

Chemical Compositions and Antioxidant Activity of Essential Oil From Sun-cured Tobacco *Nicotiana tabacum* 'Daliuye' and 'Daheiyuan'

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Abstract

Nicotiana tabacum is a natural source of active chemical constituents against plant or human diseases. The chemical compositions of essential oil of *N. tabacum* 'Daliuye' and 'Daheiyuan' were analyzed by GC-MS. Their antioxidant activity were tested by a method of DPPH radical scavenging activity. The results demonstrated The highest antioxidant activity was the essential oil from the leaves of *N. tabacum* 'Daliuye' (IC₅₀ = 0.536 mg/mL) compared to that of 'Daheiyuan' tobacco (IC₅₀ = 5.686 mg/mL).

Keywords: *N. tabacum*; DPPH Radical Scavenging Activity; Antioxidant Activity

Introduction

Nicotiana tabacum is a natural source of active chemical constituents against plant or human diseases [1-7], which includes lots of varieties such as *N. tabacum* 'Daliuye', 'K326', 'Hongda' and so on [8]. According to the curing method sun-cured tobacco is a type of *N. tabacum* and usually produced by curing leaves of tobacco in the air [9]. *N. tabacum* 'Daliuye', a raw material for tobacco industry in China, is a kind of sun-cured tobacco [10]. To the best of our knowledge, no reference deals with the chemical constituents of *N. tabacum* 'Daliuye' and 'Daheiyuan'. In order to reveal their usage we researched the chemical compositions of essential oil and their antioxidant activity in this paper.

Materials and Methods

The leaves of *N. tabacum* 'Daliuye' and 'Daheiyuan' were collected from Huize county of Yunnan Province, China, 2020 and two

voucher specimens corresponding to No.2020012 and 2020013, respectively, were deposited at the Key Laboratory of Sustainable Utilization of Plateau characteristic spice plant resources, Education Department of Yunnan Province. The essential oil was extracted by Soxhlet Extractor and then analyzed by GC-MS.

Results and Discussion

Fifty-eight compounds extracted from the leaves of *N. tabacum* 'Daliuye' were detected by GC-MS. The identified compounds and their percentages are shown in table 1. The major chemical compositions are nicotine (51.22%), n-hexadecanoic acid (4.42%), phytol (1.20%), (Z,Z)-9,12-octadecadienoic acid (1.65%), octadecane (1.92%), dl-alpha-tocopherol (1.27%), ergost-5-en-3-ol (1.29%), campesterol (1.29%), stigmaterol (2.57%), gamma-sitosterol (1.22%), beta-sitosterol (1.22%), pregn-5-en-3-ol (1.22%).

Sixty-three compounds extracted from the leaves of *N. tabacum* 'Daheiyang' were detected by GC-MS. The identified compounds and their percentages are shown in table 2. The major chemical compositions are (S)-(-)-Nicotine (38.27%), n-hexadecanoic acid (5.15%), phytol (2.41%), (Z,Z)-9,12-octadecadienoic acid (1.01%), hentriacontane (4.79%), cholesterol (1.14%).

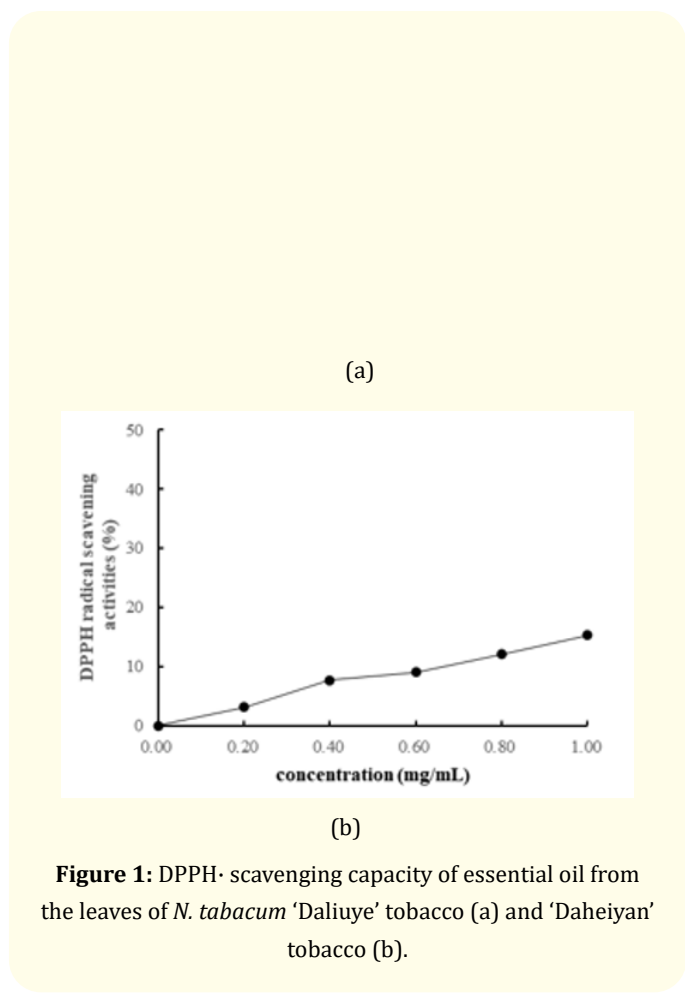


Figure 1: DPPH· scavenging capacity of essential oil from the leaves of *N. tabacum* 'Daliuye' tobacco (a) and 'Daheiyang' tobacco (b).

Peak no.	Compounds	Rt, min	%
1	3-Methylpentanoic acid	12.959	0.54
	Heptanoic acid		
2	Nicotine	19.654	51.22
3	α-Nicotine	20.026	0.07
4	3-(3,4-Dihydro-2H-pyrrol-5-yl) pyridine	20.942	0.28
5	2-Methyl-6-pyridin-3-ylloxazinane	22.166	0.07

6	Nicotyrine	22.401	0.22
7	2,3'-Dipyridyl	23.585	0.38
8	1,2,3,6-Tetrahydro-2,3'-bipyridine	24.094	0.11
9	Megastigmatrienone	25.685	0.11
10	2-Cyclohexen-1-one, 4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-	26.229	0.36
11	Cotinine	27.682	0.87
12	n-Nitrosornicotine	28.603	0.18
13	6,10,14-Trimethyl-2-pentadecanone	30.349	0.20
14	9-Eicosyne	30.686	0.19
15	(E)-Dodec-2-en-1-yl propyl carbonate	30.686	0.19
16	3,7-Dimethyl-6-octen-1-yl acetate	31.041	0.31
17	n-Hexadecanoic acid	33.232	4.42
18	4-[3-Ethoxypropylamino]benzo-1,2,3-triazine	35.201	0.67
19	Phytol	35.515	1.20
20	5-Eicosyne	36.099	0.65
21	(Z,Z)-9,12-Octadecadienoic acid	36.271	1.65
22	Octadecanoic acid	36.746	1.24
23	Bicyclo[10.1.0]tridec-1-ene	37.844	0.03
24	Alloaromadendrene	38.382	0.11
Peak no.	Compounds	Rt, min	%
25	1-Octadecene	38.519	0.21
26	Cycloeicosane	38.519	0.21
27	Cyclopentadecane	38.519	0.21
28	trans-Geranylgeraniol	40.110	0.37
29	C(14a)-Homo-27-nor-14beta-gammaceran-3alpha-ol	41.117	0.07
30	Heptacosyl acetate	41.810	0.19
31	Octacosyl acetate	41.810	0.19
32	Behenic alcohol	41.810	0.19
33	Hexadecane	41.935	0.10
34	Dotriacontane	41.935	0.10
35	1-Iodohexadecane	41.935	0.10
36	Bis(2-ethylhexyl) phthalate	42.719	0.05
37	Docosanoic acid	43.372	0.33
38	1,8-Dihydroxy-3-methoxy-6-methylanthracene-9,10-dione	44.608	0.06

39	Tetracosane	45.689	0.56
40	Heptadecane	45.689	0.56
41	Vitamin E	46.124	0.26
42	Squalene	49.042	0.19
43	Docosane	50.181	0.16
44	2-Methylhexacosane	50.181	0.16
45	Hexadecane	51.526	0.51
46	Tetratriacontane	53.992	0.13
47	1-Chloroheptacosane	55.651	0.23
48	Cholesterol	60.435	0.60
49	Octadecane	61.362	1.92
50	dl-alpha-Tocopherol	62.620	1.27
51	Ergost-5-en-3-ol	66.330	1.29
Peak no.	Compounds	Rt, min	%
52	Campesterol	66.330	1.29
53	Heneicosane	68.176	0.17
54	Stigmasterol	70.036	2.57
55	gamma-Sitosterol	74.396	1.22
56	beta-Sitosterol	74.396	1.22
57	Pregn-5-en-3-ol	74.396	1.22
58	Cholest-5-en-3-ol	75.878	0.46

Table 1: Chemical compositions of essential oil from the leaves of *N. tabacum* ‘Daliuye’ tobacco.

Peak no.	Compounds	Rt, min	%
1	Phenylethyl alcohol	4.42	0.05
2	(S)-(-)-Nicotine	9.774	38.27
3	2-(1-Methyl-2-pyrrolidinyl) pyridine	11.153	0.03
4	3-(3,4-Dihydro-2H-pyrrol-5-yl) pyridine	11.628	0.26
5	Dihydropseudoionone	12.223	0.03
6	Nicotyrine	12.218	0.47
7	2,4-bis(1,1-Dimethylethyl)-phenol	13.916	0.05
8	1,2,3,6-Tetrahydro-2,3'-bipyridine	14.077	0.82
9	Dihydroactinidiolide	14.454	0.22
10	2,3'-Dipyridyl	14.729	0.43

11	2-Pyridinemethanol	17.739	0.02
12	2-Cyclohexen-1-one	18.425	0.09
13	Cotinine	19.467	0.65
14	n-Nitrosornicotine	20.640	0.32
15	Tetradecanoic acid	21.412	0.04
16	6,10,14-Trimethyl-2-pentadecanone	22.774	0.43
17	1-Methylene-2b-hydroxymethyl-3,3-dimethyl-4b-(3-methylbut-2-enyl)-cyclohexane	24.553	0.19
18	14-Methyl-pentadecanoic acid methyl ester	24.754	0.02
19	cis,cis,cis-7,10,13-Hexadecatrienal	25.641	0.07
20	3-(4,8,12-Trimethyltridecyl) furan	25.744	0.21
21	n-Hexadecanoic acid	26.144	5.15
22	Heneicosane	28.812	0.15
23	Phytol	29.165	2.41
Peak no.	Compounds	Rt, min	%
24	1,1-Dimethyl-3,4-bis(1-methylethenyl)cyclohexane	29.394	0.13
25	(Z, Z)-9,12-Octadecadienoic acid	29.892	1.01
26	(Z, Z, Z)-9,12,15-Octadecatrienoic acid	30.745	0.76
27	Octadecanoic acid	41.17	0.07
28	11,13-Dimethyl-12-tetradecen-1-olacetate	31.654	0.11
29	1-Docosanol, methyl ether	32.896	0.25
30	Behenic alcohol	32.896	0.25
31	1-Tetracosanol	32.896	0.25
32	2(1H)-Naphthalenone	33.199	0.07
33	13-Tetradecene-11-yn-1-ol-2-Methyl-3-(3-methyl-but-2-enyl)-2	33.485	0.16
34	1-(4-tert-Butylphenyl)propan-2-one	34.596	0.33
35	trans-Geranylgeraniol	34.859	0.16
36	Eicosanoic acid	35.185	0.16
37	1,12-Bis(2-nitrophenoxy) dodecane	35.522	0.15
38	Lanosterol	35.774	0.08
39	(E)-5-eicosene	36.999	0.31

40	1-Heptacosanol	36.999	0.31
41	Octadecane	37.176	0.15
42	9-Octylicosane	37.176	0.15
43	gamma-Sitosterol	38.881	0.79
44	beta-Sitosterol	38.881	0.79
45	Heptacosane, 1-chloro-	39.064	0.13
Peak no.	Compounds	Rt, min	%
46	Tetracosane	39.064	0.13
47	Octacosane	39.064	0.13
48	Stigmasterol	40.277	0.05
49	Androst-5,15-dien-3ol acetate	40.352	0.06
50	Eicosane	42.463	0.02
51	Hexacosane	42.721	0.04
52	5 α -Cholest-2-ene-2-methanol	43.075	0.16
53	Squalene	44.128	0.15
54	4-(2,2-Dimethyl-6-methylenecyclohexyl) butanal	47.876	0.08
55	Hentriacontane	53.255	2.0
56	Cholesterol	54.319	1.14
57	Heptadecane	55.418	4.79
58	Vitamin E	56.282	0.36
59	dl-alpha-Tocopherol	56.282	0.36
61	Nonacosane	61.483	0.55
62	Yangambin	63.572	0.08
63	24-methylene cycloartanol	63.875	0.23

Table 2: Chemical compositions of essential oil from the leaves of *N. tabacum* 'Daheiyang' tobacco.

The antioxidant activity of essential oil from the leaves of *N. tabacum* 'Daliuye' and 'Daheiyang' tobacco was tested by a method of DPPH radical scavenging activity [11,12]. The results obtained from both extracts are shown in figure 1. The highest antioxidant activity was the essential oil from the leaves of *N. tabacum* 'Daliuye' (IC₅₀ = 0.536 mg/mL) compared to that of 'Daheiyang' tobacco (IC₅₀ = 5.686 mg/mL).

Conclusion

This study indicated that *N. tabacum* 'Daliuye' and 'Daheiyang' have moderate antioxidant activity. In our future work, the effect of chemical constituents against plant or human diseases will be further investigated.

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Conflict of Interest

There are no any conflict of interest exists.

Bibliography

1. Z Y Chen., et al. *Journal of Agricultural and Food Chemistry* 57 (2009): 6590.
2. L Li., et al. *Phytochemistry Letter* 13 (2015): 156.
3. X M Gao., et al. *Heterocycles* 85 (2012): 147.
4. P He., et al. *Heterocycles* 94 (2017): 949.
5. D R Mou., et al. *Heterocycles* 85 (2012): 2485.
6. S Z Shang., et al. *Fitoterapia* 108 (2016): 1.
7. W B Zhou., et al. *Plant Protection* 43 (2017): 108 (2017).
8. J Chen., et al. *Industrial Crops and Products* 167 (2021): 113534.
9. M L Xu and Y P Li. "Illustration of tobacco germplasm resources". 1th Ed., Science Press, Beijing (2009).
10. K Shimada., et al. *Journal of Agricultural and Food Chemistry* 40 (1992): 945.
11. G Y Ji., et al. *Chemistry of Natural Compounds* 57 (2021): 560.