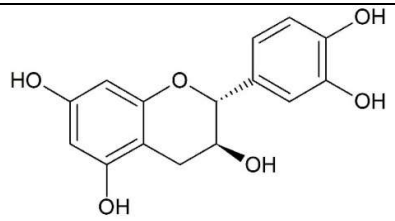
Fig. S7 Experimental ΔMBV data fitted with Hill equations (dotted lines) for the different antioxidants. P-Cu(Nc)$_2$:paper/complex and P-dLDH-Alg-Cu(Nc)$_2$: paper/sensor.

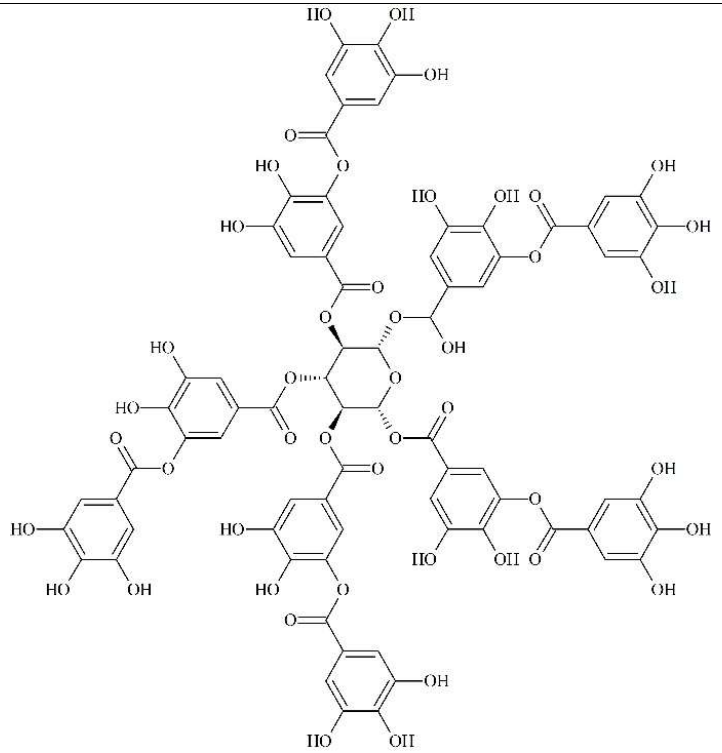
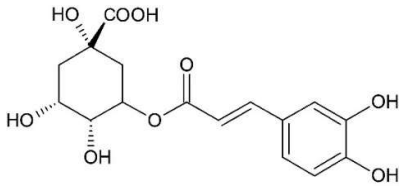
Table S1 Identified Raman bands and their assignments. (ν: stretching vibration, δ: bending vibration and β: (special) bending mode vibration of water).

Raman shift (cm^{-1})	Assignment	Sample
1095	ν (COC), ν (CH)	paper, P-dLDH
1309	δ (HCO), δ (HCC)	paper, P-dLDH, P-$Cu(Nc)_2$, P-dLDH-Alg-$Cu(Nc)_2$
1404 and ~ 1580	ν (C=C) [aromatic ring]	$Cu(Nc)_2$, P-$Cu(Nc)_2$, P-dLDH-Alg-$Cu(Nc)_2$
1609	β (OH)	P-dLDH
~ 2900	ν (CH), ν (CH_2)	paper, P-dLDH, P-$Cu(Nc)_2$, P-dLDH-Alg-$Cu(Nc)_2$

Table S2 The structure, TEAC, LOD and linear range of investigated antioxidants.

Antioxidant	Structure	TEAC P-Cu(Nc)$_2$	TEAC P-dLDH-Alg-Cu(Nc)$_2$	LOD P-Cu(Nc)$_2$ [μM]	LOD P-dLDH-Alg-Cu(Nc) [μM]	Linear range P-Cu(Nc)$_2$ [μM]	Linear range P-dLDH-Alg-Cu(Nc) [μM]
Trolox		1	1	42	39	45-100	40-100
Ascorbic acid		0.97	1.25	72	48	80-100	60-100
Eugenol		1.04	0.90	65	59	80-100	65-100

Diosmin		0.24	0.28	65	124	65-100	150-300
Gallic acid		3.59	3.04	29	18	30-60	20-60
Glutathione		0.52	1.14	146	79	150-200	80-100
Catechin		1.70	2.20	16	10	20-60	10-60

Tannic acid		4.52	4.01	15	1	30-60	3-60
Chlorogenic acid		2.51	2.70	31	16	35-60	20-60

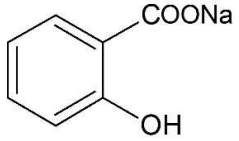
Sodium salicylate		-	-	-	-	-	-

Table S3 Comparison of antioxidant detection methods

Method	Antioxidants	Properties	Reference
Colorimetric assay based on etching of gold nanorods	Ascorbic acid, tannic acid, ferulic acid	Linear range: 0.4-116.7 μM LOD: 0.3-2.3 μM	1
Nafion membrane modified by ferric-*o*-phenantroline	Caffeic acid, ferulic acid, catechin, gallic acid, quercetin, rutin, rosmarinic acid, ascorbic acid, uric acid, α-tocopherol, bilirubin, glutathione, cysteine, homocysteine	Linear range: 0.46-104.8 μM LOD (for trolox): 0.26 μM	2
Paper based CuPRAC assay	Gallic acid, vanillic acid, ascorbic acid, caffeic acid	Linear range: 0.5-70 mM LOD: 0.5-1.2 mM	3
CuPRAC based electrochemical sensor	Trolox, ascorbic acid, gallic acid	Linear range: 62-770 μM LOD (for trolox): 62.9 μM	4
Paper and 3D printed antioxidant sensor based on CeO_2 nanoparticles	Vanillic acid, ascorbic acid, trolox, quercetin, ellagic acid, ferulic acid	Linear range: 2-500 μM LOD: 9-32 μM	5

Functionalized paper by dLDH particles	Trolox, ascorbic acid, eugenol, diosmin, gallic acid, glutathione, catechin, tannic acid, chlorogenic acid, sodium salycilate	Linear range: 3-300 μM LOD: 1-146 μM	This work

References

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