Electronic Supplementary Material (ESI) for RSC Advances.

Electrochemical depolymerization of lignin into renewable aromatic compounds in a non-diaphragm electrolytic cell

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Supplementary Information

The low molecular weight depolymerization products of lignin extracted by diethyl ether were identified by GC-MS (shown in Fig. S1 and Table S1).

The depolymerization products in aqueous phase were confirmed by ESI-MS/MS (shown in Fig. S2 and Table S2).

The yields of products in aqueous phase were further confirmed by UV spectrophotometry (shown in Fig. S3, Fig. S4 and Fig. S5)

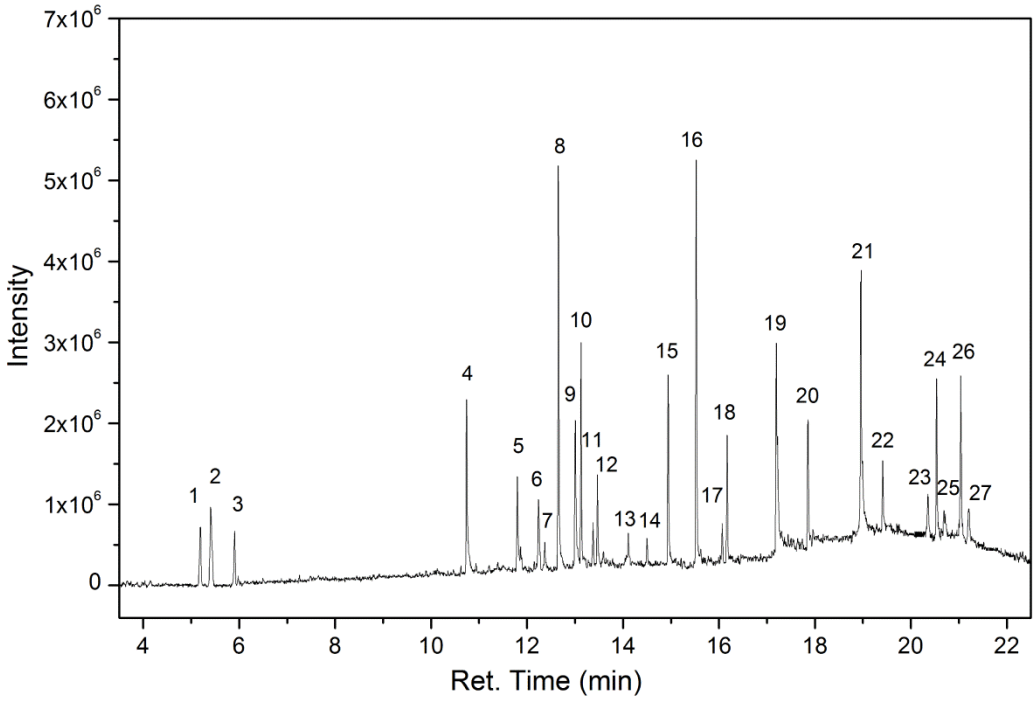
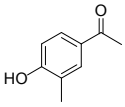
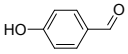
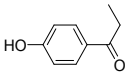
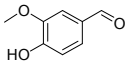
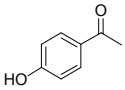
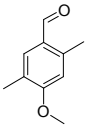
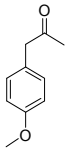
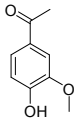
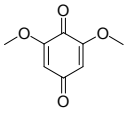
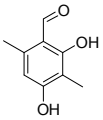
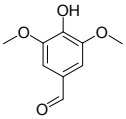
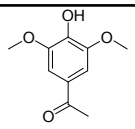
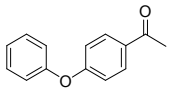
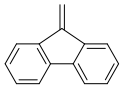
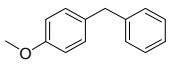
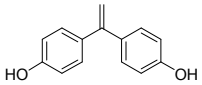
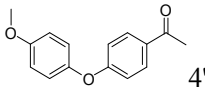
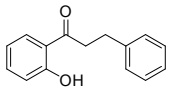
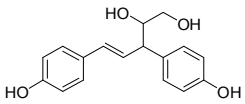
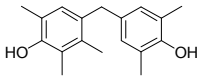
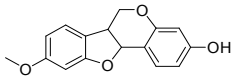
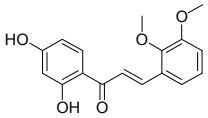
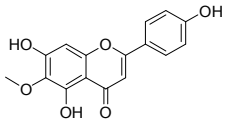


Fig. S1 The GC-MS ion chromatograms of the ether extractives

Table S1 Compounds and their relative contents in the ether extractives after lignin depolymerization

No	The compounds	Relative content (%)
1	 Ethyl benzene	2.33
2	 *o*-Dimethyl benzene	4.34
3	 *m*-Dimethyl benzene	1.90
4	 2,3-Dihydro-benzofuran	6.35
5	 4-Hydroxy-3-methylacetophenone	2.99
6	 4-Hydroxy-benzaldehyde	3.21
7	 4'-Hydroxypropiophenone	0.55
8	 Vanillin	12.36
9	 4'-Hydroxy-acetophenone	5.02
10	 2,5-Dimethyl-*p*-anisaldehyde	5.43
11	 4-Methoxy-phenylacetone	0.85
12	 3'-Methoxy-4'-hydroxyacetophenone	2.32
13	 2,6-Dimethoxy-1,4-benzoquinone	0.44
14	 2,4-Dihydroxy-3,6-dimethylbenzaldehyde	0.51
15	 Syringaldehyde	4.89

16		Acetosyringone	10.89
17		4-Phenoxyacetophenone	0.97
18		9-Methylene-9H-fluorene	3.50
19		4-Methoxydiphenylmethane	1.49
20		4,4'-Ethylidenediphenol	3.94
21		4'-(4-Methoxyphenoxy)acetophenone	9.26
22		1-(2-Hydroxyphenyl)-3-phenyl-1-propanone	1.65
23		(2S,3S,4E)-3,5-Bis(4-hydroxyphenyl)-4-pentene-1,2-diol	0.97
24		4-(4-Hydroxy-2,3,5-trimethylphenylmethyl)-2,6-dimethylphenol	5.86
25		3-Hydroxy-9-methoxypterocarpan	0.73
26		2,3-Dimethoxy-2',4'-dihydroxychalcone	5.80
27		5,7-Dihydroxy-2-(4-hydroxyphenyl)-6-methoxy-4H-1-benzopyran-4-one	1.48

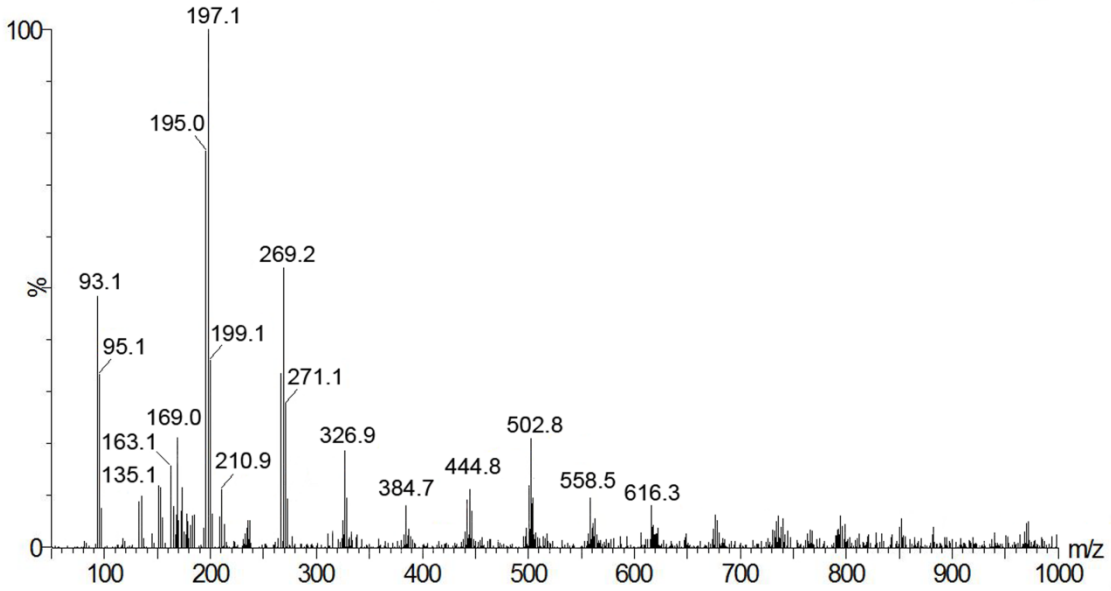
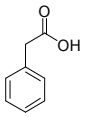
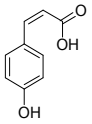
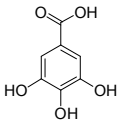
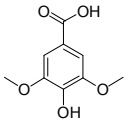
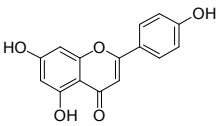


Fig. S2 Negative mode ESI-MS/MS spectra of compounds in aqueous phase

Table S2 Results of ionisation and identification of the compounds in aqueous phase by ESI-MS/MS in negative ionisation mode (acidic conditions, infusion)

Molecular ions (m/z) $[M-H]^-$	Fragment ions (m/z) and the cleavage pathway	Structures and names
93		 Phenol
135	91 [M-H-CO_2] 44	 Phenylacetic acid
163	119 [M-H-CO_2] 44 93 [M-H-CO_2-CH= CH] 70	 p-Coumaric acid
169	125 [M- H-CO_2] 44 107 [M-H-CO_2-H_2O] 62 97 [M-H-CO_2-CO] 72	 Gallic acid
197	182 [M-H-CH_3] 15 167 [M-H-2CH_3] [M-H-OCH_2] 30 153 [M-H-CO_2] 44 123 [M- H- 2CH_3- CO_2][M- H- OCH_2- CO_2] 74 121 [M-H-CH_3-CO_2-OH] 76	 Syringic acid
269	241 [M-H- CO] 28 225 [M-H- CO_2] 44 201 [M-H- C_3O_2] 68 151 [M-H-CH=C-benzene-OH] 118 107 [M-H-CO_2-CH=C-benzene-OH] 118	 Apigenin

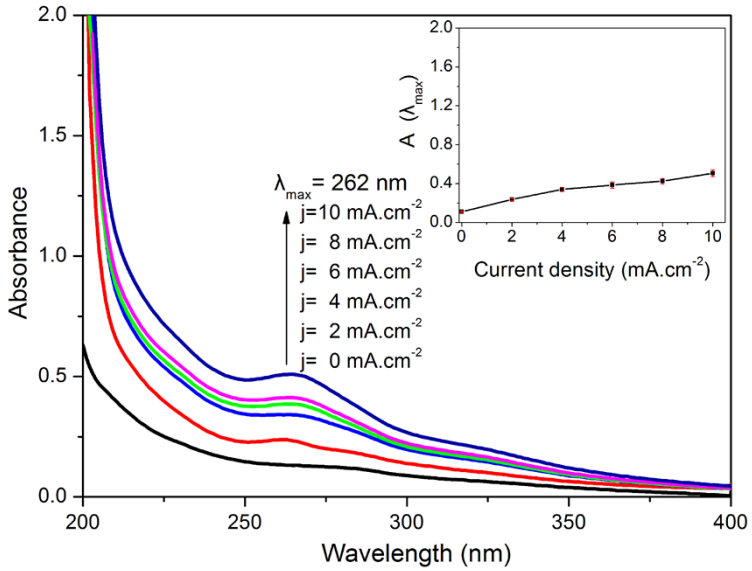


Fig. S3 UV spectra of the aqueous phase after electrolysis in different current density (electrolysis conditions: room temperature, time =1h, 2 wt% lignin in 1 mol L^{-1} NaOH)

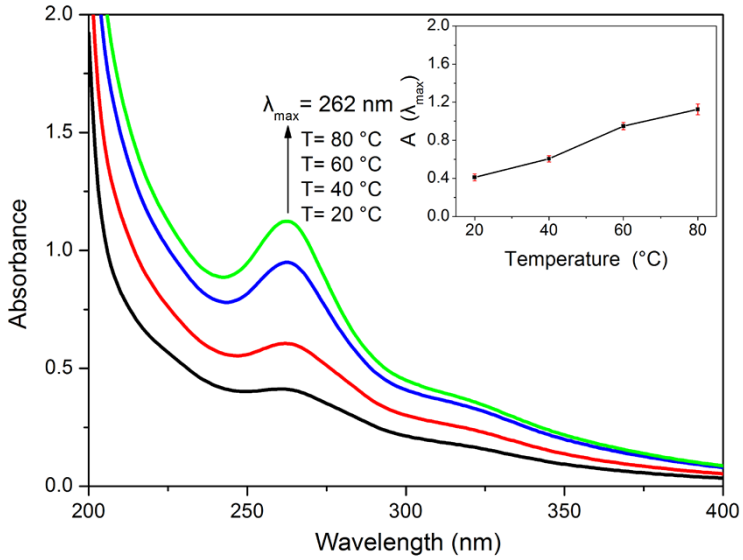


Fig. S4 UV spectra of the aqueous phase after electrolysis in different temperature (electrolysis conditions: current density j=8mA cm^{-2}, time =1h, 2 wt% lignin in 1 mol L^{-1} NaOH)

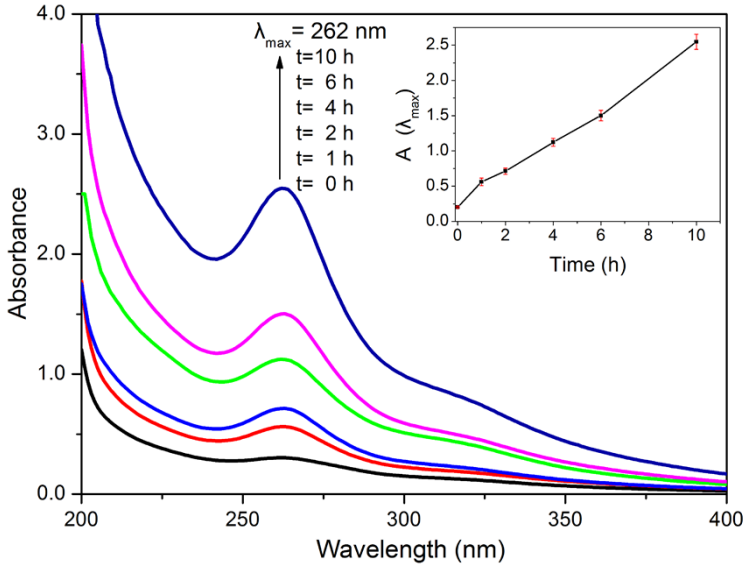


Fig. S5 UV spectra of the aqueous phase after electrolysis in different time (electrolysis conditions: room temperature, current density j=8mA cm^{-2}, 2 wt% lignin in 1 mol L^{-1} NaOH)