Support Information

Laser-Induced Graphene Electrochemical Sensors: An Emerging Platform for Agri-Food and Environmental Detection

Xinyang Cui [1, 2], Tingting Gu [1,*], Kexin Ma [1], Jiwu Zeng [2,*] and Hongqi Xia [2,*]

[1] School of Chemical Engineering, University of Science and Technology Liaoning, Anshan 114051, China;

cuixinyang0327@163.com (X.C.); mkx1987699987@163.com (K.M.)

[2] Key Laboratory of South Subtropical Fruit Biology and Genetic Resource Utilization (MARA),

Guangdong Provincial Key Laboratory of Science and Technology Research on Fruit Tree,

Institute of Fruit Tree Research, Guangdong Academy of Agricultural Sciences, Guangzhou 510640, China

* Correspondence: gutingting@ustl.edu.cn (T.G.); zengjiwu@163.com (J.Z.); xiahongqi@gdaas.cn (H.X.)

Table S1 Typical examples of laser-induced graphene (LIG) based electrochemical sensors for agri-food and environmental detection

Precursor	Parameters	Modification	Analyte	Linear range	LOD	Sensitivity	Real sample	Recovery	Reference mothed	ref
PI	10.6 μm/9.2 W/30 mm s^{-1}	bare	Pb^{2+}	1–5 μg L^{-1} 10–100 μg L^{-1}	0.5 μg L^{-1}	0.1772 μA $μg^{-1}$ L 0.7081 μA $μg^{-1}$ L	pond water	/	/	[1]
PI	10.6 μm/6 W/160 mm s^{-1}	bare	paraquat	0.5–35 μM	0.54 μM	46.6 μA $μM^{-1}$ cm^{-2}	tap water	96.6%	/	[2]
PI	10.6 μm/ 4.5W/15 cm s^{-1}	bare	salicylic acid	10–1000 μM	8.2 μM	82.3 nA $μM^{-1}·cm^{-2}$	persea americana Hass	/	/	[3]
PI	10.6 μm/3.12 W /100 mm s^{-1}	bare	glyphosate	50–1000 μM	5.94 μM	/	drinking water	/	/	[4]

PI	5.225W/ 0.5 cm s^{-1}	bare	salicylic acid	0.5 μM–500 μM	0.16 μM	10.99 μA $μM^{-1}$	lettuce and watermelon	lettuce: 99.60%–100.63% watermelon: 97.07%– 100.80%	artificial neural network and least squares support vector machine	[5]
PI	6.4 W/30 cm s^{-1}	bare	Cd^{2+}, Pb^{2+}	Cd^{2+}:25–1000 ppb Pb^{2+}: 10–500 ppb	Cd^{2+}: 6.13 ppb Pb^{2+}: 2.96 ppb	Cd^{2+}: 0.45 μA ppb^{-1} cm^{-2} Pb^{2+}: 0.93 μA ppb^{-1} cm^{-2}	ore, tap water	/	/	[6]
PI	405 nm/2.1W	bare	naringin hesperidin	50 nM–100 μM	naringin: 11 nM hesperidin: 15 nM	naringin: 0.019 μA $μM^{-1}$ hesperidin: 0.014 μA $μM^{-1}$	extract of citrus grandis "Tomentosa"	naringin: 98.7%–108.7% hesperidin: 93.0%–103.7%	/	[7]

PI	450 nm/4.42 W /0.5 cm s^{-1}	bare	sulfadimidine	3–110 μM	0.03 μM	/	beef, milk	beef: 93.34%–103.70% milk: 98.50%–100.80%	SPE and GCE	[8]
PEEK	3 W	bare	polymethoxylated flavones	5–100	PMFs: 0.1 μM hesperidin: 1.7 μM	PMFs: 2.36 mA cm^{-2} mM^{-1} hesperidin: 0.17 mA cm^{-2} mM^{-1}	*Citri Reticulatae* Pericarpium	PMFs: 91%–107% hesperidin:90%–99%	HPLC	[9]
PI	3.2 W	Fe	salicylic acid	0–400 μM	0.27 μM	1.98 nA $μM^{-1}$	plant samples under salt stress	96%–106%	HPLC	[10]
PI	/	Pt	clenbuterol hydrochloride	0.1–820.9 μM	0.072 μM	0.2383 μA $μM^{-2}$	beef	93.80%–97.00%	/	[11]
PI	355	Ag NPs	formaldehyde	0–500 μM	0.275 μg	0.363μA	/	92.9%–103.5%	/	[12]

	nm/2.5W/10 ms				mL^{-1}	μM^{-1} cm^{-2}				
PI	10.6 μm	AuNPs	organophosphorus residues	3–4000 ng mL^{-1}	1.2 ng mL^{-1}	/	pakchoi	99%–105%	/	[13]
PI	10.6 μm/9 W/19.5 cm s^{-1}	Bi^{3+}	Al^{3+}	one-time measurements: 1.07–300 ppm incremental measurements: 1.76–100 ppm	0.34 ppm	/	soil	/	potentiometric titration, ICP-OES, and flame atomic absorption	[14]
PI	10.6 μm	Ag-$La(OH)_3$@Dy_2O_3	tartrazine	0.1–2 μM	0.96 nM	4.23×10^{-4} A μM^{-1} cm^{-2}	river water, snacks, milk, and isotonic drinks	96%–104%	/	[15]

PI	3.5 W	MoS_2 $MoSe_2$	glyphosate	10–90 μM	MoS_2/LIG: 4.0 μM $MoSe_2$/LIG: 6.1 μM	MoS_2/LIG: 47.0 nA μM^{-1} $MoSe_2$/LIG: 22.8 nA μM^{-1}	canned pinto beans and soybeans	MoS_2/LIG: 86.3%–111.1% $MoSe_2$/LIG: 79.3–98.8%	LC-MS	[16]
PI	/	NiCo-LDH	glucose	0.5–270 μM 0.27–3.6 mM	0.05 μM	9.750 μA μM^{-1} cm^{-2} (0.5–270 μM) 3.760 μA μM^{-1} cm^{-2} (0.27–3.6 mM)	coffee drinks, milk, tea, cola, orange juice, vitamin drinks, and honey	96.0%–102.0%	UV-Vis	[17]
PI	6 W/2 mm s^{-1}	$Ti_3C_2T_x$	benomyl	10–6000 nM	5.8 nM	169.9 μA μM^{-1} cm^{-2}	apple, pear, mushroom, environmen	91.6%–108.0%	/	[18]

							tal water			
PET	405 nm/400 mW	AgNPs	carbosulfan	0.01–10 mg kg^{-1}	0.005 mg kg^{-1}	/	apple, orange, rice	90%–105%	/	[19]
PI	405 nm/2 W	MWCNT-PANI	4-aminophenol	0.1–55 μM	0.006 μM	46.6 μA μM^{-1} cm^{-2}	tap water paracetamol tablet	tap water: 96.40%–98.17% paracetamol tablet: 100.63%–105.41%	/	[20]
PI	405 nm/2 W /50 mm s^{-1}	f-MWCNT/AuNPs	NO^{2-}	10–140 μM	0.9 μM	/	real water	90.76%–96.15%	/	[21]
PI	450 nm/1.54 W/	GOx	glucose	0–8 mM	0.431 mM	43.15 μA mM^{-1} cm^{-2}	/	96.0%–102.0%		[22]
PI	3 W	Salmonella antibodies	salmonella enterica serovar typhimurium	25–10^5 CFU mL^{-1}	13±7 CFU mL^{-1}	24 Ω log CFU^{-1} mL	chicken broth	/	/	[23]
PI	50.8 cm/s	PDA	atenolol	100–800 μM	80 μM	0.020±0.04 μA μM^{-1}	/	/	/	[24]
PI	355 nm	PEDOT	SCN^{-}	10–300 μM	0.52 μM	3.06 μA	milk and	96.2%–105.5%	/	[25]

						μM^{-1} cm^{-2}	artificial saliva			
PI	/	ampter/nPt	listeria monocytogenes	1–10^5 CFU/10 mL	10 CFU 10 mL^{-1}	154 mF log CFU^{-1} mL	hydroponic water (lettuce)	/	/	[26]
PI	3.6 W/20 cm s^{-1}	OPH/AuNPs	methyl parathion	20–500 μM	0.01 μM	2.13 nA/lg (μM)	spinach and apple	/	/	[27]
PI	2.5 W/200 mm s^{-1}	AuNPs-pPy-Chi	ascorbic acid	0.25–5.00 mM 5.00–25.00 mM	0.22 mmol L^{-1}	/	orange juice	97%–109.1%	standard spectrophotometric method	[28]
PI	405 nm/1 W/20 ms	solid contact ion selective membranes	NH_4^+, NO_3^-	10^{-5}–10^{-1} M	NH_4^+: 28.2±25.0 μmol L^{-1} NO_3^-: 20.6±14.8 μmol L^{-1}	NH_4^+: 55.2±3.6 mV/decade NO_3^-: −53.4±1.1 mV/decad	soil	NH_4^+: 96% NO_3^-: 95%	commercial NO_3^- or NH_4^+ electrodes	[29]

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SPE, screen print electrode; GCE, glassy carbon electrode; HPLC, high-performance liquid chromatograph; ICP-OES, inductively coupled plasma-optical emission spectrometry; LC-MS, liquid chromatography coupled with mass spectrometry; UV-Vis: Ultraviolet-Visible Spectroscopy.

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