

Study on the Quality Difference between Hand-made and Machine-made Mengding yellow bud

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Abstract: In order to explore the quality difference between hand-made and machine-made Mengding yellow bud, the fresh leaves of the *C. sinensis* cv. Chuancha were used as raw materials to make manual process Mengding yellow bud and mechanical Mengding yellow bud respectively. Through the sensory evaluation and biochemical composition determination, the quality difference between the Mengding yellow buds produced by two processing techniques was compared in the aspects of appearance and intrin. The results showed that hand-made Mengding yellow buds had higher amino acid and caffeine retention, and more theaflavins formed. Therefore, the hand-made Mengding yellow buds had mellow and sweet taste, high and long aroma, and bright yellow soup color. Machine-made Mengding yellow buds had more beautiful appearance than hand-made Mengding yellow bud. The contents of water extract, tea polyphenol and the soluble sugar of machine-made Mengding yellow buds were higher. Therefore, machine-made Mengding yellow buds had more bitter taste and lacked sweet and mellow quality characteristics of yellow tea.

1. Introduction

Yellow tea is a lightly fermented tea, unique to China, and it has a unique procedure called “sealed yellowing” which created the unique quality characteristics of yellow infusion and yellow brewed leaves. Yellow tea is popular and is a healthy drink for consumers because yellow tea not only has good flavor, but also possesses special effects on anti-cancer, free radical scavenging, anti-bactericidal and gastrointestinal protecting effects [1], therefore it is recommended by experts as the most suitable tea. Traditional famous yellow tea in China include “Junshan Yinzhen” and “Weishan Maojian” from Hunan, “Mengding Yellow Bud tea” from Sichuan, “Yuan'an Luyuan Tea” from Hubei, “Huoshan Yellow Bud tea” and “Huoshan yellow big Tea” from Anhui, “Pingyang yellow liquid” from Zhejiang, etc [2]. Compared to green tea, the taste of yellow tea is mellow because the unique processing step “sealed yellowing” reduces the amount of ester catechins, increases the content of amino acids, reduces the chlorophyll, and weakens the astringency of tea soup. The nutritional value and pharmacological ingredients of yellow tea are in the top three of six major teas [3]. However, the total output of yellow tea in China is low. Except for some brands, the production of other yellow teas has shrunk. Some enterprises have switched to produce other teas such as green tea, which makes traditional brands into empty shells and faces the danger of market shrinkage and loss of processing technology of yellow tea [4]. Because it's difficult to master the processing step “sealed yellowing”, some yellow tea enterprises change the processing step “sealed yellowing” into the processing step of frying and covering in the pot. The traditional processing technique of yellow tea has low production efficiency and unstable quality, which is the most direct reason for impeding the marketization of yellow tea [5].

This paper compared and analyzed the difference of the qualities between hand-made Mengding yellow bud tea and machine-made Mengding yellow bud tea and explored the quality status of

mechanical yellow buds , which is of great practical significance for the improvement for the quality and production efficiency of yellow tea and can promote the development of yellow tea market.

2. Material and methods

2.1 Manufacturing processes of Mengding yellow bud tea

All buds were collected from the *C. sinensis* cv. Chuancha plant. Hand-made Mengding yellow bud teas were made by a master who has more than 20 years of experience in traditional yellow tea processing. The manufacturing process was as follows: fresh buds→frying (by hands)→first sealed yellowing (8h) →second fried→third fried→drying. Machine-made Mengding yellow bud teas were made by a new process as follows: fresh buds →frying (in a tea-firing roller machine) →first sealed yellowing (4h) →refring →resealed yellowing (2-3h) →squashing (by tea-squashing machine) →stacking and spreading →drying.

2.2 Sensory evaluation

According to the tea sensory evaluation method (GB/T23776-2009), 5 senior tea experts with national qualifications scored in shapes, aromas, soup colors, tastes and leaf bottoms with weighted percentage method.

2.3 Main determination method of biochemical composition

The total polyphenol contents of the tea products were determined using sulfuric acid–phenol method [6].The content of free amino acids were determined by ninhydrin colorimetry [7].The content of caffeine were determined by uv spectrophotometry [8]. Chlorophyll content was determined by spectrophotometry [9].The contents of TF, TR and TB were determined by systematic analysis method. The total amount of soluble sugar was determined by anthrone colorimetric method. The content of water extract was determined according to GB/ T8305-1987.

3. Results and discussion

3.1 Sensory evaluation results

According to the sensory evaluation results of Mengding yellow bud teas processed in different ways as shown in Table 1, the score of hand-made Mengding yellow bud tea was higher than that of machine-made Mengding yellow bud tea in general. On base of dry tea appearance, the machine-made Mengding yellow bud teas were flat, straight, and yellow, while the hand-made Mengding yellow bud teas were darker and uneven. On base of the taste, the traditional hand-made Mengding yellow bud teas were fresh and sweet, mellow and sweet, delicate, while the taste of the machine-made Mengding yellow bud teas were similar to green tea, with more bitter taste. On base of the aroma, the traditional hand-made Mengding yellow bud teas were tender and tall, and the quality was superior to machine-made Mengding yellow bud teas. On base of the soup color, hand-made Mengding yellow bud teas were light apricot yellow, and the machine-made Mengding yellow bud teas were yellow-green. In general, the qualities of hand-made yellow buds was closer to traditional yellow buds than mechanical yellow buds.

Although the traditional hand-made Mengding yellow bud teas were not as bright and uniform as the machine-made Mengding yellow bud teas, the endogenous quality, especially the aroma and the sweetness unique to yellow tea, was better than the machine-made Mengding yellow bud teas. It was supposed that the traditional hand-made processing degraded the polyphenols during fired green due to the high temperature for a long time, and the hydrolysis and pyrolysis of proteins and polysaccharides were produced during the “sealed yellowing” process with long time, which increased the content of free amino acids and simple sugars. Therefore, the ratio of phenol to ammonia of the hand-made Mengding yellow bud teas was smaller, and the taste was more mellow and sweet.

Table 1. The Sensory Evaluation Result of the hand-made and machine-made Mengding yellow bud

product type	Appearance (25%)	Taste (30%)	Aroma (25%)	Liquor color (10%)	Leaf (10%)	Synthesis score
hand-made Mengding yellow bud	flat, with a hair Brown yellow	mellow, sweet, fresh and delicate	tender, sweet, high and long	tender yellow and bright	hypertrophy, uniform neat	86.28
machine-made Mengding yellow bud	flat and straight, even and regular Yellow and bright	thick, rough	Stir-fried beans, burnt incense, less pure	yellow green and bright	hypertrophy, even, regular Green yellow, bright	83.34

3.2 Determination of the main biochemical components of traditional yellow buds and mechanism yellow buds

According to Table 2, the water extract and soluble sugar content of machine-made Mengding yellow buds were higher than that of hand-made. It is likely to be thought as a result of damp-heat effect, during which the insoluble macromolecular substances were degraded to form small molecules, so that there were more extractions. The content of amino acid and caffeine in hand-made Mengding yellow buds was higher than that in the machine-made Mengding yellow bud tea polyphenols which mainly affected the convergence of tea soup in hand-made Mengding yellow buds were lower. For yellow tea, the reduction of tea polyphenols can reduce the astringency of tea soup. The ratio of tea polyphenols to amino acids is an important indicator to measure the taste, especially the mellow and freshness degree. The smaller the phenolic ammonia ratio, the more mellow the taste [9]. The experiment suggested that the phenolic ammonia ratio of the hand-made Mengding yellow buds was smaller than that of machine-made Mengding yellow buds, so the taste of hand-made yellow buds was mellow.

Table 2. The Main Composition Test Results of the hand-made and machine-made Mengding yellow bud

product type	Water extract (%)	TP (%)	Amino acid (%)	Caffeine (%)	Soluble saccharides (%)
hand-made Mengding yellow bud	42.05±0.61	35.35±0.24	4.42±0.00	4.46±0.35	6.19±0.04
machine-made Mengding yellow bud	43.86±0.56	36.52±0.98	3.98±0.41*	4.22±0.06	6.55±0.51

Ps: All the tabular data in the paper are the average of 3 repetitions of each treatment. In the same column, "*" indicates significant difference ($P < 0.05$); "***" indicates that the difference is extremely significant ($P < 0.01$)

3.3 Determination results of main pigment components in the hand-made and machine-made Mengding yellow bud

During the yellowing process, tea polyphenols were oxidized to produce pigment substances such as theaflavins (TF), thearubigins (TR) and theabrownins (TB) under the conditions of moist heat and microorganisms. As shown in the Table 3, compared with the hand-made Mengding yellow buds, the machine-made Mengding yellow buds had more total chlorophyll content slightly and higher chlorophyll a content with a significant difference. The content of theaflavin and thearubigin was lower than that of hand-made Mengding yellow buds significantly. Theaflavin which had strong astringency is an important component of the taste intensity and freshness of the soup, and affects the

color of the leaf bottom. On base of dry tea color, the machine-made Mengding yellow buds color was bright yellow and the hand-made Mengding yellow buds color was dark yellow. On base of the taste, mechanical yellow buds had stronger convergence and heavier bitter and astringent taste. On base of the soup color, machine-made Mengding yellow buds soup was yellow-green and the hand-made Mengding yellow bud color was apricot yellow. This indicated that the traditional hand-made yellow bud process is more suitable for the transformation of chlorophyll and the conversion of tea polyphenols to theaflavins and thearubigin in tea than the mechanical yellow buds, which confirmed the results of the sensory review.

Table 3. The Main Pigment Content Test Results of the hand-made and machine-made Mengding yellow bud

product type	Total chlorophyll (mg/g)	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Theaflavine (%)	Thearubigins (%)	Theabrownins (%)
hand-made Mengding yellow bud	1.04±0.03	0.80±0.07	0.29±0.02	0.17±0.02	3.06±0.15	2.70±0.02
machine-made Mengding yellow bud	1.06±0.21	0.82±0.01*	0.25±0.04	0.11±0.03	2.67±0.23	3.08±0.03

Ps: All the tabular data in the paper are the average of 3 repetitions of each treatment. In the same column, "*" indicates significant difference ($P < 0.05$); "***" indicates that the difference is extremely significant ($P < 0.01$)

4. Conclusion

This paper compares the qualities of the Mengding yellow buds produced by the two processing methods and the results showed that hand-made yellow buds were higher in the content of aroma, and taste and biochemical components, which were closer to the characteristics of yellow tea, but its color was darker and uneven. Although the mechanical Mengding yellow buds were beautiful in color, they lacked the unique aroma and taste of yellow tea. The machine-made Mengding yellow bud in this study changed the "refrying" process in the wok to frying in the tea-carding machine, which needed more amount of leaves and shortened the sealed time to about half of the traditional time, thus improving the production efficiency. However, the quality was similar to green tea, and there were some shortcomings such as weak taste, less vellus and low aroma which may be because that the yellow tea production enterprises have less research on the mechanized processing process of yellow tea, and have not systematic and comprehensive technical parameters of each step of the process. This is the problem that yellow tea industry faces jointly at present.

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