Supporting information for

Unraveling the complexity of complex mixtures by combining high-resolution pharmacological, analytical and spectroscopic techniques: Antidiabetic constituents in Chinese medicinal plants

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Figure S19. IC_{50} curves of isolates and Acarbose (reference compound) in the α-glucosidase inhibition assays.

Figure S20. IC_{50} curves of isolates and RK682 (reference compound) in the PTP1B inhibition assays.

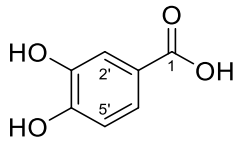
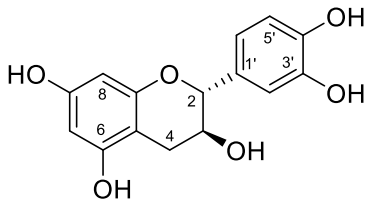
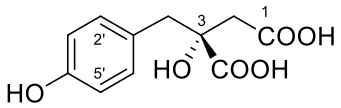
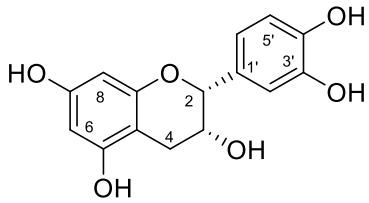
Table S1. Plants tested for α-glucosidase, α-amylase and PTP1B inhibitory activity at a single concentration of 50 μg/mL.

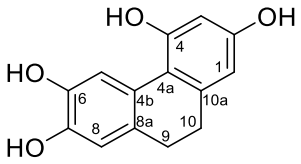
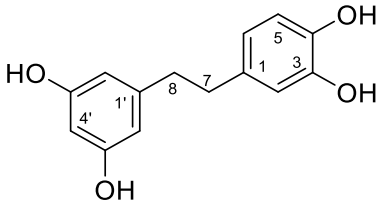
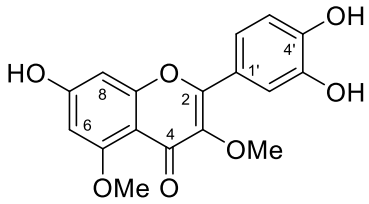
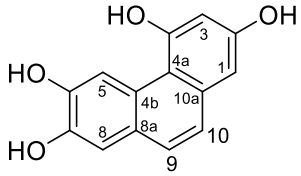
No.	Plant	Botanical family	Part used	Voucher specimen #	% inhibition at 50 μg/mL[a]		
					AGH	AM	PTP1B
1	*Rhus chinensis* Mill.	Anacardiaceae	Root	zyc003	2.3	6.4	95.5
2	*Oenanthe javanica* (Bl.) DC.	Apiaceae	Seed	hch109	-2.5	5.8	78.0
3	*Oenanthe javanica* (Bl.) DC.	Apiaceae	Whole plant	zyc022	-1.6	4.5	92.9
4	*Ligusticum striatum* DC.	Apiaceae	Rhizome	hch114	33.2	8.4	42.9
5	*Rauvolfia verticillata* (Lour.) Baill.	Apocynaceae	Root	zyc054	20.6	6.3	28.9
6	*Amorphophallus rivieri* Durieu ex Riviere	Araceae	Tuber	zyc111	27.7	5.3	75.6
7	*Pinellia ternata* (Thunb.) Breit.	Araceae	Rhizome	zyc092	-2.1	3.6	88.1
8	*Ophiopogon japonicus* (Thunb.) Ker Gawl.	Asparagaceae	Tuber	hch104	-0.9	25.9	42.3
9	*Anemarrhena asphodeloides* Bunge.	Asparagaceae	Rhizome	hch111	51.5	8.7	82.8
10	*Taraxacum mongolicum* Hand.-Mazz.	Asteraceae	Whole plant	zyc203	4.2	6.8	52.7
11	*Senecio scandens* Buch.-Ham.	Asteraceae	Whole plant	zyc182	17.4	8.2	86.0
12	*Siegesbeckia orientalis* L.	Asteraceae	Whole plant	zyc202	18.9	7.2	89.5
13	*Bidens bipinnata* L.	Asteraceae	Whole plant	zyc184	23.3	3.2	105.8
14	*Bidens pilosa* L.	Asteraceae	Whole plant	zyc184	28.0	17.1	102.5
15	*Commelina communis* L.	Commelinaceae	Whole plant	zyc235	8.2	3.3	91.6
16	*Cornus officinalis* Siebold & Zucc.	Cornaceae	Fruit	hch112	14.2	6.0	73.3
17	*Sedum erythrostictum* Miq.	Crassulaceae	Whole plant	zyc263	61.9	10.3	87.8
18	*Trichosanthes kirilowii* Maxim.	Cucurbitaceae	Root	hch107	2.7	2.6	24.9
19	*Dioscorea oppositifolia* L.	Dioscoreaceae	Rhizome	hch103	5.7	6.2	3.8
20	*Dioscorea bulbifera* L.	Dioscoreaceae	Rhizome	zyc040	94.3	16.8	78.2
21	*Eucommia ulmoides* Oliv.	Eucommiaceae	Bark	hch113	5.8	0.8	73.1
22	*Phyllanthus urinaria* L.	Euphorbiaceae	Whole plant	zyc268	37.3	5.2	105.1
23	*Ocimum basilicum* L.	Lamiaceae	Whole plant	zyc118	53.2	7.5	78.9
24	*Prunella vulgaris* L.	Lamiaceae	Whole plant	zyc125	53.0	2.4	102.1
25	*Tinospora sagittata* Gagnep.	Menispermaceae	Rhizome	zyc145	83.8	4.5	67.1
26	*Melastoma dodecandrum* Roxb.	Melastomataceae	Whole plant	zyc175	39.6	23.4	96.1
27	*Cistanche deserticola* Y.C.Ma	Orobanchaceae	Rhizome	hch102	-0.5	5.6	12.6
28	*Zea mays* L.	Poaceae	Stigmas and style	hch108	23.8	4.1	82.7
29	*Lophatherum gracile* Brongn.	Poaceae	Leaves	hch110	1.1	4.1	81.3
30	*Reynoutria multiflora* (Thunb.) Moldenke	Polygonaceae	Tuber	hch101	-2.9	5.5	23.5
31	*Persicaria bistorta* (L.) Samp.	Polygonaceae	Rhizome	zyc085	88.9	44.6	99.4

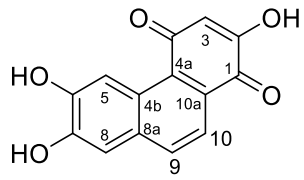
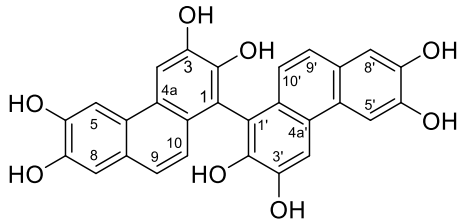
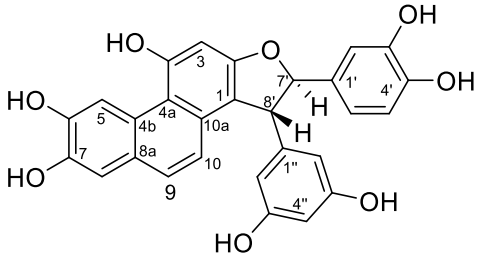
32	*Portulaca oleracea* L.	Portulacaceae	Whole plant	zyc225	10.8	5.7	95.7
33	*Coptis chinensis* Franch.	Ranunculaceae	Rhizome	hch106	20.4	1.7	-3.7
34	*Semiaquilegia adoxoides* (DC.) Makino	Ranunculaceae	Root	zyc126	39.1	-0.3	77.9
35	*Potentilla kleiniana* Wight & Arn.	Rosaceae	Whole plant	zyc243	6.2	11.2	49.9
36	*Gardenia jasminoides* Ellis	Rubiaceae	Fruit	zyc315	8.1	6.1	56.2
37	*Paederia scandens* (Lour.) Merr.	Rubiaceae	Whole plant	zyc309	60.1	4.2	95.0
38	*Dimocarpus longan* Lour.	Sapindaceae	Seed	zyc295	41.3	9.8	27.4
39	*Scrophularia ningpoensis* Hemsl.	Scrophulariaceae	Tuber	hch105	0.6	6.6	65.9
40	*Boehmeria nivea* (L.) Gaudich	Urticaceae	Root	zyc105	84.8	8.6	97.2

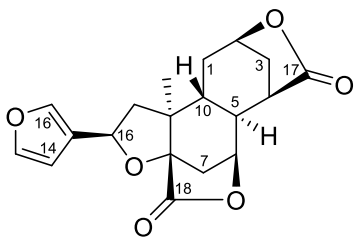
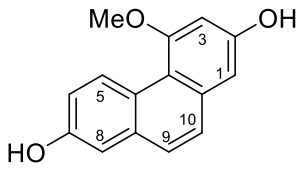
[a] Values expressed as mean of three independent experiments.

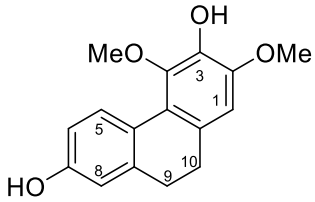
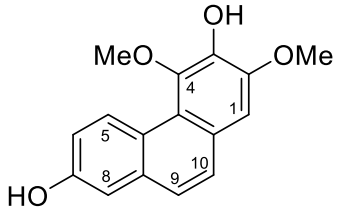
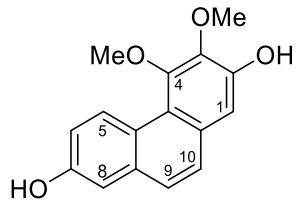
Table S2. Identification metabolites with HRMS and NMR data.

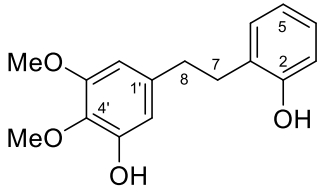
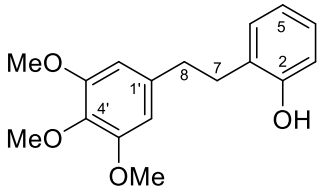
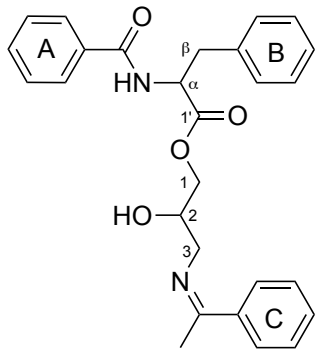
Peak	Detected precursor ion (*m/z*, positive)	Molecular formula	Compound	NMR Data [a]
1	155.0347 $[M+H]^+$ (calcd for $C_7H_7O_4^+$: 155.0339) ΔM -5.0 ppm	$C_7H_6O_4$	 3,4-Dihydroxybenzoic acid	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 7.43 (1H, d, J = 1.6 Hz, H-2'), 7.41 (1H, dd, J = 8.1, 1.6 Hz, H-6'), 6.79 (1H, d, J = 8.1 Hz, H-5')
2	291.0864 $[M+H]^+$ (calcd for $C_{15}H_{15}O_6^+$: 291.0863) ΔM -0.3 ppm	$C_{15}H_{14}O_6$	 Catechin	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 6.84 (1H, d, J = 1.8 Hz, H-2'), 6.76 (1H, d, J = 8.2 Hz, H-5'), 6.72 (1H, dd, J = 8.2, 1.8 Hz, H-6'), 5.93 (1H, s, H-8), 5.86 (1H, s, H-6), 4.56 (1H, d, J = 7.4 Hz, H-2), 3.98 (1H, m, H-3), 2.85 (1H, dd, J = 16.0, 2.4 Hz, H-4b), 2.50 (1H, dd, J = 16.0, 8.6 Hz, H-4a).
3	241.0706 $[M+H]^+$ (calcd for $C_{11}H_{13}O_6^+$: 241.0707) ΔM 0.3 ppm	$C_{11}H_{12}O_6$	 Eucomic acid	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 7.07 (1H, d, J = 8.3 Hz, H-2' and H-6'), 6.66 (1H, d, J = 8.3 Hz, H-3' and H-5'), 2.96 (1H, d, J = 13.5 Hz, H-4a), 2.84 (1H, d, J = 16.2 Hz, H-2b), 2.82 (1H, d, J = 13.5 Hz, H-4b), 2.58 (1H, d, J = 16.2 Hz, H-2a)
4	291.0872 $[M+H]^+$ (calcd for $C_{15}H_{15}O_6^+$: 291.0863) ΔM -3.1 ppm	$C_{15}H_{14}O_6$	 Epicatechin	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 6.97 (1H, d, J = 1.9 Hz, H-2'), 6.80 (1H, dd, J = 8.2, 1.9 Hz, H-6'), 6.76 (1H, d, J = 8.2 Hz, H-5'), 5.94 (1H, d, J = 2.2 Hz, H-8), 5.91 (1H, d, J = 2.2 Hz, H-6), 4.69 (1H, m, H-3), 2.87 (1H, dd, J = 16.8, 4.7 Hz, H-4b), 2.73 (1H, dd, J = 16.8, 2.8 Hz, H-4a).

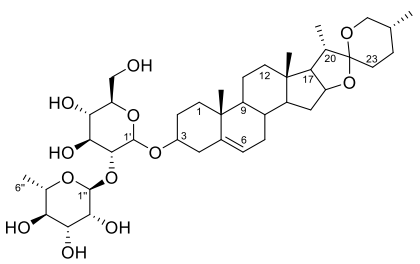
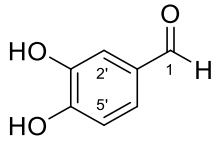
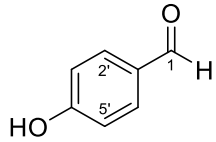
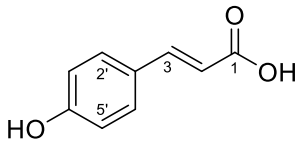
5	245.0795 $[M+H]^+$ (calcd for $C_{14}H_{13}O_4^+$: 245.0808) ΔM 5.6 ppm	$C_{14}H_{12}O_4$	 9,10-Dihydro-2,4,6,7-phenanthrenetetrol	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 7.88 (1H, s, H-8), 6.59 (1H, s, H-5), 6.23 (1H, d, J = 2.4 Hz, H-3), 6.19 (1H, d, J = 2.4 Hz, H-1), 2.59 (2H, m, H-10), 2.57 (2H, m, H-9)
6	247.0955 $[M+H]^+$ (calcd for $C_{14}H_{15}O_4^+$: 247.0965) ΔM 4.0 ppm	$C_{14}H_{14}O_4$	 Dihydropiceatannol	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 6.65 (1H, d, J = 8.0 Hz, H-5), 6.61 (1H, d, J = 2.0 Hz, H-2), 6.47 (1H, dd, J = 8.0, 2.0 Hz, H-6), 6.13 (2H, d, J = 1.8 Hz, H-2', H-6'), 6.08 (1H, d, J = 1.8 Hz, H-4'), 2.68 (4H, m, H-7, 8)
7	331.0811 $[M+H]^+$ (calcd for $C_{17}H_{15}O_7^+$: 331.0812) ΔM 0.3 ppm	$C_{17}H_{14}O_7$	 3,5-Di-*O*-methylquercetin	^{1}H NMR (DMSO-d_6, 600 MHz, δ in ppm, J in Hz) δ: 7.48 (1H, d, J = 2.0 Hz, H-2'), 7.36 (1H, dd, J = 8.2, 2.0 Hz, H-6'), 6.87 (1H, d, J = 8.2 Hz, H-5'), 6.43 (1H, d, J = 1.8 Hz, H-8), 6.35 (1H, d, J = 1.8 Hz, H-6), 3.79 (3H, s, 5-OMe), 3.69 (3H, s, 3-OMe)
8	243.0649 $[M+H]^+$ (calcd for $C_{14}H_{11}O_4^+$: 243.0652) ΔM 1.0 ppm	$C_{14}H_{10}O_4$	 2,4,6,7-phenanthrenetetrol	See as Table 2 in manuscript

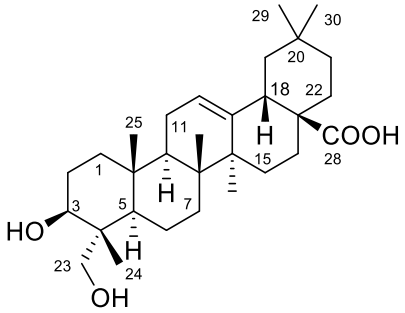
9	257.0449 $[M+H]^+$ (calcd for $C_{14}H_9O_5^+$: 257.0444) ΔM -1.9 ppm	$C_{14}H_8O_5$	 2,6,7-Trihydroxy-1,4-phenanthrenedione	See as Table 2 in manuscript
10	483.1064 $[M+H]^+$ (calcd for $C_{28}H_{19}O_8^+$: 483.1074) ΔM 2.2 ppm	$C_{28}H_{18}O_8$	 [1,1'-Biphenanthren]-2,2',3,3',6,6',7,7'-octaol	See as Table 2 in manuscript
11	485.1231 $[M+H]^+$ (calcd for $C_{28}H_{21}O_8^+$: 485.1231) ΔM 5.0 ppm	$C_{28}H_{20}O_8$	 Cassigarol D	^{1}H NMR (methanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 9.20 (1H, s, H-5), 7.31 (1H, d, J = 8.9 Hz, H-9), 7.08 (1H, s, H-8), 7.00 (1H, d, J = 8.9 Hz, H-10), 6.79 (1H, d, J = 2.0 Hz, H-2'), 6.75 (1H, d, J = 8.1 Hz, H-5'), 6.70 (1H, s, H-3), 6.68 (1H, dd, J = 8.1, 2.0 Hz, H-6'), 6.14 (1H, t, J = 2.2 Hz, H-4''), 6.11 (2H, d, J = 2.2, H-2'', 6''), 5.34 (1H, d, J = 5.8 Hz, H-7'), 4.59 (1H, d, J = 5.8 Hz, H-8'). ^{13}C NMR (methanol-d_4, 150 MHz, δ in ppm) δ: 114.2 (C-1), 158.6 (C-2), 96.5 (C-3), 115.4 (C-4a), 131.3 (C-4b), 113.7 (C-5), 146.0 (C-6), 144.7 (C-7), 112.6 (C-8), 127.3 (C-8a), 128.3 (C-9), 121.2 (C-10), 127.3 (C-10a), 135.0 (C-1'), 113.4 (C-2'), 146.0 (C-3'), 146.0 (C-4'), 116.0 (C-5'), 118.2 (C-6'), 95.0 (C-7'), 58.7 (C-8'), 147.7 (C-1''), 107.0 (C-2'', C-6''), 159.7 (C-3'', C-5''), 101.9 (C-4'').

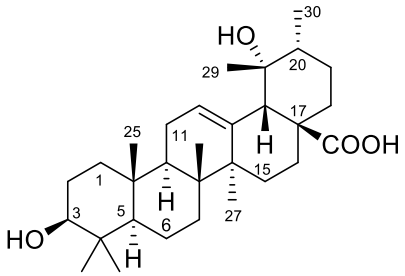
12	345.1318 $[M+H]^+$ (calcd for $C_{19}H_{21}O_6^+$: 345.1333) ΔM 4.2 ppm	$C_{19}H_{20}O_6$	 Diosbulbin B	^{1}H NMR (acetone-d_6, 600 MHz, δ in ppm, J in Hz) δ: 7.62 (1H, s, H-16), 7.47 (1H, d, J = 1.5 Hz, H-15), 6.94 (1H, d, J = 1.5 Hz, H-14), 5.30 (1H, dd, J = 10.9, 5.5 Hz, H-12), 4.84 (1H, m, H-2), 4.75 (1H, d, J = 5.9 Hz, H-6), 2.71 (1H, m, H-4), 2.50 (1H, m, H-3β), 1.99 (1H, m, H-3α), 2.46 (1H, m, H-7β), 2.26 (1H, m, H-7α), 2.25 (1H, m, H-5), 2.06 (1H, m, H-11β), 1.98 (1H, m, H-11α), 2.01 (1H, m, H-1β), 1.77 (1H, m, H-1α), 1.90 (1H, m, H-10), 1.29 (3H, s, H-19). ^{13}C NMR (acetone-d_6, 150 MHz, δ in ppm) δ: 29.6 (C-1), 77.2 (C-2), 39.4 (C-3), 42.7 (C-4), 42.7 (C-5), 77.9 (C-6), 37.8 (C-7), 90.2 (C-8), 45.9 (C-9), 39.4 (C-10), 42.8 (C-11), 75.6 (C-12), 126.9 (C-13), 111.0 (C-14), 143.3 (C-15), 141.3 (C-16), 175.7 (C-17), 177.3 (C-18), 16.6 (C-19).
13	241.0860 $[M+H]^+$ (calcd for $C_{15}H_{13}O_3^+$: 241.0859) ΔM -0.4 ppm	$C_{15}H_{12}O_3$	 Flavanthrinin	^{1}H NMR (acetone-d_6, 600 MHz, δ in ppm, J in Hz) δ: 9.37 (1H, d, J = 9.2 Hz, H-5), 7.55 (1H, d, J = 8.8 Hz, H-9), 7.51 (1H, d, J = 8.8 Hz, H-10), 7.23 (1H, d, J = 2.8 Hz, H-6), 7.14 (1H, dd, J = 9.2, 2.8 Hz, H-6), 6.90 (1H, d, J = 2.4 Hz, H-1), 6.82 (1H, d, J = 2.4 Hz, H-3), 4.09 (3H, s, 4-OMe).

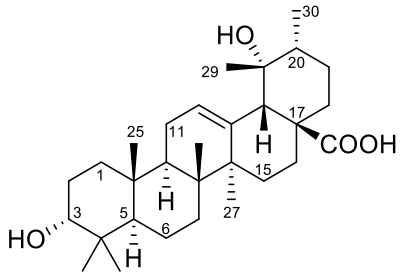
14	273.1112 $[M+H]^+$ (calcd for $C_{16}H_{17}O_4^+$: 273.1121) ΔM 3.6 ppm	$C_{16}H_{16}O_4$	 Flavanthridin	^{1}H NMR (acetone-d_6, 600 MHz, δ in ppm, J in Hz) δ: 8.09 (1H, d, J = 8.5 Hz, H-5), 6.73-6.65 (2H, m, H-6, 8), 6.56 (1H, s, H-1), 3.83 (3H, s, 3-OMe), 3.64 (3H, s, 4-OMe), 2.64 (4H, s, H-9, 10). ^{13}C NMR (acetone-d_6, 150 MHz, δ in ppm) δ: 107.6 (C-1), 128.4 (C-5), 114.6 (C-6), 113.4 (C-8), 30.0 (C-9), 30.3 (C-10), 59.4 (2-OMe), 56.0 (4-OMe).
15	271.0962 $[M+H]^+$ (calcd for $C_{16}H_{15}O_4^+$: 271.0965) ΔM 1.1 ppm	$C_{16}H_{14}O_4$	 2,4-Dimethoxy-3,7-phenanthrenediol	^{1}H NMR (acetone-d_6, 600 MHz, δ in ppm, J in Hz) δ: 9.34 (1H, d, J = 9.2, H-5), 7.60 (1H, d, J = 8.8, H-10), 7.46 (1H, d, J = 8.8, H-9), 7.24 (1H, s, H-8), 7.23 (1H, s, H-1), and 7.19 (1H, d, J = 9.2, H-6), 3.99 (3H, s, 2-OMe) and 3.93 (3H, s, 4-OMe) ^{13}C NMR (acetone-d_6, 150 MHz, δ in ppm) δ: 106.0 (C-1), 129.0 (C-5), 117.4 (C-6), 112.2 (C-8), 125.3 (C-9), 128.1 (C-10), 59.6 (4-OMe), 56.3 (2-OMe).[b]
16	271.0967 $[M+H]^+$ (calcd for $C_{16}H_{15}O_4^+$: 271.0965) ΔM -1.0 ppm	$C_{16}H_{14}O_4$	 Nudol	^{1}H NMR (acetone-d_6, 600 MHz, δ in ppm, J in Hz) δ: 9.32 (1H, d, J = 9.2, H-5), 7.50 (1H, d, J = 8.8, H-10), 7.49 (1H, d, J = 8.8, H-9), 7.24 (1H, m, H-6), 7.23 (1H, s, H-8), 7.19 (1H, d, J = 9.2, H-6), 4.00 (3H, s, 3-OMe). 3.97 (3H, s, 4-OMe) ^{13}C NMR (acetone-d_6, 150 MHz, δ in ppm) δ: 108.2 (C-1), 128.3 (C-5), 116.5 (C-6), 111.8 (C-8), 126.3 (C-9), 127.1 (C-10), 61.2 (4-OMe), 59.7 (2-OMe).[b]

17	275.1267 $[M+H]^+$ (calcd for $C_{16}H_{19}O_4^+$: 275.1278) ΔM 4.1 ppm	$C_{16}H_{18}O_4$	 5-(2-Hydroxyphenethyl)-3,4-dimethoxyphenol	^{1}H NMR (chloroform-*d*, 600 MHz, δ in ppm, *J* in Hz) δ: 7.10 (1H, d, *J* = 7.5, H-6), 7.08 (1H, m, H-4), 6.87 (1H, m, H-5), 6.75 (1H, d, *J* = 7.5, H-3), 6.49 (1H, d, *J* = 1.8, H-2'), 6.25 (1H, d, *J* = 1.8, H-6'), 5.70 (1H, brs, 3'-OH), 4.61 (1H, brs, 2-OH), 3.87 (3H, s, 4'-OMe) and 3.80 (3H, s, 5'-OMe), 2.89 (2H, m, H-7), 2.83 (2H, m, H-8).
18	289.1443 $[M+H]^+$ (calcd for $C_{17}H_{21}O_4^+$: 289.1434) ΔM -3.0 ppm	$C_{17}H_{20}O_4$	 2-(3,4,5-trimethoxyphenethyl)phenol	^{1}H NMR (chloroform-*d*, 600 MHz, δ in ppm, *J* in Hz) δ: 7.10 (1H, d, *J* = 7.5, H-6), 7.08 (1H, m, H-4), 6.88 (1H, m, H-5), 6.75 (1H, d, *J* = 7.5, H-3), 6.38 (1H, s, H-2', H-6'), 4.55 (1H, brs, 2-OH), 3.83 (3H, s, 4'-OMe) and 3.81 (6H, s, 3', 5'-OMe), 2.90 (2H, m, H-7), 2.86 (2H, m, H-8).
19	445.2111 $[M+H]^+$ (calcd for $C_{27}H_{29}N_2O_4^+$: 445.2122) ΔM 2.3 ppm	$C_{27}H_{28}N_2O_4$	 Trichosanatine	^{1}H NMR (chloroform-*d*, 600 MHz, δ in ppm, *J* in Hz) δ: 7.71 (2H, m, ring A, H-2, H-6), 7.51 (1H, m, ring C, H-4), 7.42 (2H, m, ring C, H-3, H-5), 7.30 (2H, m, ring C, H-2, H-6), 7.24 (4H, m, ring B), 7.17 (3H, m, ring A), 7.10 (1H, t, *J* = 6.7, ring B), 4.30 (1H, m, H-2), 3.90 (1H, dd, *J* = 11.4, 4.5, H-1a), 3.13 (1H, m, H-1b), 3.09 (1H, dd, *J* = 13.8, 6.5 Hz, H-3β), 2.98 (1H, dd, *J* = 13.8, 8.5 Hz, H-β), 2.82 (1H, dd, *J* = 13.8, 8.5 Hz, H-3a), 2.75 (1H, m, H-3b), 1.98 (3H, s, Me).

20	723.4301 $[M+H]^+$ (calcd for $C_{39}H_{63}O_{12}^+$: 723.4314) ΔM 1.8 ppm	$C_{39}H_{62}O_{12}$	 Diosgenyl α-L-rhamnopyranosyl-(1→2)-β-D-glucopyranoside	^{1}H NMR (pyridine-d_5, 600 MHz, δ in ppm, J in Hz) δ: 6.35 (s, 1H, H-1"), 5.27 (br d, 1H, J = 3.8 Hz, H-6), 5.00 (1H, m, H-1'), 4.76 (1H, br s, H-2"), 4.59 (1H, m, H-3"), 4.53-4.45 (2H, m, H-16, H-5"), 4.28-4.24 (3H, m, H-2', H-4', H-4"), 4.13 (1H, m, H-3'), 3.91-3.84 (2H, m, H-3, H-50), 3.56 (1H, m, H-26), 3.46 (1H, t, J = 9.6 Hz, H-26), 1.73 (3H, d, J = 6.5 Hz, 6"-Me), 1.10 (3H, d, J = 6.7 Hz, 21-Me), 1.01 (3H, s, 18-Me), 0.78 (3H, s, 18-Me), 0.65 (3H, br s, 27-Me)
21	139.0391 $[M+H]^+$ (calcd for $C_7H_7O_3^+$: 139.0390) ΔM -1.1 ppm	$C_7H_6O_3$	 3,4-Dihydroxybenzaldehyde	^{1}H NMR (metanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 9.66 (1H, s, H-1), 7.30 (1H, dd, J = 8.0, 1.6 Hz, H-6'),7.29 (1H, d, J = 1.6 Hz, H-2'), 6.89 (1H, d, J = 8.0 Hz, H-5')
22	123.0438 $[M+H]^+$ (calcd for $C_7H_7O_2^+$: 123.0441) ΔM 2.1 ppm	$C_7H_6O_2$	 *p*-Hydroxybenzaldehyde	^{1}H NMR (metanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 9.76 (1H, s, H-1), 7.78 (1H, d, J = 8.7 Hz, H-2', 6'), 6.92 (1H, d, J = 8.7 Hz, H-3', 5')
23	165.0540 $[M+H]^+$ (calcd for $C_9H_9O_3^+$: 165.0546) ΔM 3.6 ppm	$C_9H_8O_3$	 (*E*)-Cinnamic acid	^{1}H NMR (metanol-d_4, 600 MHz, δ in ppm, J in Hz) δ: 7.49 (1H, d, J = 15.9 Hz, H-3), 7.41 (1H, d, J = 8.6 Hz, H-2', 6'), 6.79 (1H, d, J = 8.6 Hz, H-3', 5'), 6.30 (1H, d, J = 15.9 Hz, H-2).

24	473.3638 $[M+H]^+$ (calcd for $C_{30}H_{49}O_4^+$: 473.3625) ΔM -1.3 ppm	$C_{30}H_{48}O_4$	 Hederagenin	^{1}H NMR (DMSO-d_6, 600 MHz, δ in ppm, J in Hz) δ: 5.15 (1H, s, H-12), 3.43 (1H, overlapped, H-3), 3.32 (1H, overlapped, H-23a), 3.07 (1H, d, J = 10.6 Hz, H-23b), 2.74 (1H, dd, J = 3.2, 13.7 Hz, H-18), 1.89 (1H, t, J = 12.6 Hz, H-16β), 1.80 (2H, m, H-11α, H-11β), 1.66 (1H, m, H-15β), 1.61 (1H, m, H-22β), 1.60 (1H, m, H-19β), 1.50 (1H, overlapped, H-9), 1.48 (1H, m, H-16α), 1.47 (1H, m, H-1β), 1.46 (2H, m, H-2), 1.43 (1H, m, H-7β), 1.42 (1H, m, H-22α), 1.40 (1H, m, H-6α), 1.31 (1H, m, H-21α), 1.23 (1H, m, H-6β), 1.16 (1H, m, H-7α), 1.12 (1H, m, H-21α), 1.04 (1H, m, H-19α), 0.97 (1H, m, H-15α), 1.10 (1H, m, H-5α), 1.09 (3H, s, H-27), 0.87 (9H, s, H-25, H-29, H-30), 0.84 (1H, m, H-1α), 0.71 (3H, s, H-26), 0.53 (3H, s, H-24). ^{13}C NMR (DMSO-d_6, 150 MHz, δ in ppm) δ: 37.7 (C-1), 26.3 (C-2), 70.0 (C-3), 41.6 (C-4), 46.1 (C-5), 17.3 (C-6), 31.8 (C-7), 38.6 (C-8), 46.9 (C-9), 35.9 (C-10), 22.8 (C-11), 121.3 (C-12), 143.6 (C-13), 40.8 (C-14), 27.0 (C-15), 22.5 (C-16), 45.1 (C-17), 40.6 (C-18), 45.6 (C-19), 30.2 (C-20), 33.2 (C-21), 31.9 (C-22), 64.4 (C-23), 12.4 (C-24), 15.2 (C-25), 16.7 (C-26), 25.5 (C-27), 32.6 (C-29), 23.2 (C-30).

25	473.3613 $[M+H]^+$ (calcd for $C_{30}H_{49}O_4^+$: 473.3625) ΔM 2.6 ppm	$C_{30}H_{48}O_4$	 Pomolic acid	^{1}H NMR (DMSO-d_6, 600 MHz, δ in ppm, J in Hz) δ: 5.15 (1H, s, H-12), 3.00 (1H, m, H-3), 2.48 (1H, m, H-16β), 2.39 (1H, m, H-18),1.89 (1H, m, H-11β), 1.83 (1H, m, H-11α), 1.69 (1H, m, H-15α), 1.68 (1H, m, H-2β), 1.61 (1H, m, H-21α),1.59 (1H, m, H-22β), 1.58 (1H, m, H-9), 1.52 (1H, m, H-1β), 1.50 (1H, m, H-22α), 1.49 (1H, m, H-1α), 1.46 (1H, m, H-6β), 1.45 (1H, m, H-7β), 1.38 (1H, m, H-16α), 1.31 (1H, m, H-6α), 1.28 (3H, s, H-27), 1.26 (1H, m, H-20), 1.22 (1H, m, H-7α), 1.12 (1H, m, H-21β), 1.07 (3H, s, H-29), 0.89 (3H, s, H-23), 0.85 (3H, s, H-25), 0.87 (1H, m, H-15β), 0.84 (3H, s, H-30), 0.70 (3H, s, H-26),0.68 (3H, s, H-24), 0.67 (1H, m, H-5). ^{13}C NMR (DMSO-d_6, 150 MHz, δ in ppm) δ: 37.9 (C-1), 27.9 (C-2), 76.7 (C-3), 38.2 (C-4), 54.6 (C-5), 17.9 (C-6), 32.6 (C-7), 39.1 (C-8), 46.5 (C-9), 38.1 (C-10), 23.0 (C-11), 126.8 (C-12), 138.6 (C-13), 40.9 (C-14), 27.9 (C-15), 25.0 (C-16), 46.8 (C-17), 53.1 (C-18), 73.4 (C-19), 41.3 (C-20), 25.7 (C-21), 37.1 (C-22), 28.1 (C-23), 15.8 (C-24), 15.4 (C-25), 16.4 (C-26), 23.8 (C-27), 178.8 (C-28), 26.1 (C-29), 16.1 (C-30).

26	473.3607 $[M+H]^+$ (calcd for $C_{30}H_{49}O_4^+$: 473.3625) ΔM 3.9 ppm	$C_{30}H_{48}O_4$	 3-*epi*-pomolic acid	^{1}H NMR (DMSO-d_6, 600 MHz, δ in ppm, J in Hz) δ: 5.17 (1H, s, H-12), 3.00 (1H, m, H-3), 2.48 (1H, m, H-16β), 2.39 (1H, m, H-18), 1.90 (1H, m, H-11β), 1.82 (1H, m, H-11α), 1.69 (1H, m, H-15β), 1.69 (1H, m, H-9), 1.61 (1H, m, H-21α), 1.60 (1H, m, H-22β), 1.45 (1H, m, H-1β), 1.45 (1H, m, H-7β), 1.51 (1H, m, H-22α), 1.38 (1H, m, H-16α), 1.34 (1H, m, H-6β), 1.30 (1H, m, H-1α), 1.29 (3H, s, H-27),1.29 (1H, m, H-6α), 1.26 (1H, m, H-20), 1.23 (1H, m, H-5), 1.22 (1H, m, H-7α), 1.12 (1H, m, H-21β), 1.08 (3H, s, H-29), 0.87 (1H, m, H-15α), 0.86 (3H, s, H-25), 0.84 (3H, s, H-30), 0.83 (3H, s, H-23), 0.76 (3H, s, H-24), 0.70 (3H, s, H-26). ^{13}C NMR (DMSO-d_6, 150 MHz, δ in ppm) δ: 32.4 (C-1), 76.0 (C-3), 36.6 (C-4), 47.9 (C-5), 17.6 (C-6), 32.4 (C-7), 40.2 (C-8), 46.4 (C-9), 36.1 (C-10), 23.2 (C-11), 126.7 (C-12), 138.3 (C-13), 40.2 (C-14), 27.6 (C-15), 25.0 (C-16), 46.7 (C-17), 53.0 (C-18), 73.5 (C-19), 41.0 (C-20), 25.5 (C-21), 37.0 (C-22), 28.4 (C-23), 22.0 (C-24), 14.7 (C-25), 16.4 (C-26), 23.8 (C-27), 26.2 (C-29), 16.0 (C-30).
27	279.2306 $[M+H]^+$ (calcd for $C_{18}H_{31}O_2^+$: 279.2319) ΔM 4.4 ppm	$C_{18}H_{30}O_2$	α-Linolenic acid	^{1}H NMR (chloroform-d, 600 MHz, δ in ppm, J in Hz) δ: 5.39-5.35 (6H, m, H-9, H-10, H-12, H-13, H-15, H-16), 2.81 (4H, br t, J = 5.4 Hz, H-11 and H-14), 2.34 (2H, t, J = 7.4 Hz, H-2), 2.10-2.04 (4H, m, H-8 and H-17), 1.64-1.61 (2H, m, H-3), 1.35-1.25 (8H, m, H-4, H-5, H-6, H-7), 0.96 (3H, t, J = 7.4 Hz, H-18).

28	281.2464 $[M+H]^+$ (calcd for $C_{18}H_{33}O_2^+$: 281.2475) ΔM 3.9 ppm	$C_{18}H_{32}O_2$	Linolenic acid	^{1}H NMR (chloroform-*d*, 600 MHz, δ in ppm, *J* in Hz) δ: 5.37-5.32 (4H, m, H-9, H-10, H-12, H-13), 2.76 (2H, t, *J* = 6.8 Hz, H-11), 2.33 (2H, t, *J* = 7.6 Hz, H-2), 2.03-2.06 (4H, m, H-8 and H-14), 1.62 (2H, p, *J* = 7.3 Hz, H-3), 1.36-1.25 (14H, m, H-4, H-5, H-6, H-7, H-15, H-16 and H-17), 0.88 (3H, t, *J* = 7.2 Hz, H-18).

[a] ^{13}C NMR data were obtained from HSQC and/or HMBC spectra. [b] Quaternary carbon was not determinated.

Figure S1. α-Glucosidase (A) and PTP1B (B) inhibition curves of crude ethyl acetate extracts of *Persicaria bistorta* (L.) Samp., *Dioscorea bulbifera* L., *Boehmeria nivea* (L.) Gaudich, and *Tinospora sagittata* Gagnep.

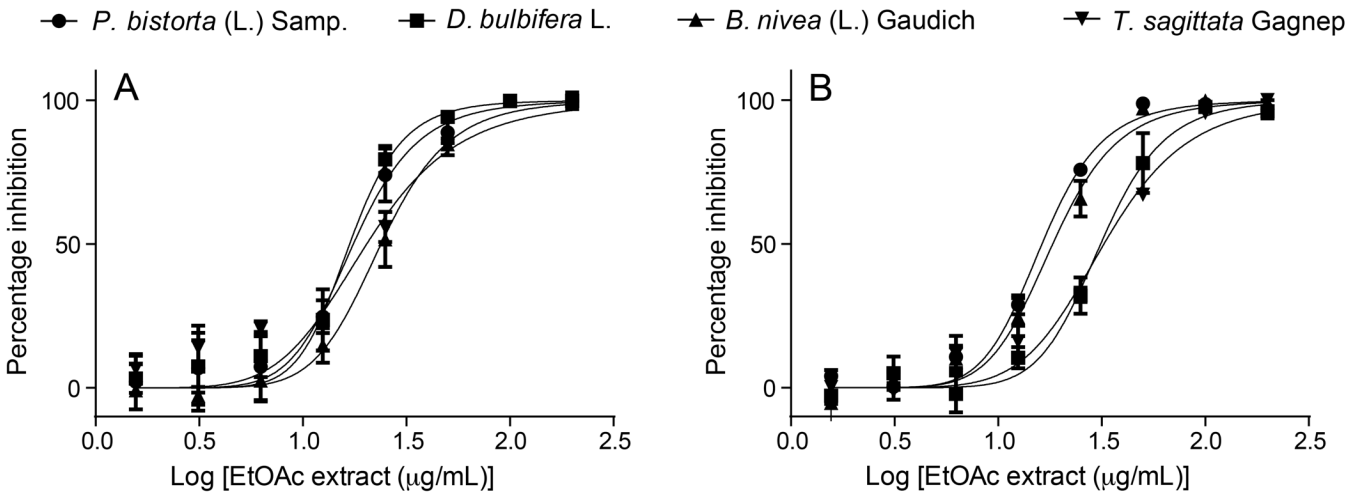


Figure S2. UV and HRMS spectra of compound **8** obtained in the HPLC-HRMS mode.

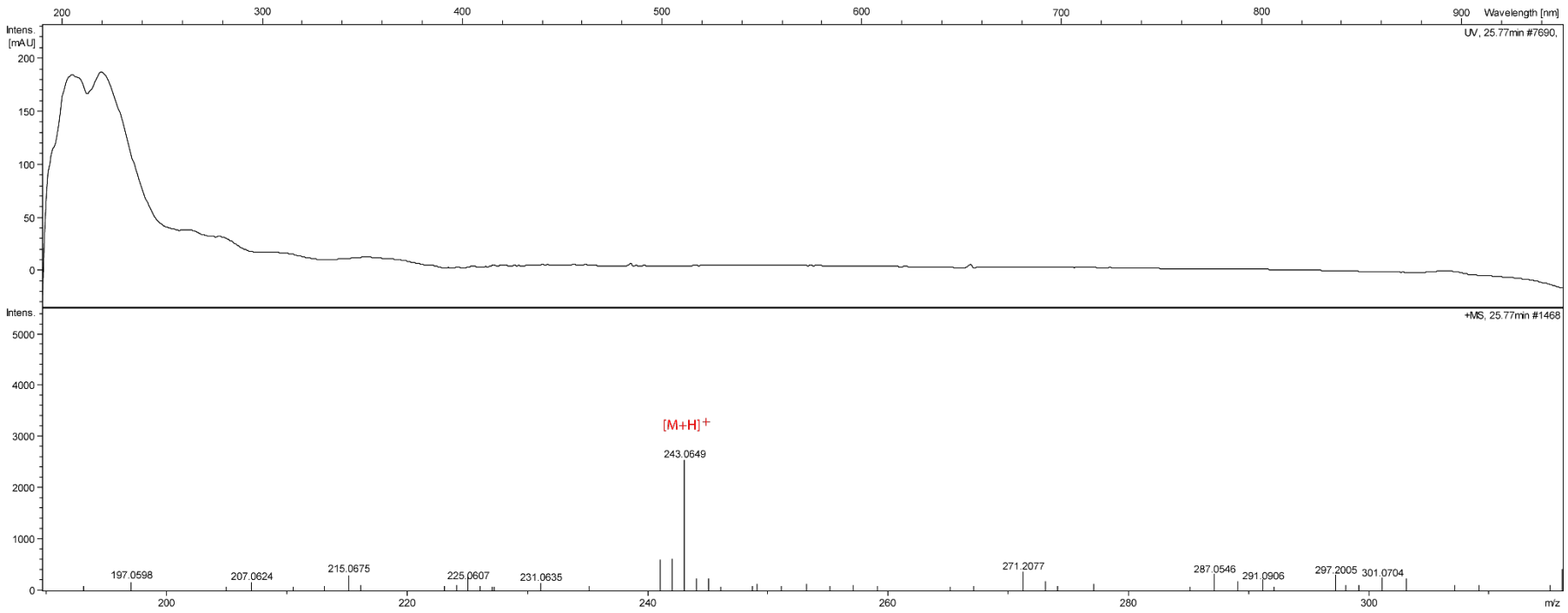


Figure S3. [1]H-NMR spectrum of the mixture of compound **7** and **8** (600 MHz, Methanol-d_4).

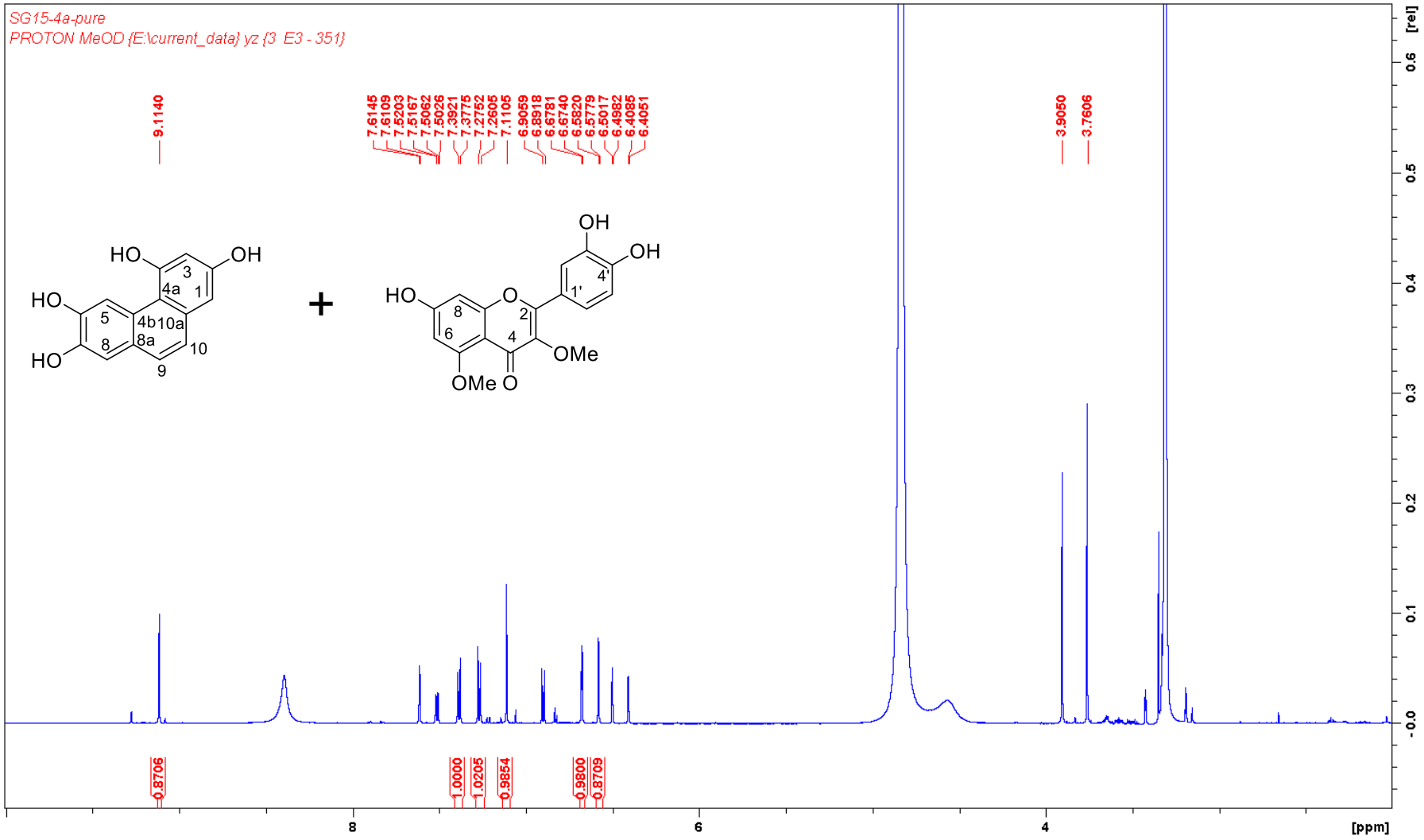


Figure S4. ^{1}H-NMR spectrum of compound **7** and the mixture of compound **7** and **8** (600 MHz, Methanol-d_4).

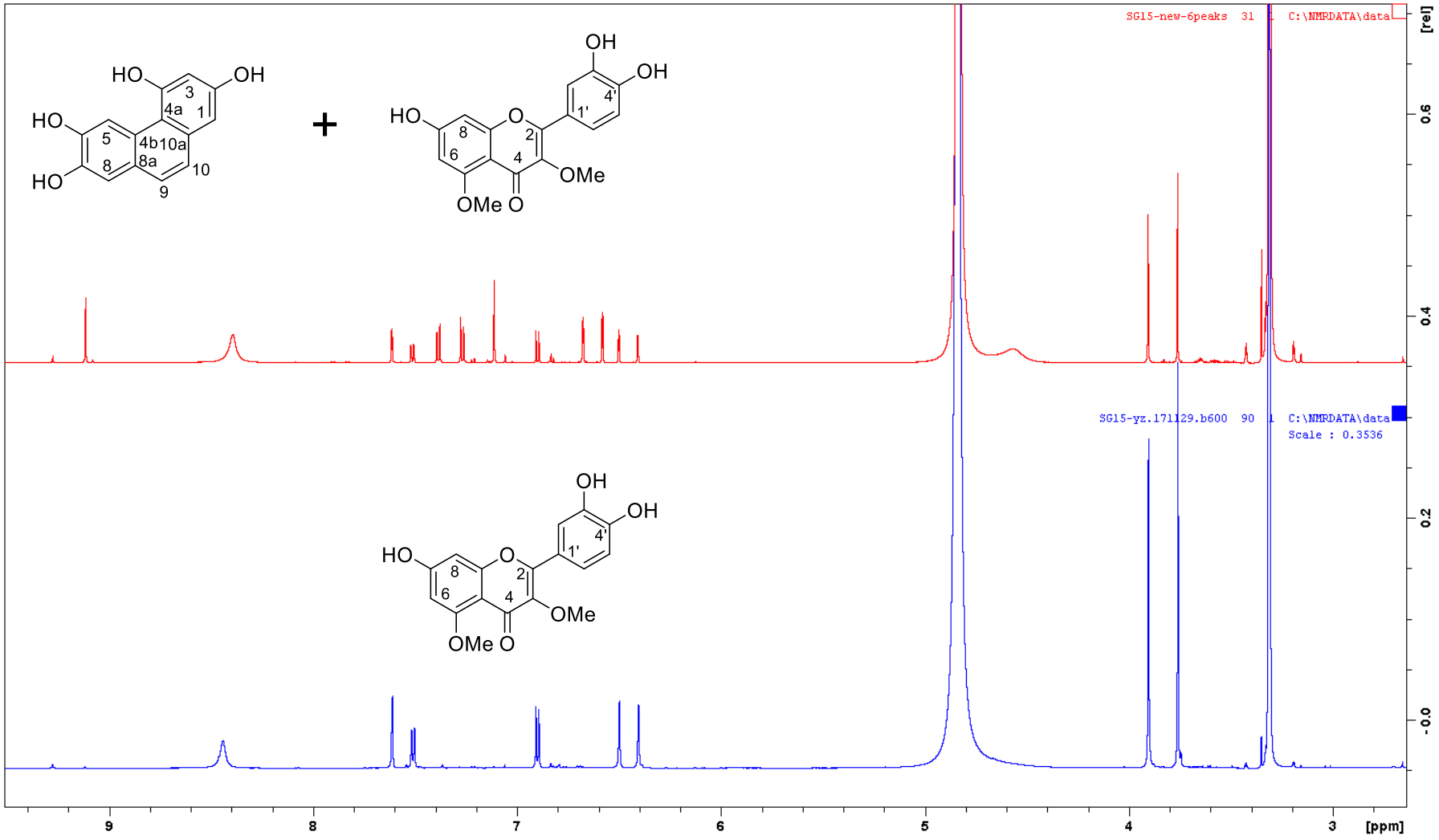


Figure S5. HSQC spectrum of the mixture of compound **7** and **8** (600 MHz, Methanol-d_4).

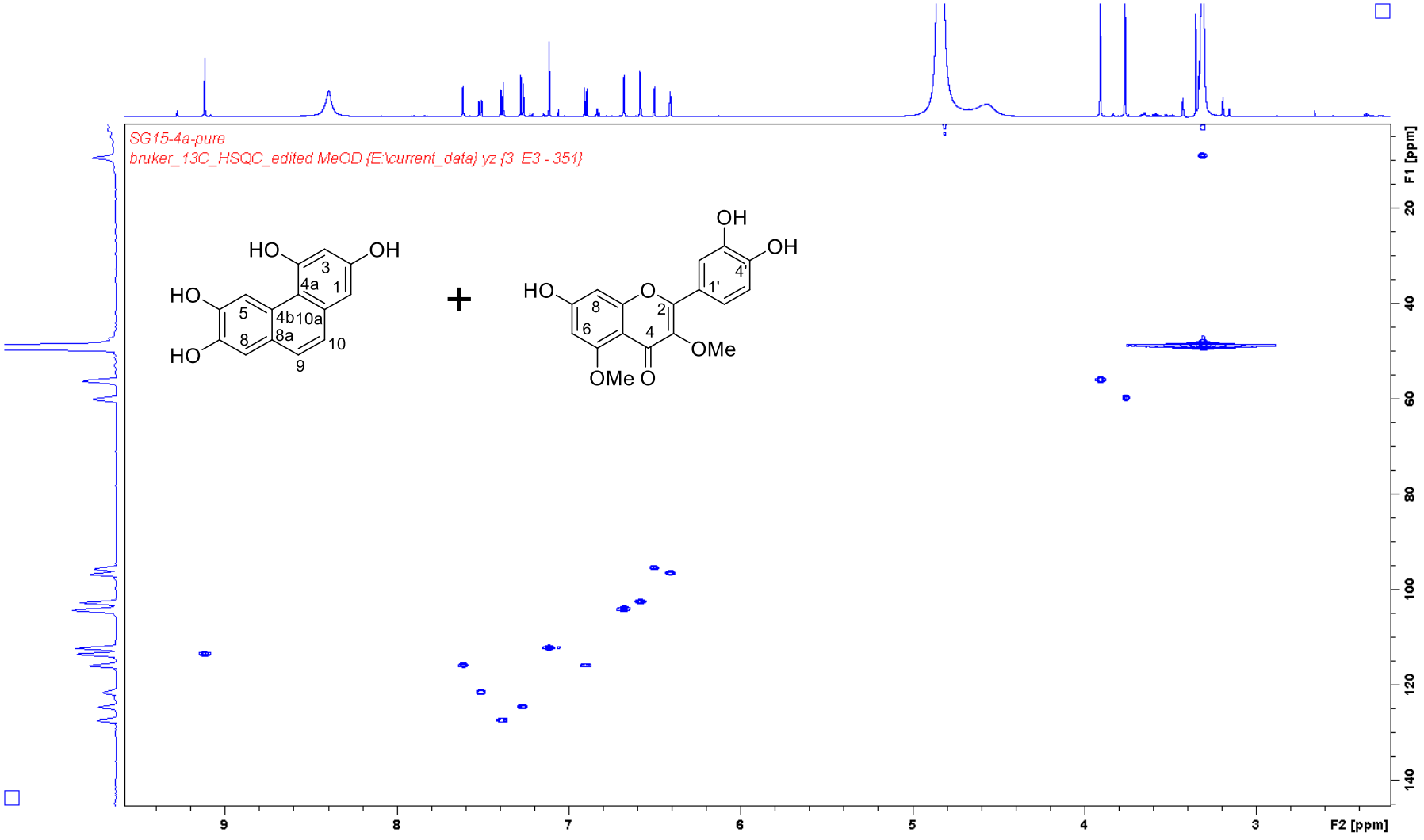


Figure S6. HMBC spectrum of the mixture of compound **7** and **8** (600 MHz, Methanol-d_4).

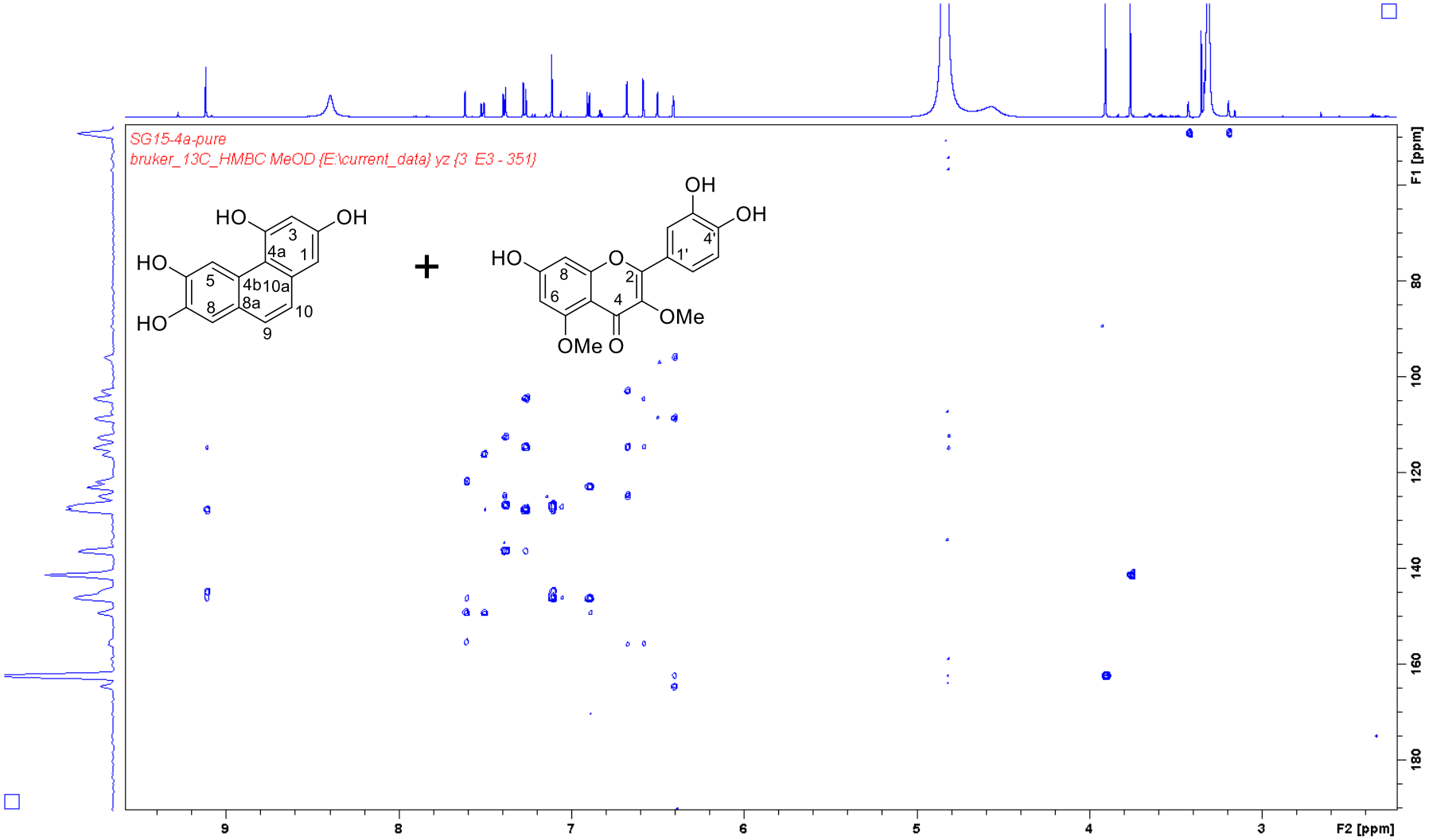


Figure S7. COSY spectrum of the mixture of compound **7** and **8** (600 MHz, Methanol-d_4).

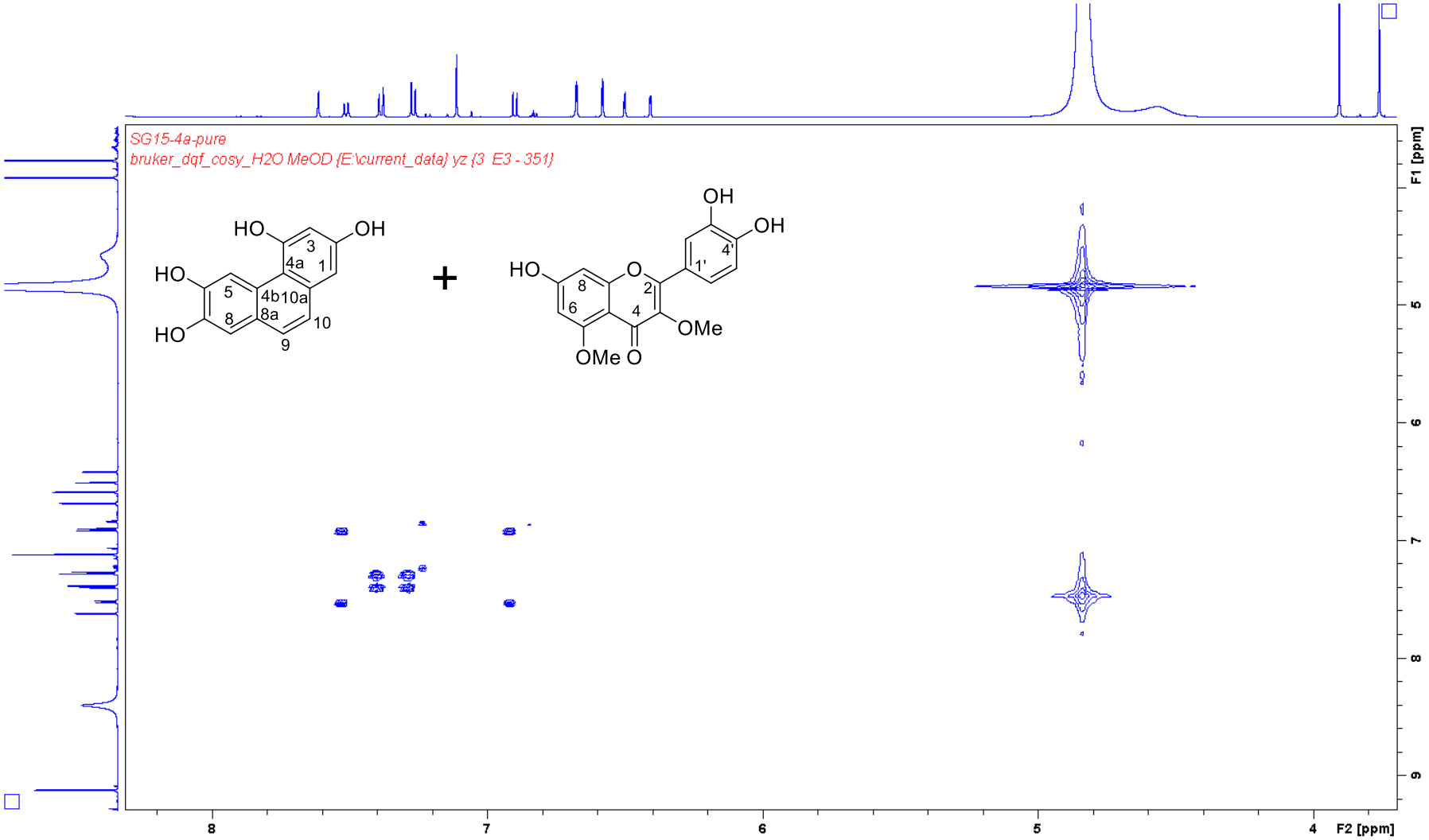


Figure S8. UV and HRMS spectra of compound **9** obtained in the HPLC-HRMS mode.

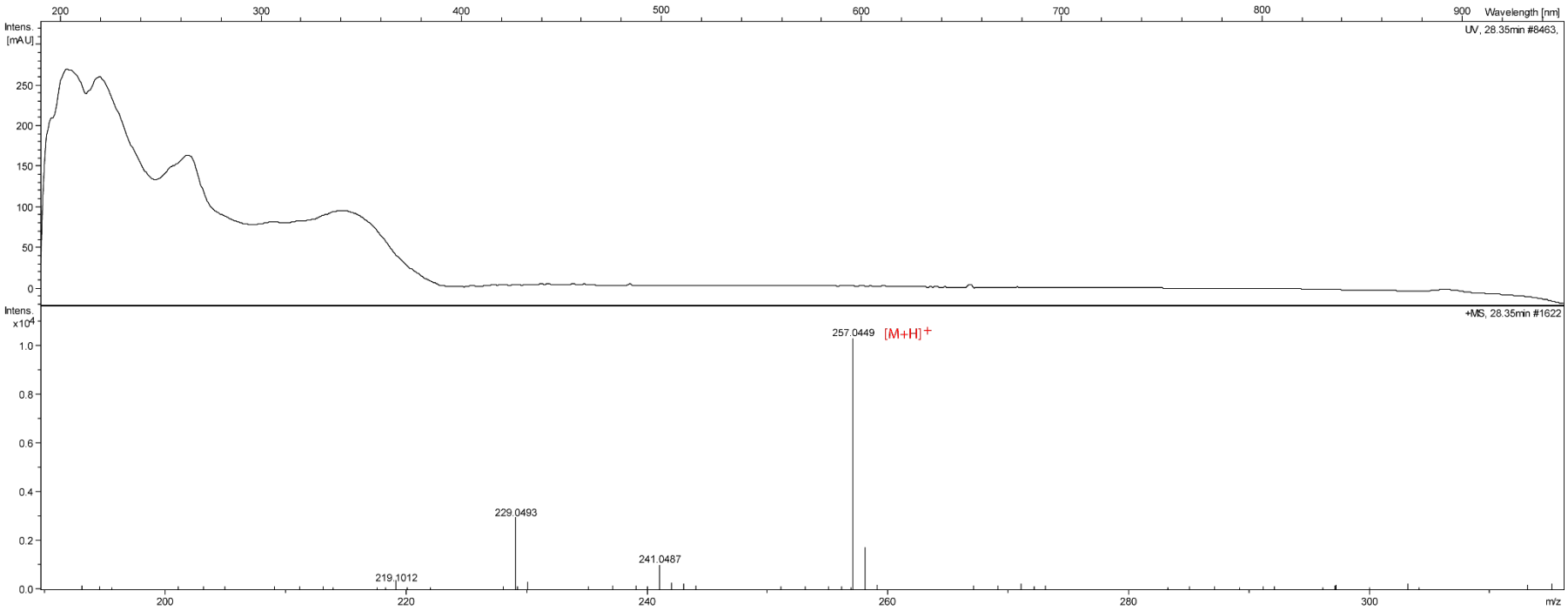


Figure S9. ^{1}H-NMR spectrum of compound **9** (600 MHz, DMSO-d_6).

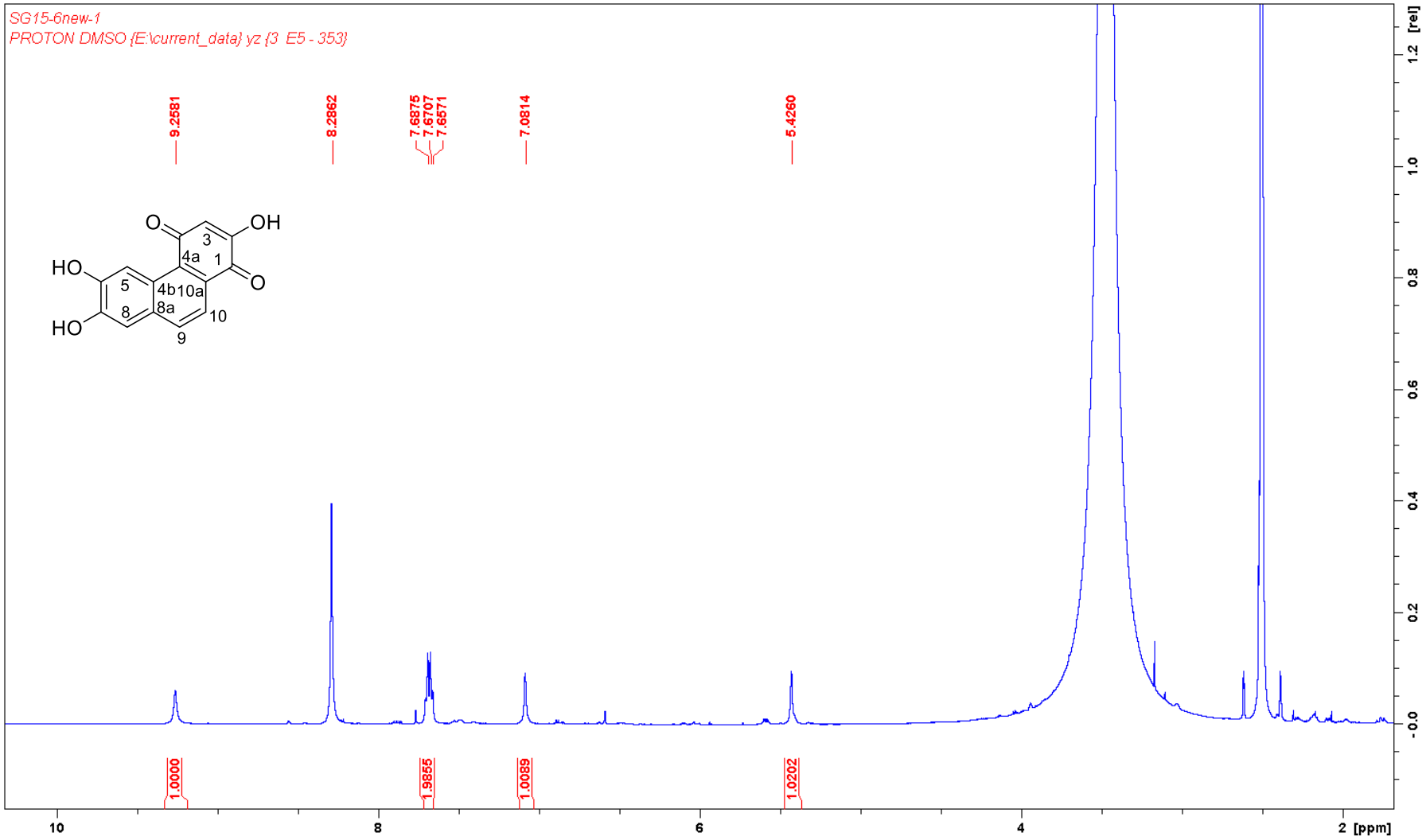


Figure S10. HSQC spectrum of compound **9** (600 MHz, DMSO-d_6).

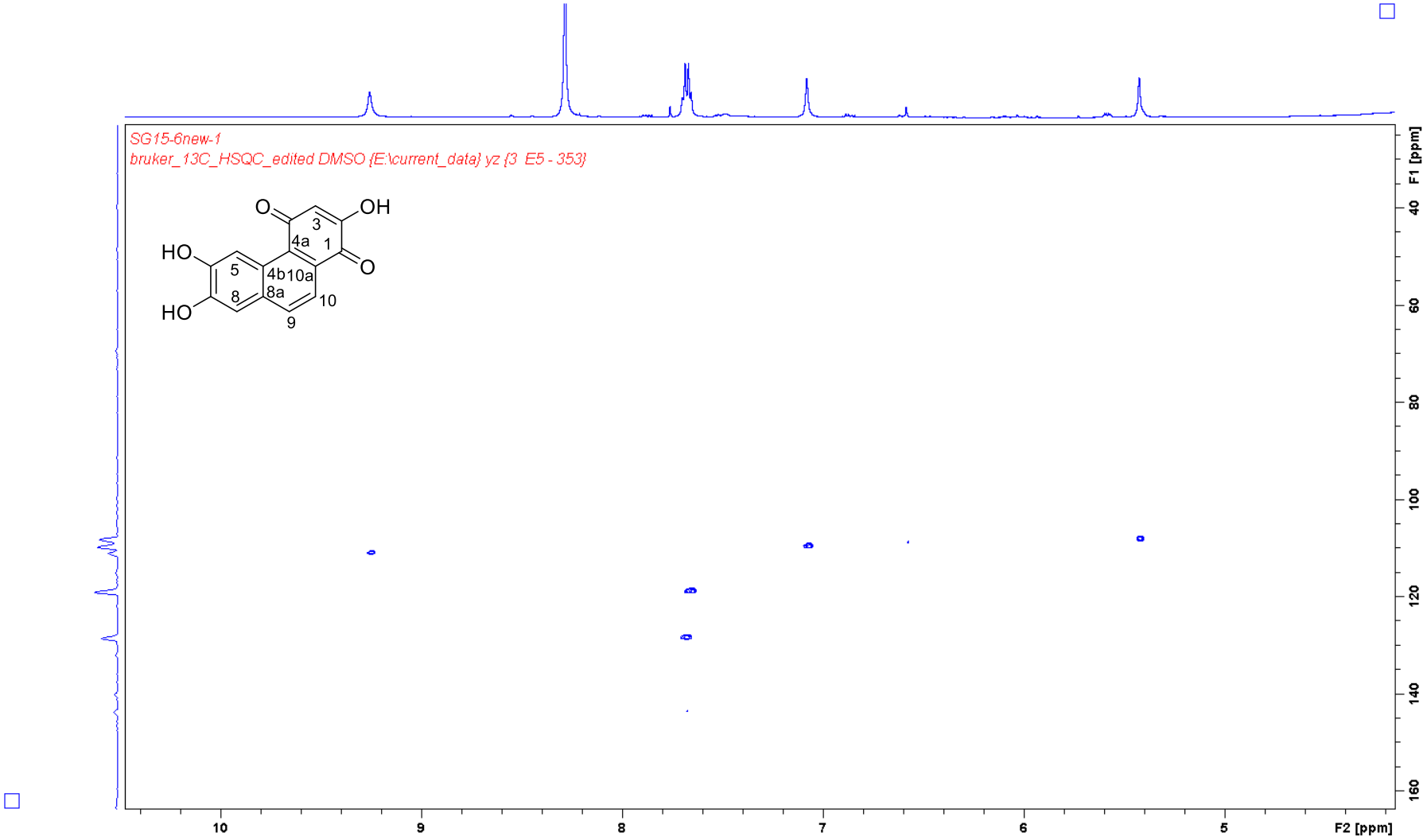


Figure S11. HMBC spectrum of compound **9** (600 MHz, DMSO-d_6).

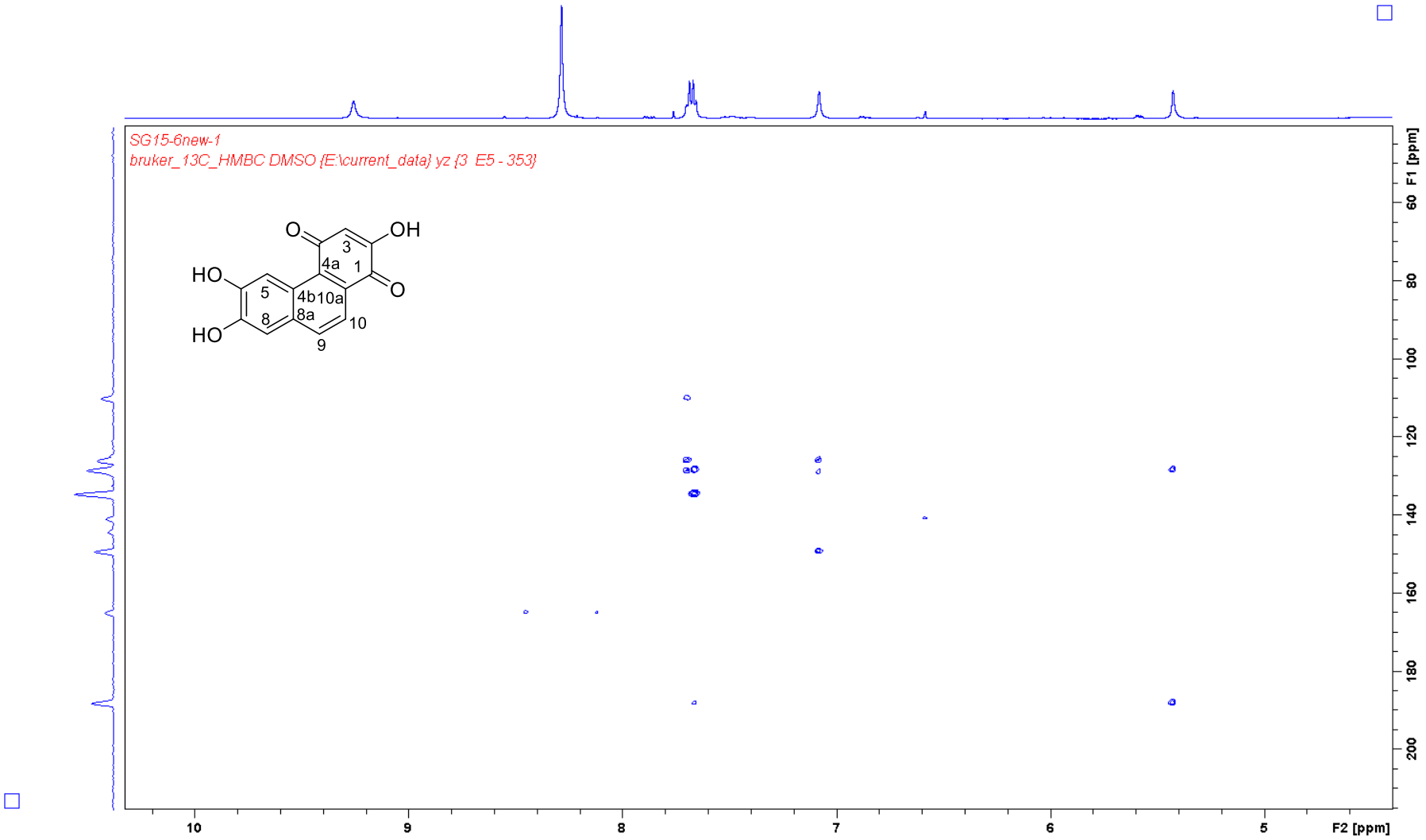


Figure S12. COSY spectrum of compound **9** (600 MHz, DMSO-d_6).

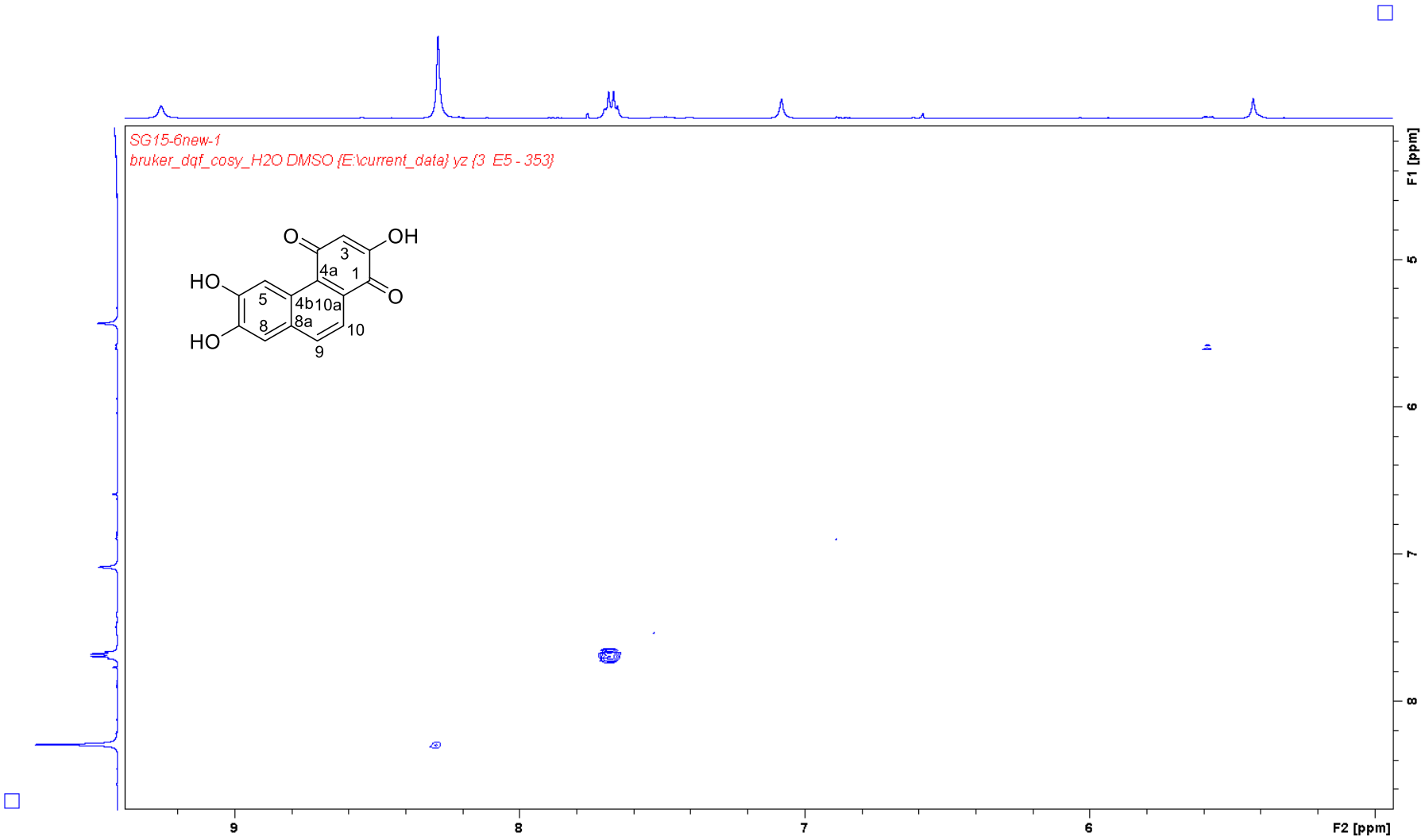


Figure S13. UV and HRMS spectra of compound **10** obtained in the HPLC-HRMS mode.

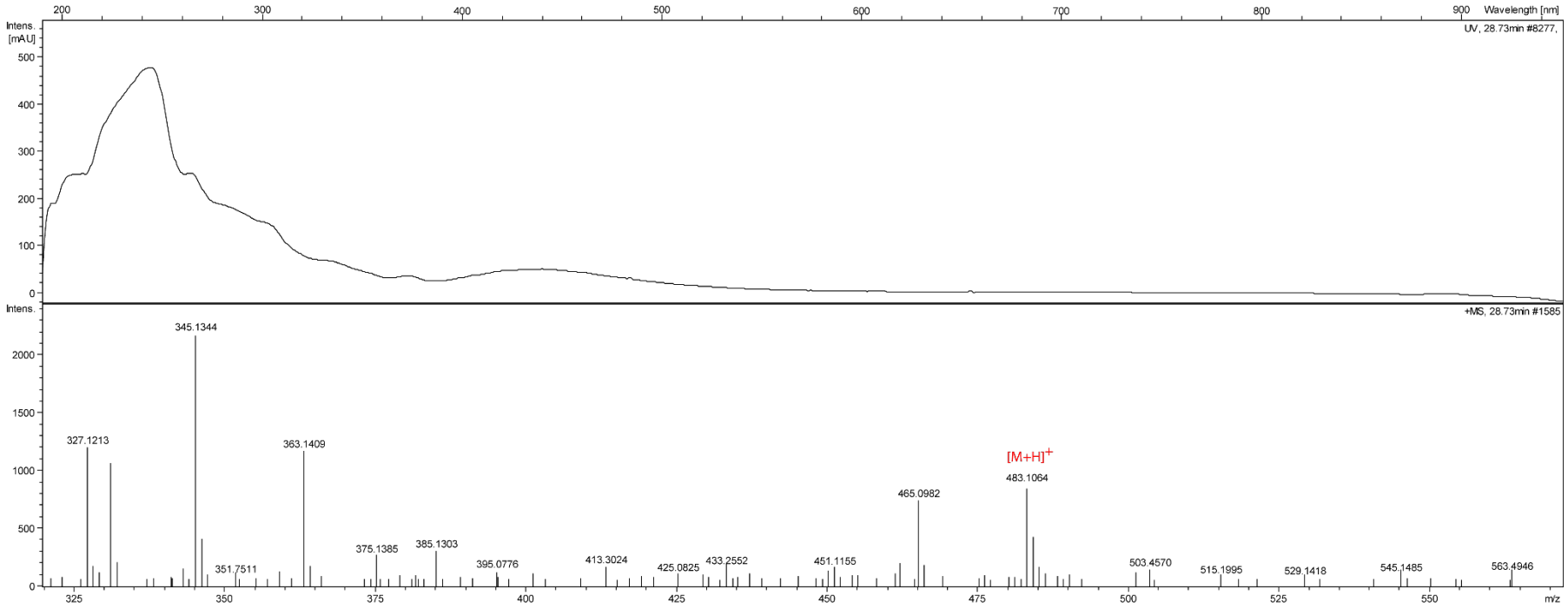


Figure S14. ^{1}H-NMR spectrum of compound **10** (600 MHz, Methanol-d_4).

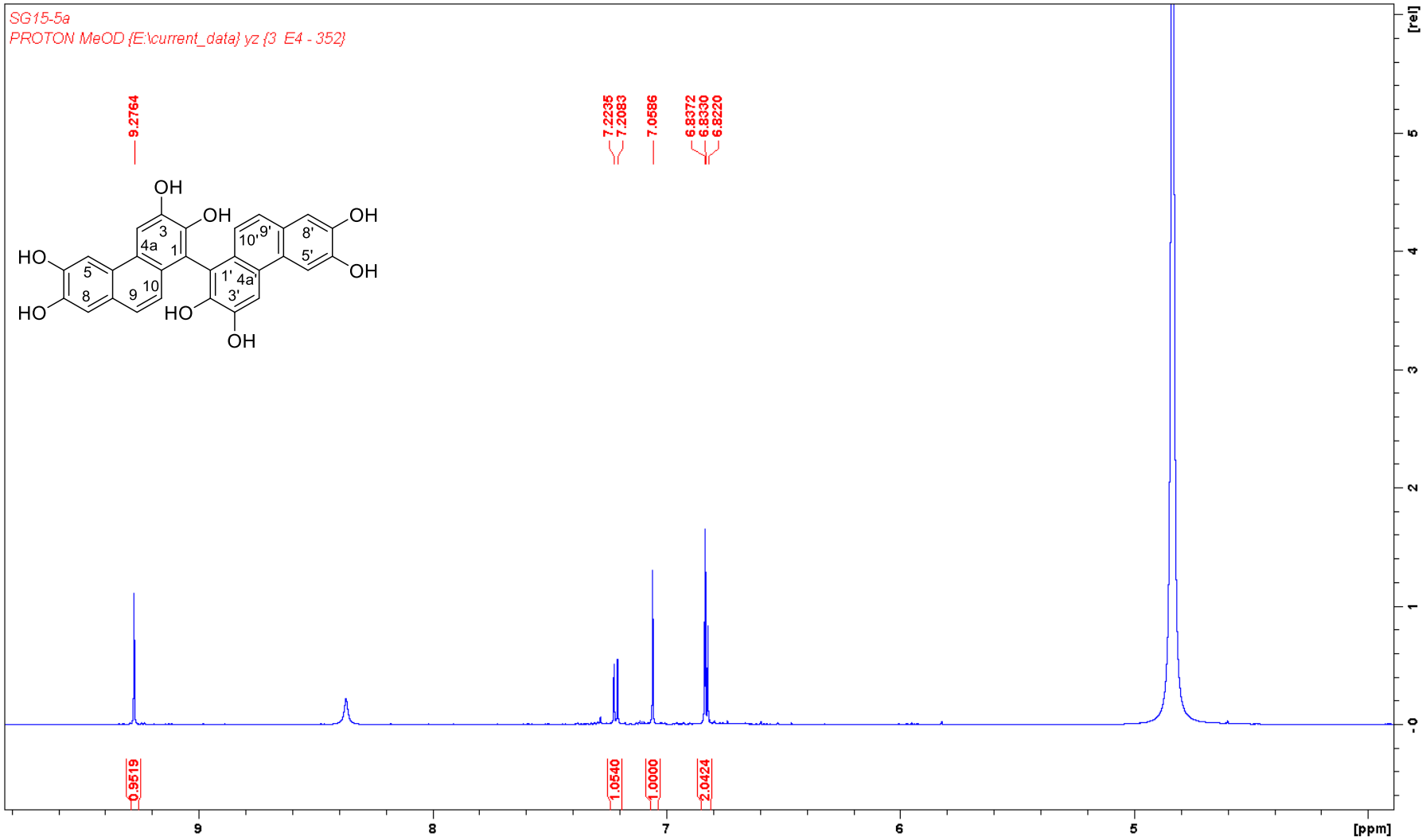


Figure S15. HSQC spectrum of compound **10** (600 MHz, Methanol-d_4).

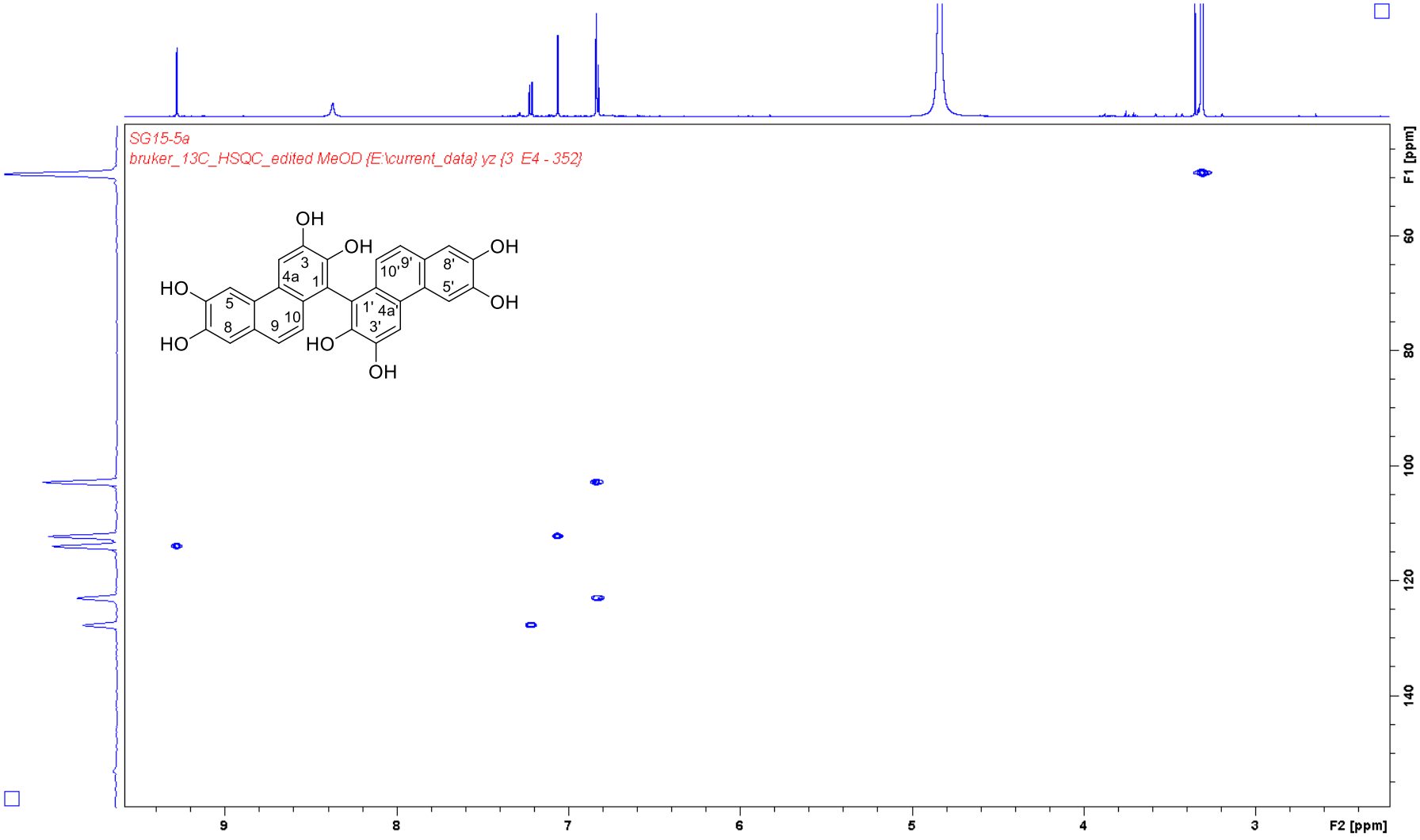


Figure S16. HMBC spectrum of compound **10** (600 MHz, Methanol-d_4).

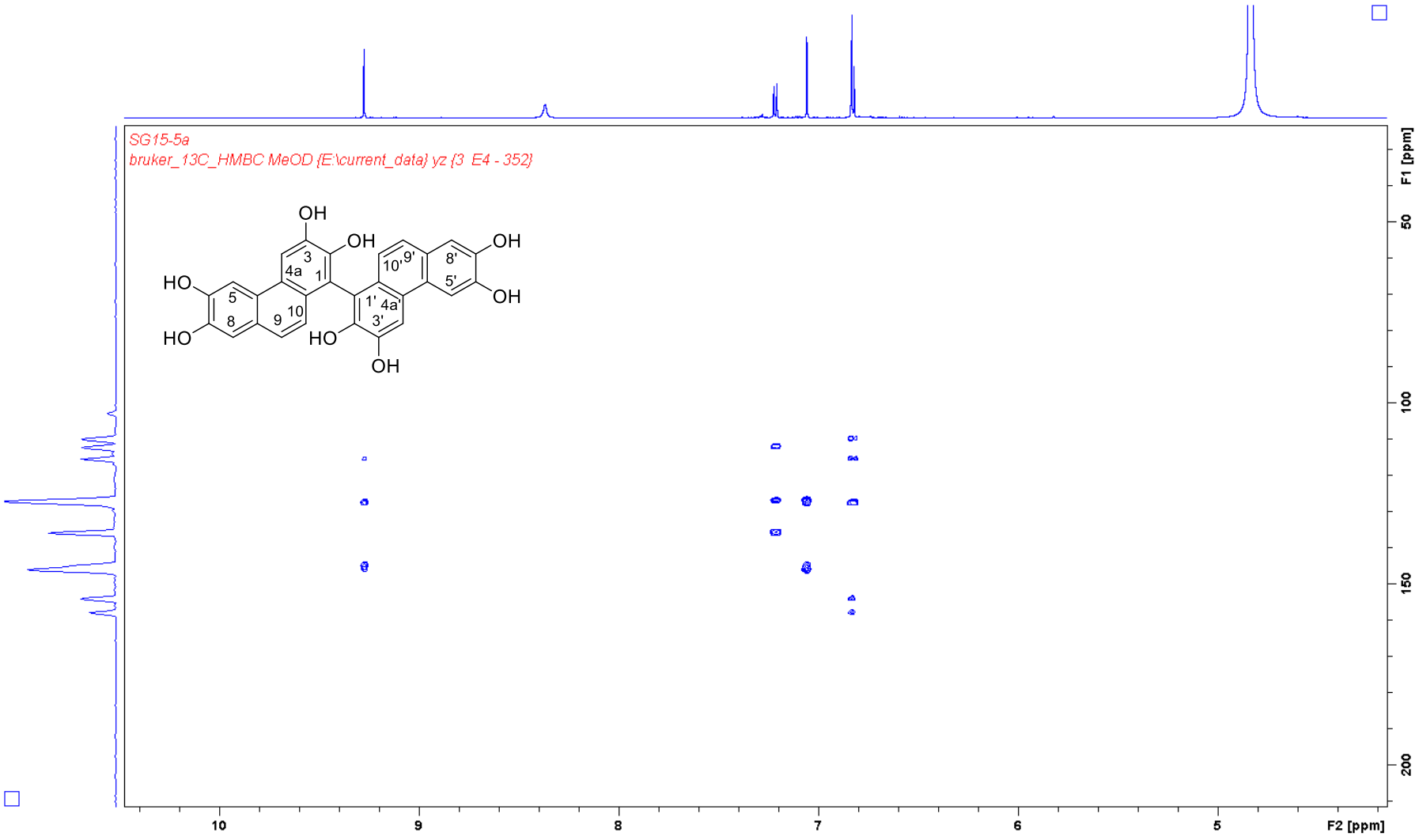


Figure S17. COSY spectrum of compound **10** (600 MHz, Methanol-d_4).

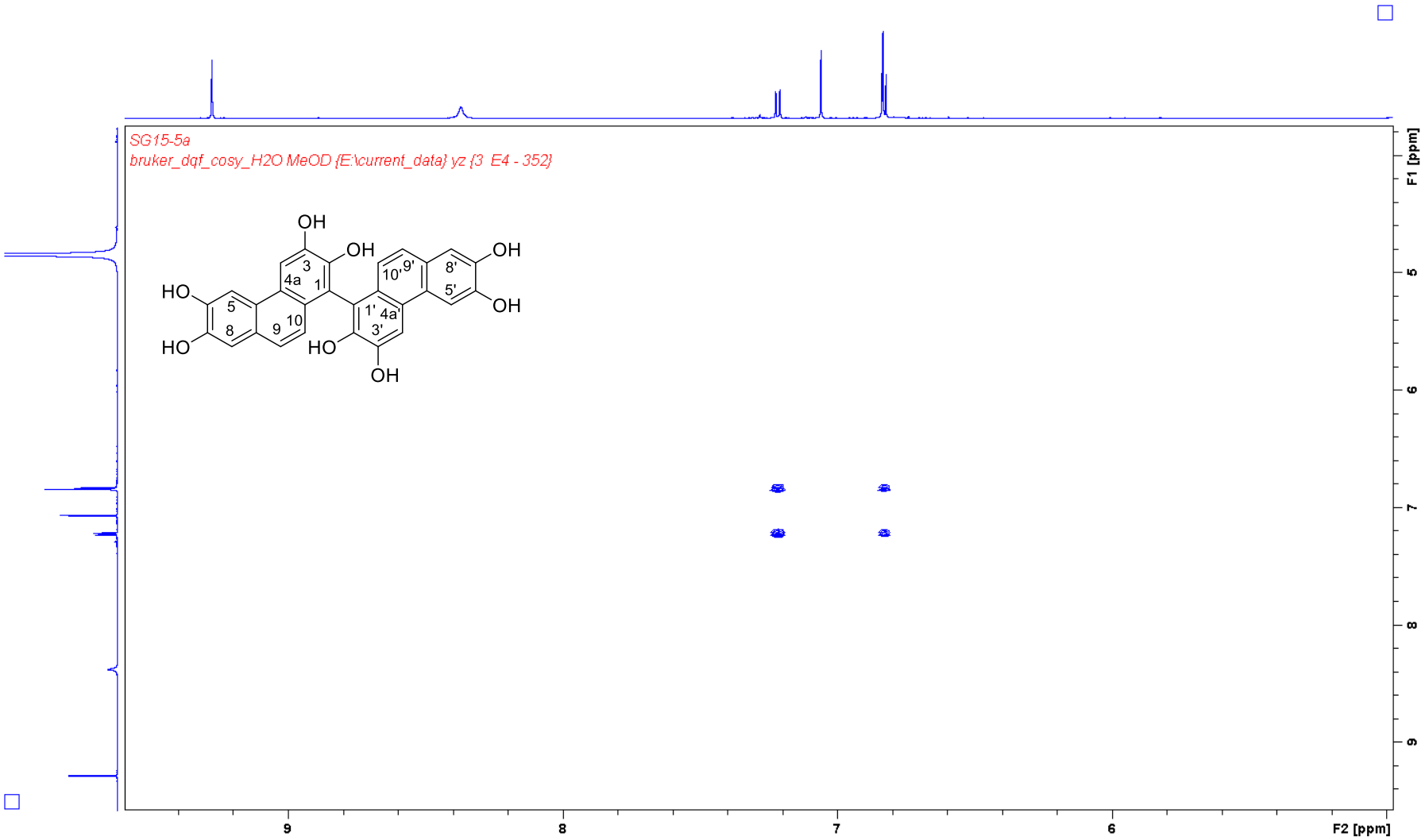


Figure S18. HPLC chromatogram of crude *P. bistorta* ethyl acetate extract monitored at 254 nm (black) as well as high-resolution α-glucosidase inhibition profile (red), high-resolution PTP1B inhibition profile (green) and high-resolution α-amylase inhibition profile (blue) [40 mg/mL, 10 µL injection].

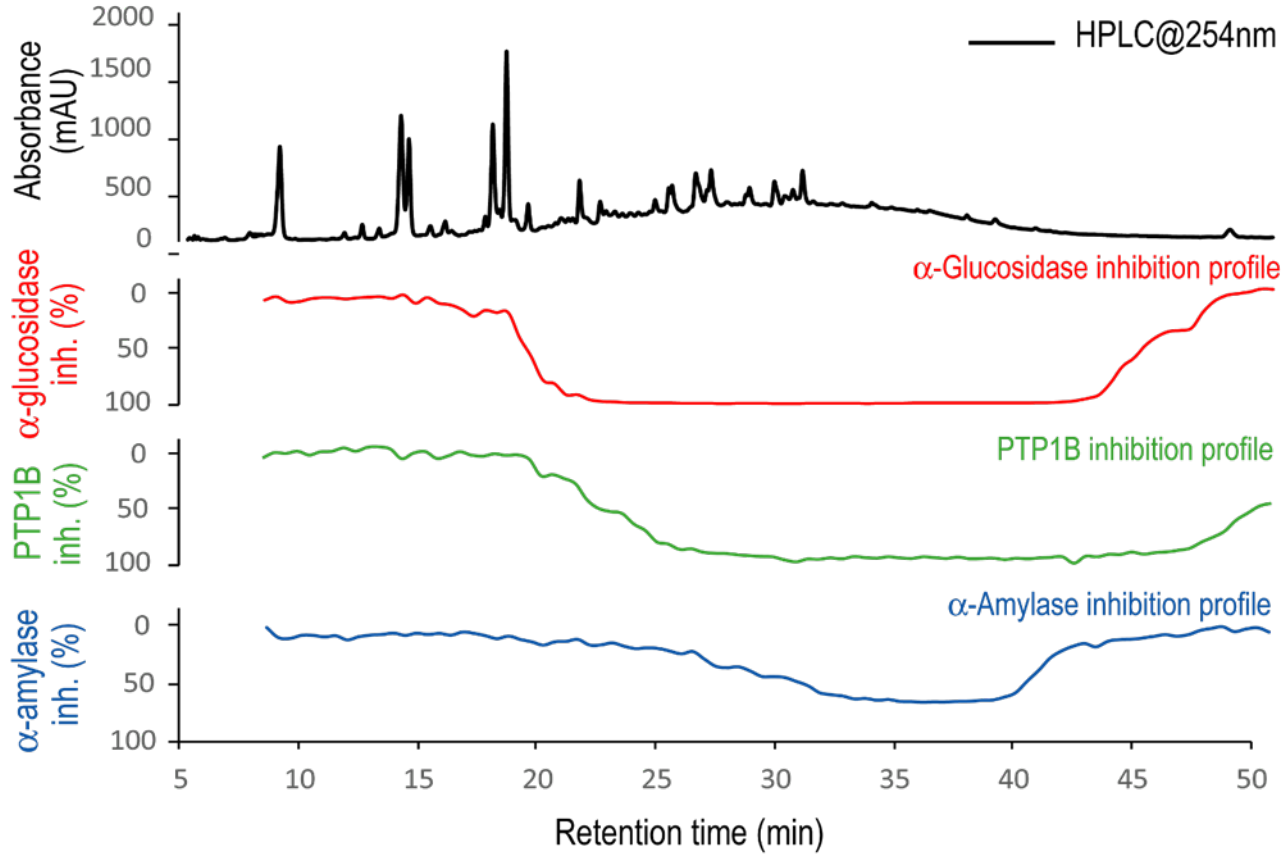
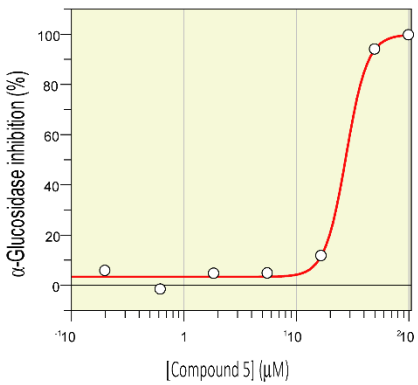
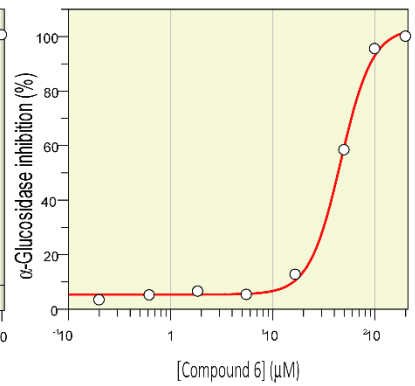


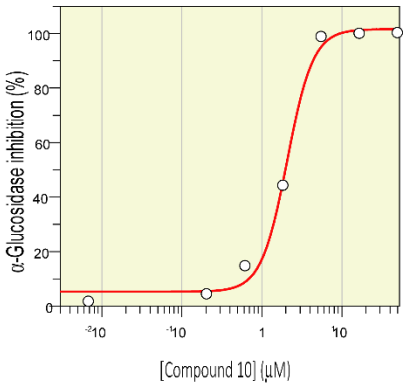
Figure S19. IC_{50} curves of isolated compounds and Acarbose (reference compound) in the α-glucosidase inhibition assays.



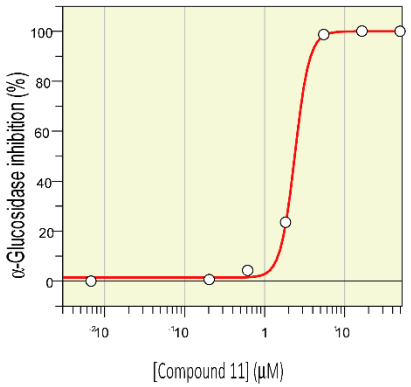
Parameter	Value	Std. Error
Y Range	96.5629	4.0711
IC 50	27.7341	2.9840
Slope factor	-4.6256	0.8900
Background	3.3264	1.7019



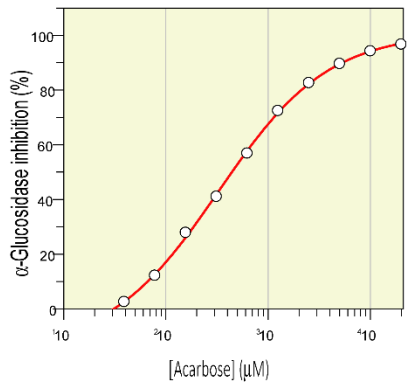
Parameter	Value	Std. Error
Y Range	97.7685	3.0188
IC 50	46.2874	1.8146
Slope factor	-2.8128	0.3605
Background	5.3744	1.0938



Parameter	Value	Std. Error
Y Range	96.3329	5.0247
IC 50	2.0765	0.1855
Slope factor	-2.6874	0.7395
Background	5.2961	3.1253

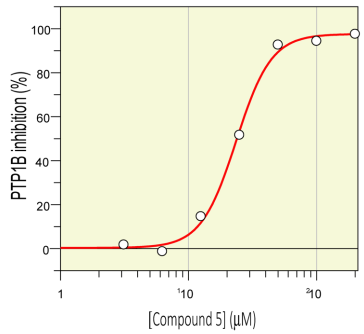


Parameter	Value	Std. Error
Y Range	98.5500	1.7087
IC 50	2.3943	0.1554
Slope factor	-4.8194	1.0748
Background	1.4099	1.0640

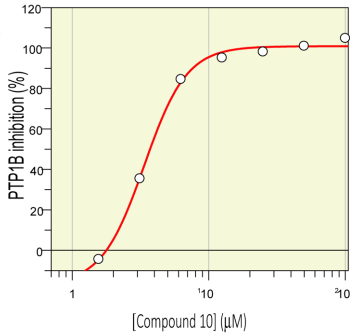


Parameter	Value	Std. Error
Y Range	115.8875	4.5623
IC 50	328.2079	25.3967
Slope factor	-0.8099	0.0472
Background	-14.8614	3.5314

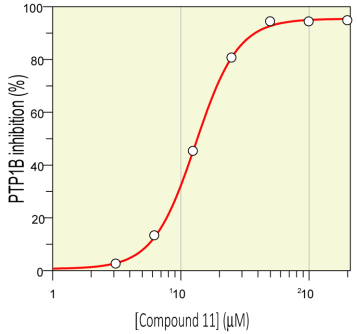
Figure S20. IC_{50} curves of isolated compounds and RK682 (reference compound) in the PTP1B inhibition assays.



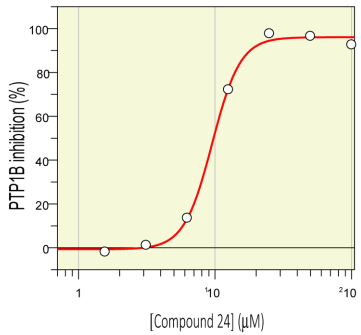
Parameter	Value	Std. Error
Y Range	97.2253	4.1812
IC 50	23.5551	1.2387
Slope factor	-3.1715	0.5268
Background	0.3609	2.7918



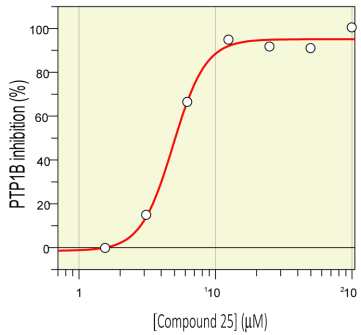
Parameter	Value	Std. Error
Y Range	117.8557	8.9821
IC 50	3.3647	0.2509
Slope factor	-2.7914	0.4356
Background	-16.9829	8.2752



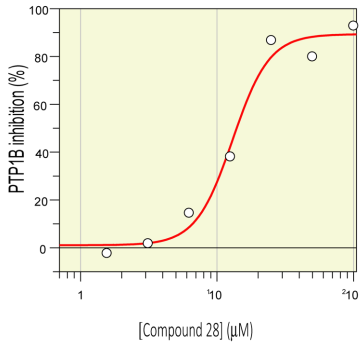
Parameter	Value	Std. Error
Y Range	94.7670	1.7945
IC 50	13.0348	0.2977
Slope factor	-2.6204	0.1449
Background	0.6661	1.4345



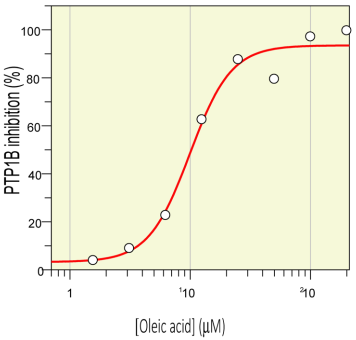
Parameter	Value	Std. Error
Y Range	96.7780	2.9308
IC 50	9.5323	0.3875
Slope factor	-4.2182	0.4862
Background	-0.6975	2.2158



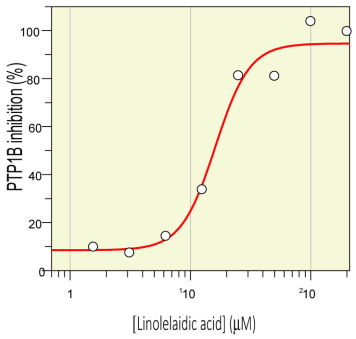
Parameter	Value	Std. Error
Y Range	96.5260	6.4813
IC 50	4.8936	0.3775
Slope factor	-3.6513	0.7672
Background	-1.4377	5.6812



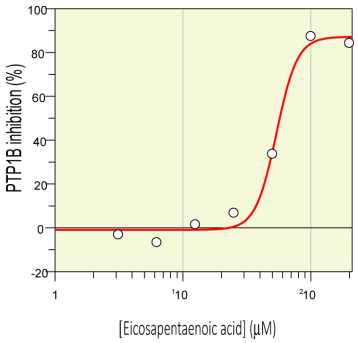
Parameter	Value	Std. Error
Y Range	88.2799	9.5469
IC 50	13.0082	1.7045
Slope factor	-3.2266	1.2874
Background	1.0818	6.0337



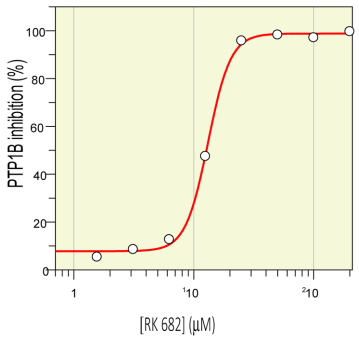
Parameter	Value	Std. Error
Y Range	90.2879	9.3769
IC 50	9.9320	1.4876
Slope factor	-2.5304	0.7963
Background	3.2387	7.2728



Parameter	Value	Std. Error
Y Range	86.1473	6.9126
IC 50	16.0828	1.9232
Slope factor	-3.0550	0.8614
Background	8.4845	4.6958



Parameter	Value	Std. Error
Y Range	88.0644	7.0675
IC 50	53.7672	4.2025
Slope factor	-5.3475	3.0534
Background	-0.9292	3.1186



Parameter	Value	Std. Error
Y Range	91.0115	1.8864
IC 50	13.1468	0.2926
Slope factor	-4.6262	0.6894
Background	7.7921	1.3180