

Supporting Information

Quantitative Interrelation between Atractylenolide I, II, and III in *Atractylodes japonica* Koidzumi Rhizomes, and Evaluation of Their Oxidative Transformation using Biomimetic Kinetic Model

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Table S1

Linear equations, correlation coefficients (r^2), LOD, and LOQ values for the three marker compounds in the methanol extract of *A. japonica* rhizomes

Compound	Linear equation	r^2	Linear range ($\mu\text{g/mL}$)	LOD ^a (ng/mL)	LOQ ^b (ng/mL)
Atractylenolide III	$y = 0.252x + 0.292$	0.9976	0.47–30.00	43	146
Atractylenolide II	$y = 2.613x + 1.098$	0.9991	0.31–20.00	23	78
Atractylenolide I	$y = 1.183x + 1.021$	0.9980	0.47–30.00	29	97

^a LOD, limit of detection

^b LOQ, limit of quantification

Table S2Repeatability of analysis of the three marker compounds in methanol extract of *A. japonica* rhizomes

Compound	Repeatability ($n = 6$, RSD ^a %)	
	Retention time	Absolute area
Atractylenolide III	6.03	0.06
Atractylenolide II	4.63	0.62
Atractylenolide I	6.04	0.54

^a RSD, relative standard deviation (%) = (standard deviation/mean) × 100.

Table S3The average content of the three marker compounds in methanol extract of *A. japonica* rhizomes ($n = 3$)

Sample No.	Average content (mg/g) ^a			<i>p</i> -value
	Atractylenolide III	Atractylenolide II	Atractylenolide I	
1	6.372 ± 0.514	3.802 ± 0.269	4.108 ± 0.125	b ^{***} , c ^{***}
2	8.655 ± 0.397	4.985 ± 0.259	4.613 ± 0.395	b ^{***} , c ^{***}
3	1.784 ± 0.240	1.070 ± 0.059	2.659 ± 0.149	a ^{***} , b ^{***} , c ^{**}
4	11.333 ± 0.930	5.090 ± 0.286	3.580 ± 0.207	a [*] , b ^{***} , c ^{***}
5	1.397 ± 0.157	0.728 ± 0.031	1.897 ± 0.059	a ^{***} , b ^{**} , c ^{***}
6	7.103 ± 0.282	3.234 ± 0.176	6.627 ± 0.444	a ^{***} , c ^{***}
7	1.023 ± 0.175	0.694 ± 0.052	1.818 ± 0.088	a ^{***} , b ^{***} , c [*]
8	14.864 ± 0.934	9.756 ± 0.751	8.409 ± 0.522	b ^{***} , c ^{***}
9	1.166 ± 0.101	0.665 ± 0.102	1.851 ± 0.160	a ^{***} , b ^{**} , c ^{**}
10	8.722 ± 0.201	5.161 ± 0.221	4.802 ± 0.204	b ^{***} , c ^{***}
11	4.777 ± 0.180	3.197 ± 0.146	7.430 ± 0.532	a ^{***} , b ^{***} , c ^{**}
12	6.356 ± 0.251	4.402 ± 0.083	5.683 ± 0.255	a ^{***} , b [*] , c ^{***}
13	5.643 ± 0.252	3.382 ± 0.143	3.497 ± 0.189	b ^{***} , c ^{***}
14	7.642 ± 0.312	3.227 ± 0.148	5.575 ± 0.424	a ^{***} , b ^{***} , c ^{***}
15	3.964 ± 0.293	2.307 ± 0.179	4.040 ± 0.235	a ^{***} , c ^{***}
16	18.380 ± 0.403	9.556 ± 0.302	11.158 ± 0.313	a ^{**} , b ^{***} , c ^{***}
17	10.822 ± 0.616	8.495 ± 0.406	11.559 ± 0.773	a ^{**} , c ^{**}
18	16.428 ± 1.402	11.502 ± 0.631	7.255 ± 0.667	a ^{**} , b ^{***} , c ^{***}
19	14.843 ± 0.736	11.883 ± 0.469	10.875 ± 0.338	b ^{***} , c ^{**}
20	7.569 ± 0.380	6.549 ± 0.229	9.229 ± 0.487	a ^{***} , b ^{**} , c [*]
21	7.067 ± 0.045	7.494 ± 0.249	6.084 ± 0.127	a ^{***} , b ^{***} , c [*]
22	12.166 ± 0.289	7.420 ± 0.377	15.380 ± 0.970	a ^{***} , b ^{**} , c ^{***}
23	9.349 ± 0.151	11.414 ± 0.087	10.788 ± 0.399	b ^{**} , c ^{***}
24	24.021 ± 0.228	17.691 ± 0.845	20.941 ± 0.532	a ^{**} , b ^{**} , c ^{***}
25	17.201 ± 1.842	14.860 ± 0.430	14.343 ± 0.745	-
26	12.125 ± 0.927	6.158 ± 0.320	8.028 ± 0.731	a [*] , b ^{**} , c ^{***}
27	4.750 ± 0.480	3.412 ± 0.190	2.356 ± 0.088	a [*] , b ^{***} , c ^{**}
28	13.707 ± 0.717	8.696 ± 0.452	7.203 ± 0.440	a [*] , b ^{***} , c ^{***}
29	25.281 ± 1.104	15.291 ± 0.257	6.870 ± 0.284	a ^{***} , b ^{***} , c ^{***}
30	3.823 ± 0.245	2.263 ± 0.121	5.648 ± 0.245	a ^{***} , b ^{***} , c ^{***}
31	11.117 ± 0.058	8.952 ± 0.108	13.005 ± 0.416	a ^{***} , b ^{***} , c ^{***}
32	22.736 ± 0.963	14.992 ± 0.664	6.330 ± 0.353	a ^{***} , b ^{***} , c ^{***}
33	21.213 ± 0.358	12.271 ± 0.852	5.525 ± 0.243	a ^{***} , b ^{***} , c ^{***}

34	15.193 ± 1.070	10.484 ± 0.523	6.725 ± 0.538	a **, b ***, c ***
35	19.114 ± 0.687	13.007 ± 0.309	6.311 ± 0.219	a ***, b ***, c ***
36	8.848 ± 0.310	7.047 ± 0.299	6.276 ± 0.170	a *, b ***, c ***
37	18.462 ± 1.055	11.714 ± 0.240	4.858 ± 0.214	a ***, b ***, c ***
38	6.583 ± 0.166	3.276 ± 0.079	4.694 ± 0.237	a ***, b ***, c ***
39	3.972 ± 0.178	1.345 ± 0.008	3.839 ± 0.178	a ***, c ***
40	17.137 ± 1.293	7.817 ± 0.782	5.294 ± 0.659	a *, b ***, c ***
41	6.764 ± 0.162	3.367 ± 0.028	5.330 ± 0.167	a ***, b ***, c ***

^a Average content (mg/g) of the marker compounds are represented as mean content ± standard deviation.

a, the difference of content between atractylenolide I and II with significance at * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

b, the difference of content between atractylenolide I and III with significance at * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

c, the difference of content between atractylenolide II and III with significance at * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Table S4Samples of *Atractylodes japonica* rhizomes from diverse locations in Korea and China

Sample No.	Location	Sample No.	Location
1	Euiseong, Gyeongbuk, Korea	22	China
2	Korea	23	Suwon, Gyeonggi, Korea
3	Euiseong, Gyeongbuk, Korea	24	Jangsu, Jeonbuk, Korea
4	Korea	25	Yongsan, Gyeongnam, Korea
5	Yeongdeok, Gyeongbuk, Korea	26	Cheongyang, Chungnam, Korea
6	Korea	27	Heilongjiang, China
7	Bonghwa, Gyeongbuk, Korea	28	Yeongcheon, Gyeongbuk, Korea
8	Yeongcheon, Gyeongbuk, Korea	29	Yeongcheon, Gyeongbuk, Korea
9	Yeongcheon, Gyeongbuk, Korea	30	Korea
10	Korea	31	Jecheon, Chungbuk, Korea
11	China	32	Yeongdeok, Gyeongbuk, Korea
12	China	33	Yeongcheon, Gyeongbuk, Korea
13	Yeongwol, Gangwon, Korea	34	Yangpyeong, Gyeonggi, Korea
14	Hwasun, Jeonnam, Korea	35	Hongcheon, Gangwon, Korea
15	Heilongjiang, China	36	Andong, Gyeongbuk, Korea
16	Korea	37	Yeongcheon, Gyeongbuk, Korea
17	Korea	38	Cheongsong, Gyeongbuk, Korea
18	Yeongdeok, Gyeongbuk, Korea	39	Neimengu, China
19	Korea	40	Hebei, China
20	China	41	China
21	China		

Figure S1. Extracted ion chromatogram of the three marker compounds and the IS in standard mixture (A) and the methanol extract of *A. japonica* samples (B) in the positive ion mode. 1, bergapten; 2, atractylenolide III; 3, atractylenolide II; and 4, atractylenolide I.

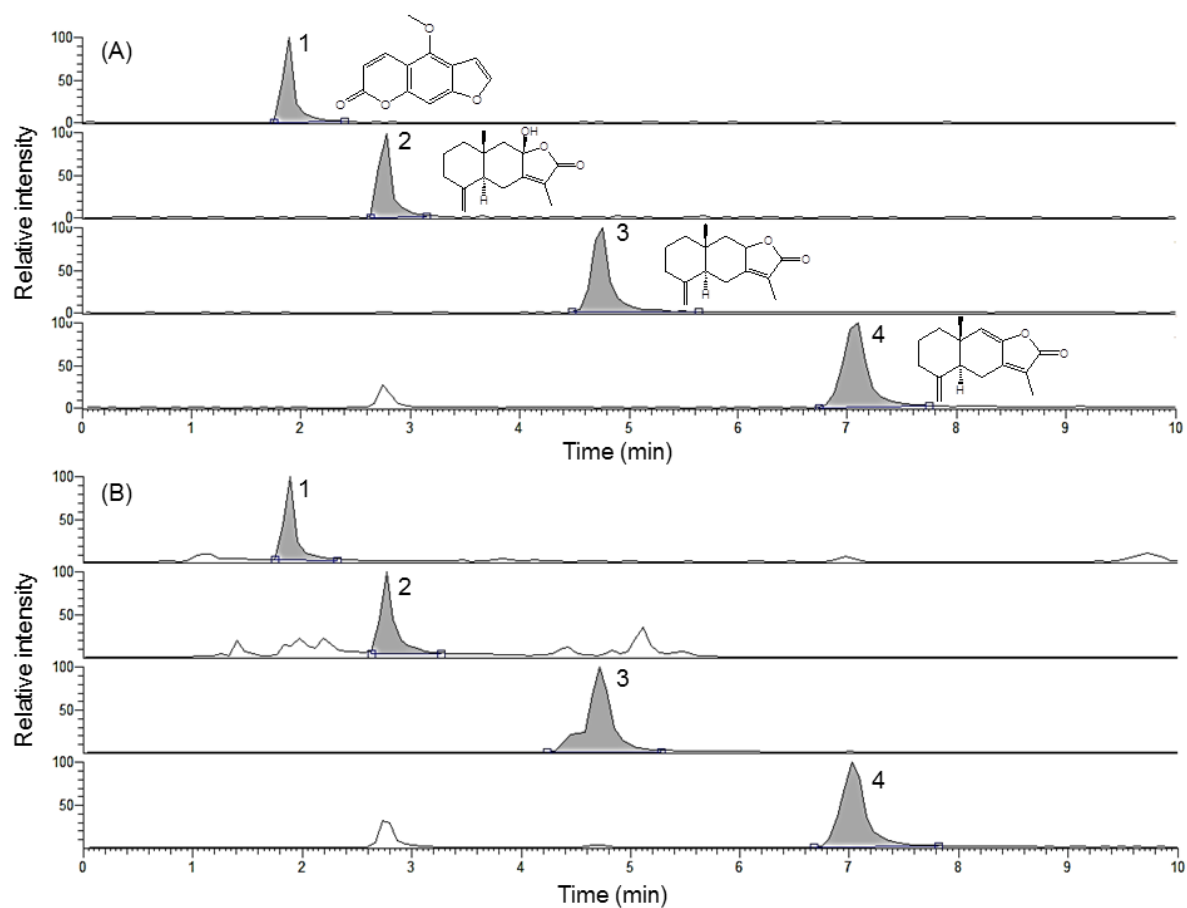


Figure S2. ESI-MS² spectra of bergapten (IS, A), atractylenolide III (B), atractylenolide II (C), and atractylenolide I (D) in the *A. japonica* samples.

