Study on Curing Characteristics of Distinctive Flue-cured Tobacco Varieties in China

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Abstract

In order to provide theoretical support in formulating curing method for different flue-cured tobacco varieties, we have conducted systematic study on flue-curing characteristics of 3 flue-cured tobacco varieties. The mature middle leaves of Hongda,CB-1, two distinctive varieties in China and Yunyan85, were used for all the tests. The characteristics of color change of tobacco leaves under dark condition and changes of plastid pigments and water content during flue-curing process were determined. The results showed that the 3 tobacco varieties displayed difference in the processes of yellowing and water loss. The distinctive varieties Hongda and CB-1 had higher pigment content than Yunyan85 in both fresh leaves and in leaves during the whole curing process, with slower yellowing process. The fresh leaves of the two distinctive varieties had higher free water and total water content. Water loss in Hongda leaves was faster at earlier stages while water loss of CB-1 was relatively slow at first and became faster at later stages of the curing process. In summary, the distinctive flue-cured tobacco varieties Hongda and CB-1 showed non-preferred flue-curing characteristics with high pigment content and asynchronous leaf yellowing and water loss processes.

Key words: feature variety; curing characteristics

Introduction

Tobacco curing characteristics has important impact on the quality of tobacco leaves. Curing characteristics is under genetic control and is formed during the agronomic process. In the curing process，for varieties with higher xanthophyll and Carotenoid, chlorophyll is degradated faster and earlier and leaves turn yellow quickly，the leaves are easy to cure. On the other hand，if the chlorophyll content is higher, leaves turn yellow slowly and are difficult to cure. The rate of water loss has a similar role in curing. Varieties with better water loss balance are easier to cure. The color change of tobacco leaves under dark condition reflects the actual tobacco curing characteristics. Varieties with fast yellowing and slow browning process under dark condition have better curing characteristics. In this study flue curing characteristics of 3 cultivars, Hongda, Yunyan85,CB-1 was studied under dark condition. The degree and rate of yellowing, changes in pigments, rate of moisture removal, contents of main chemical components were examined for all varieties during flue curing. The major factors that affect curing characteristics were analyzed to provide a theoretical basis for improving the curing quality of distinctive varieties.

Results and Analysis

2.1 change characteristics of different flue-cured tobacco varieties under dark condition

Table 1 Color change of middle tobacco leaves of three flue-cured tobacco varieties in darkness condition

Time (hour)	flue-cured tobacco varieties	Yellowing(%)	Vein whiten	Browning(%)
	CB-1	30	1/2 whiten	No browning
0	Hongda	30	1/2 whiten	No browning
	Yunyan85	30	1/2 whiten	No browning
	CB-1	60	1/2 whiten	No browning
24	Hongda	60	1/2 whiten	No browning
	Yunyan85	80	1/2 whiten	No browning
	CB-1	70	1/2 whiten	leaf apex and base, browning 10%
48	Hongda	70	1/2 whiten	leaf apex and base, browning 5%
	Yunyan85	90	2/3 whiten	No browning
	CB-1	80	2/3 whiten	leaf apex and base, browning 15%
72	Hongda	80	1/2 whiten	leaf apex and base, browning 10%
	Yunyan85	100	2/3 whiten	No browning
	CB-1	75	2/3 whiten	leaf apex and base, browning 25%
96	Hongda	85	2/3 whiten	leaf apex and base, browning 15%
	Yunyan85	95	2/3 whiten	leaf apex and base, browning 5%
	CB-1	60	2/3 whiten	leaf apex and base, middle-upper part, browning 40%
120	Hongda	80	2/3 whiten	leaf apex and base, middle-upper part, browning 20%
	Yunyan85	90	2/3 whiten	leaf apex and base, browning 10%
	CB-1	40	All whiten	All leaf browning 60%
144	Hongda	55	All whiten	All leaf browning 45%
	Yunyan85	70	2/3 whiten	All leaf browning 30%

2.2 The Curing characteristics of different flue-cured tobacco varieties

Appearance quality of different flue-curing tobacco varieties was showed in Table 2. The results indicated that Yunyan85, with more yellowing leaves and less greenish and variegated leaves, had the best curing quality. CB-1 showed the worst cured tobacco quality and Hongda was between that of Yunyan85 and CB-1. The analysis indicated that the distinctive flue-cured tobacco varieties were more difficult to cure than the conventional variety Yunyan85.

Table 2 Appearance quality of middle leaves of different flue-curing tobacco varieties

flue-curing tobacco varieties	yellowing leaves /%	greenish leaves /%	variegated leaves/%
CB-1	24.8	39.2	36
Hongda	70.4	24.6	5
Yunyan85	88.1	9.2	2.7

2.3 Pigment content of leaf blade and vein during curing

2.3.1 Analysis of pigments in leaf blade in curing process

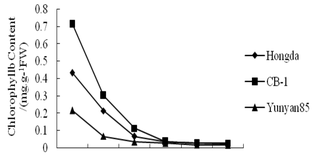

Fig. 2a Changes of chlorophyll a content during the flue-curing process

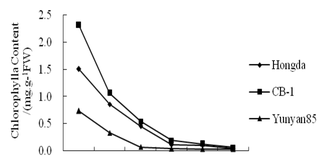

Fig. 2b Changes of chlorophyll b content during the flue-curing process

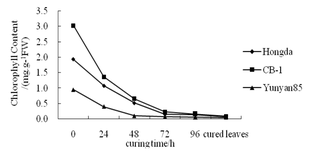

Fig.2c Changes of chlorophyll a content during the flue-curing process

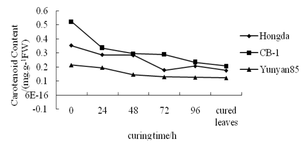

Fig.2d Changes of chlorophyll b content during the flue-curing process

2.3.2 The difference Analysis of pigments of veins in curing process

Table 4 Appearance quality of middle leaves of different flue-curing tobacco varieties

Curing time/h	CB-1/(mg/g)	Hongda/(mg/g)	Yunyan85/(mg/g)
0	1.8086	1.6605	1.1827
24	1.6016	0.9667	0.7282
48	0.3259	0.1406	0.2257
72	0.1770	0.1263	0.1174
96	0.1125	0.0944	0.0846
Cured tobacco leaves	0.0467	0.0456	0.0338

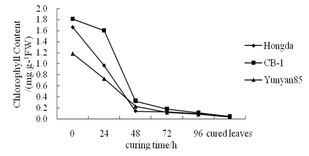

Fig.3 Changes of vein chlorophyll content during the flue-curing process

The color formation of flue-cured tobacco veins is related to chlorophyll content. The veins of fresh leaves of the distinctive flue-cured tobacco varieties have high chlorophyll content, with the order from high to low being CB-1＞Hongda＞Yunyan85. Chlorophyll content in the veins of cured leaves has the same order. Chlorophyll content of the cured tobacco veins is correlated with the amount of vein chlorophyll in fresh leaves. In order to prevent green vein in cured leaves ,vein yellowing time need to be prolonged to promote chlorophyll degradation.

2.4 Changes of total water content of tobacco leaves and veins of three varieties of flue-cured tobacco during flue-

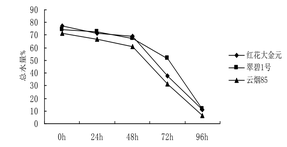

Fig. 4a Changes of total water content of tobacco leaves of three varieties of flue-cured tobacco during flue-curing

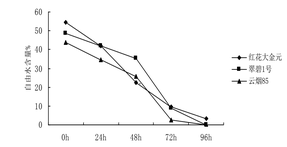

Fig. 4b Changes of free water content of tobacco leaves of three varieties of flue-cured tobacco during flue-curing

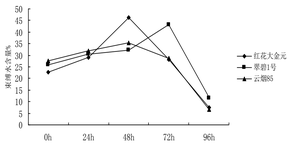

Fig. 4c Changes of bound water content of tobacco leaves of three varieties of flue-cured tobacco during flue-curing

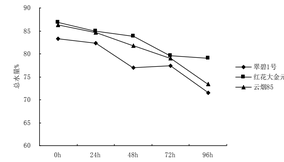

Fig. 5 Changes of total water content in veins of three varieties of flue-cured tobacco during flue-curing

Discussion

Chlorophyll in tobacco leaves are an important factor that affects leaf quality and curing characteristics. Usually, varieties with high levels of chlorophyll and carotenoid in fresh leaves have ideal flue-cured tobacco quality. High content of chlorophyll, however also means bad curing characteristics, the leaves are difficult to complete yellowing. Result from this study showed that: pigment content in fresh leaves of Hongda and CB-1 is higher than that in Yunyan85 leaves. Pigment content gradually decreases during the curing process. Pigment content in the distinctive flue-cured tobacco varieties is higher than that in Yunyan85 leaves during the whole curing process. Chlorophyll degradation rate of Yunyan85 is significantly lower and tends to be stable after hour 48 while in the distinctive flue-cured tobacco varieties chlorophyll degradation slows down only after hour 72.

The leaf dehydration characteristics is an important factor that affect flue-curing. This study showed that fresh leaves of Hongda have the highest water content and that free water loss in Honda is too fast during the first 24 hours, resulting in excessive water loss, which usually leads to green cured tobacco leaves. Fresh tobacco leaves of CB-1 also have high water content. Total water loss is relatively slow during the first 48 hours but water loss suddenly accelerate between hour 48 and hour 96. In the case of that leaf moisture is not good exhausted, the leaf color can turn green and get mottled. Free water content of the two distinctive flue-cured tobacco varieties is higher than Yunyan85 variety with Hongda having the highest free water content. During the first 48 hours, the free water loss rate of Hongda is the fastest and that of CB-1 is the slowest. Between hour 48 and hour 72 the free water loss rate of CB-1 is the fastest and that of Hongda is the slowest. During the whole flue-curing processing the content of bound water increases initially and then decreases. The bound water content of Hongda and CB-1 reaches its maximum at hour 48 and hour 72, respectively. Both are significantly higher than bound water content of Yunyan85.Total water content of tobacco veins of the three varieties of flue-cured tobacco have less change and little difference were observed during the yellowing and color fixing stages. The high frequency of undesirable green vein color on cured leaves of the distinctive flue-cured tobacco varieties may be related to the high level vein chlorophyll content. This problem can be solved via promoting chlorophyll degradation during the color fixing stages.

In conclusion, the curing characteristics of the two distinctive flue-cured tobacco varieties is not good because of high chlorophyll content and uncoordinated leaf yellowing rate and water loss rate. Water loss of Hongda leaves was fast at earlier stages, which can lead to green flue-cured leaves. Water loss of CB-1 was slow at first and became fast at later stages, potentially leading to green and mottled leaves. Flue-curing of the two distinctive flue-cured tobacco varieties is more difficult than that of the conventional variety Yunyan85

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