Effects of exogenous methyl jasmonate treatments on tea aroma

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Summary

The relative content of major terpenes and hexenyl esters in fresh tea leaves were increased and reached a peak in 24 hours after the tea bushes treated by 0.25% MeJA. The aroma sensory quality of made green tea was also obviously improved. The main active aroma components were β-linalool, linalool oxide □, methyl salicylate, geraniol, (Z)-3-hexenyl hexanoate and δ-cadinene.

Introduction

Aroma, one of the key indicators of tea quality, is influenced by tea cultivars, climatic conditions, cultivation practices, processing technologies and other extraneous factors. In this study, we investigated the changes of aroma components in fresh tea leaves treated by methyl jasmonate (MeJA), and identified the aroma sensory quality and the active aroma components of the made green teas.

Materials and methods

A bud and two leaves were sampled respectively at 0 hr, 4 hr, 8 hr, 24 hr and 28 hr from the tea bushes sprayed by 0.25% MeJA, and then were processed into the Chinese roasted green teas according to the traditional manufacture method.

For each sample 5.00g were weighed into a 150ml vial, and infused 30ml boiling water, sealed the vial with tetrafluoroethylene and immediately kept it at 60 ºC to equilibrate for 5 min in water bath, the PDMS/DVB fiber, with 65 μm film thickness(Supelco, Bellafonte, PA, USA) was exposed for 60 min to the headspace while maintaining the sample at 60 ºC. After sampling the SPME fiber was introduced into the GC injector, and was left for 3.5min to allow the analytes thermal desorption.

An Agilent (Wilmington, DE, USA) model 6890 GC and model 5973 MSD ion Trap mass spectrometer was used. A HP-5MS column (30m×0.25mm ID×0.25μm film thickness) was used. The GC oven temperature was programmed from 50 ºC (held for 5min) to 210 ºC at the rate of 3 ºC /min and followed by increasing from 210 ºC (held for 3min) to 230 ºC at the rate of 15 ºC /min. The injector temperature was 250 ºC. High purified helium was used as carrier gas with a constant flow at 1.0mL/min. The injection volume is 1μL.

The GC-O analysis was conducted using Agilent model 6890 GC equipped with an FID detector and sniffing port (Sniffer-9000, Brechbühler, made in Switzerland).The column and analysis conditions were as above. The gas chromatography effluents of 4μl of aroma extract were split between the sniffing port and FID (1/1).The temperature of the FID was 250 ºC. Three panelists responded to and recorded the retention time and descriptor of the aroma compounds. The aroma intensity of the stimulus by using a 4-point scale ranging from 0 to 4, 0=none, 2=moderate, and 4=extreme. Each sample was sniffed twice by each panelist.

Results and discussion

1. After treated with 0.25% of exogenous MeJA, the composition and content of aromatic constituents in fresh tea leaves were changed significantly during a certain period. The relative content of major terpenes and hexenyl esters were increased and reached a peak in 24 hours after the treatment. β-Cadinene, Copaene, Cubenol and Indole were new aroma components induced by MeJA (Table 1).

2. The green teas made from the fresh tea leaves treated with 0.25% of exogenous MeJA for 24 hours had a distinct floral aroma compared with the control. The relative content of major terpenes, hexenyl

esters and alcohols in the made teas were also increased significantly. The main aroma-active components in the made green teas were β-linalool, linalool oxide □, methyl salicylate, geraniol, (Z)-3-hexenyl hexanoate and δ-cadinene (Table2).

Table 1 Variations of aroma components in fresh tea leaves treated by 0.25% of MeJA at different times

Classification	Aroma components	Relative content (%)				
		0hr (CK)	4hr	8hr	24hr	28hr
Terpenes	α-Cubebene	0.17	0.45	0.50	0.74	0.58
	β-Cubebene	0.23	0.35	0.41	0.60	0.54
	Caryophyllene	0.18	0.23	0.26	0.44	0.33
	α-Farnesene	0.13	0.34	0.47	0.54	0.51
	δ- Cadinene	0.42	0.96	1.51	1.67	1.42
Hexenyl Esters	(Z)-3-Hexenyl isovalerate	0.52	0.59	0.68	1.55	0.89
	(Z)-3-Hexenyl hexanoate	1.16	1.93	2.74	6.25	3.88
	(E)-3-Hexenyl hexanoate	0.24	0.54	1.02	1.24	0.51
	(Z)-3- Hexenyl benzoate	0.15	0.18	0.31	0.67	0.24
New Components	β- Cadinene	/	/	/	0.27	0.17
	Copaene	/	/	0.27	0.33	0.29
	Cubenol	/	/	0.15	0.22	0.21
	Indole	/	0.93	1.34	0.29	0.27
	MeJA	/	1.89	1.44	0.18	0.11

Note: Relative content (%) = each peak's area/total area ×100%

Table 2 Aroma-active components detected by GC-O analysis from the made green teas

Aroma components	Odor quality	CK		Treated by 0.25% of MeJA	
		Relative content (%)	Intensity	Relative content (%)	Intensity
β- Cadinene	Floral, woody	/	0	0.73	1
Copaene	Floral	/	0	0.45	1
Cubenol	Fresh, clove	/	0	0.31	1
Indole	Floral, green, earthy	/	0	0.81	2
Caryophyllene	Floral	0.41	1	1.49	2
α-Farnesene	Floral	0.41	1	0.71	2
δ- Cadinene	Floral, herbal	3.96	2	4.97	3
(Z)-3-Hexenyl isovalerate	Floral	0.68	1	0.84	2
(Z)-3-Hexenyl hexanoate	Floral	1.53	2	2.07	3
(E)-3-Hexenyl hexanoate	Floral	1.34	1	2.22	2
β- Linalool	Floral, green, citrus	17.25	3	23.47	4
Linalool oxide Ⅳ	Fresh, woody, floral	0.85	2	1.70	3
Geraniol	Rosy, citrus peel	3.11	2	4.29	3
Methyl salicylate	Wintergreen, herbal	4.88	2	6.11	3

References

Gui Lian-you, et al. (2004) Effect of exogenous jasmonate-induced tea volatiles on host-selection behavior of insects. Journal of Tea Science. 24(3):166-171