Effect of the width of cut tobacco on the quality of slim cigarette

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Abstract: In order to further explore the characteristics of slim cigarette processing technology, this study designed different cut width (0.7mm and 0.8mm) of product A, and carried out the experiments of making and rolling under the same process conditions, and evaluated the influence of the width of cut tobacco on the quality of slim cigarette. The results showed that: the 0.7mm cut width has the following advantages: Processing characteristics, Short rejection rate, Reducing draw resistance, Weight stability, Uniformity of density is better than 0.8 mm cut width, and 0.7 mm cut width is more suitable for the production of slim cigarette.

1. Introduction

The width of cut tobacco has a significant influence on the structure of cut tobacco and the rolling quality of finished cigarettes. The physical and chemical indicators of cut tobacco have been widely studied in the field of conventional tobacco at present, which is mainly reflected in the following aspects: 1. The influence of cut width on other physical indicators and overall stability of cut tobacco [1-4]; 2. the influence of cut width on the chemical indicators of smoke and cut tobacco [4-5]; 3. the effect of cut width on cigarette sensory quality [6]. However, with the rapid development of slim cigarettes, primarily when it is found that there are significant differences between slim cigarettes and conventional cigarettes primarily in terms of cigarette blends and physical properties [7], the research work on the influence of processing technology on cigarette quality and physical and chemical indicators in the field of slim cigarettes has also been carried out gradually. Therefore, according to the actual cigarette production situation, this study designed different cut width under the same process conditions, and carried out the experiment of making and rolling, and evaluated the influence of the width of cut tobacco on the quality of slim cigarette.

2. Materials and Methods

2.1. Test Equipment

Test site: The middle stage test workshop in cigarette factory; Test equipment: 1000kg/h production line; Instrument and Equipment: Tobacco structure analysis vibrating sieve (screen size is 3.35mm, 2.5mm, 1.0mm), Balance, Filling detector, Comprehensive test bench, Cigarette maker, Hand-held thermometer; Test material: Brand A of cigarette blends.

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2.2. Test scheme
According to the standard production process, the brand A of cigarette blends is sent to the leaf storage cabinet, and the cut width of the cutting machine is set to 0.7mm and 0.8mm when cutting; the follow-up processes are stored in the storage cabinet after the standard production, and the finished products are rolled into the cigarette machine after the storage time is completed. In this process, samples were taken to detect the structure and the material indicator of cut tobacco.

3. Results and Analysis

3.1. Structure of cut tobacco
It can be seen from Table 1 that the structure of cut tobacco and filling value data with 0.7mm cut width are lower than 0.8mm cut width; the filling value of 0.8mm cut width is higher than 0.7mm cut width by 0.06cm³/g, the whole cut tobacco ratio is 1.83% higher, and the small particle content is the same.

In the data of the amount of running cut tobacco: the whole cut tobacco ratio with 0.7mm cut width decreased by 11.09%, which was better than that of 0.8mm cut width decreased by 14.67%; The small particle content of 2.39% for 0.7mm cut width is better than 2.86% for 0.8mm cut width, and the filling values of both are decreased in the same trend.

From the comparative analysis of data, the structure of 0.8 mm cut width is better than 0.7 mm cut width; after rolling, the processing characteristics of 0.7 mm cut width is better than 0.8 mm cut width.

Table 1 Distribution table of the structure of cut tobacco with different cut width

| Cut width mm        | Serial number | Total weight g | 3.35mm | 2.5mm | 1mm | <1.0mm | Whole cut tobacco ratio % | Small particle content % |
|---------------------|---------------|----------------|--------|-------|-----|--------|---------------------------|--------------------------|
| 0.7mm Cut-tobacco   | 1             | 1008.2         | 513.9  | 285.2 | 194.5 | 13     | 79.26                     | 1.29                     |
| Storage out of the cabinet | 2             | 1024.8         | 506.8  | 298   | 202.9 | 15.38  | 78.53                     | 1.5                      |
|                      | 3             | 1008.5         | 476.3  | 300.9 | 209.9 | 19.28  | 77.22                     | 1.91                     |
| Mean                |               |                |        |       |      |        | 78.34                     | 1.57                     |
| 0.8mm Cut-tobacco   | 1             | 1041.1         | 537.9  | 314.9 | 179.1 | 10.6   | 81.8                      | 1.02                     |
| Storage out of the cabinet | 2             | 1003.4         | 504.3  | 306.5 | 180.7 | 20.58  | 80.11                     | 2.03                     |
|                      | 3             | 1035.4         | 476.7  | 335.3 | 203.6 | 17.38  | 78.61                     | 1.68                     |
| Mean                |               |                |        |       |      |        | 80.17                     | 1.58                     |
| 0.7mm Cut-tobacco   | 4             | 51.5           | 5.6    | 3.8   | 28.3  | 13.7   | 18.21                     | 26.49                    |
| from cigarette      | 5             | 51.5           | 6.0    | 4.0   | 31.1  | 10.2   | 19.50                     | 19.85                    |
|                      | 6             | 50.1           | 6.1    | 3.8   | 30.2  | 9.9    | 19.76                     | 19.77                    |
| Mean                |               |                |        |       |      |        | 19.15                     | 22.06                    |
| 0.8mm Cut-tobacco   | 4             | 50.9           | 5.1    | 3.7   | 31.6  | 10.5   | 17.21                     | 20.70                    |
| from cigarette      | 5             | 50.8           | 5.6    | 3.8   | 32.1  | 9.4    | 18.42                     | 18.39                    |
|                      | 6             | 50.6           | 4.4    | 3.2   | 29.9  | 12.7   | 14.90                     | 25.06                    |
| Mean                |               |                |        |       |      |        | 16.85                     | 21.38                    |
3.2. Short rejection rate

It can be seen from Table 2 that the short rejection rate of two different cut widths on different cigarette machines is compared. It is found that the average value of the short rejection rate of the cut tobacco with 0.8mm cut width is higher than that of the cigarette with 0.7mm cut width, and the short rejection rate of the same cut tobacco on different machines fluctuates greatly. The fluctuation of the short rejection rate of the cut tobacco with 0.7mm cut width in different machines is smaller than that of the cut tobacco with 0.8mm cut width. Therefore, the 0.7mm cut width can significantly reduce the short rate of cigarettes.

Table 2 Statistics of short rejection rate of different cigarette machines

| Brand | Machine number | Short rejection rate% | Difference |
|-------|----------------|-----------------------|------------|
|       |                | 0.8mm cut width | 0.7mm cut width | ↓ |
| A     | 1#             | 9.7                 | 8.1         | 1.6   |
|       | 2#             | 10.3                | 9.2         | 1.1   |
|       | 3#             | 9.7                 | 7.9         | 1.8   |
|       | 4#             | 11.1                | 9.5         | 1.6   |
| Average |               | 10.2                | 8.675       |      |

3.3. Physical indicators of cigarette

According to the criterion of 555-560mg/cig, the cigarette weight of 0.7mm and 0.8mm cut width cigarettes was screened, and then the physical indicators of the selected cigarettes were tested. The test data are shown in table 3 and table 4.

The results showed that the standard deviation of single cigarette weight with 0.8mm cut width was 2.5% higher than that of 0.7mm under the same single cigarette weight. Under the same single cigarette weight, the average draw resistance of 0.8mm cut width is 87.19pa higher than that of 0.7mm; under the same single cigarette weight, the hardness of 0.8mm cut width is lower than 1.2% of 0.7mm cut width; under the same single cigarette weight, the influence of two kinds of cut width on circumference and length is not apparent.

In conclusion, 0.7mm cut width has a better effect on reducing draw resistance and stabilizing weight than 0.8mm cut width.

Table 3 Test results of physical indicators of cigarettes with a different cut width

| Cut width mm | Number of tests | Single cigarette weight | Circumference | Draw resistance | Cigarette length |
|--------------|-----------------|-------------------------|---------------|-----------------|-----------------|
|              |                 | Mean | SD    | Mean | SD    | Mean | SD | Mean | SD |
| 0.7mm        | 20              | 559.35 | 13.87 | 17.09 | 0.04 | 1273.8 | 5 | 56.96 | 100 | 0.13 |
| 0.7mm        | 20              | 556.8 | 15.81 | 17.09 | 0.06 | 1280.1 | 5 | 75.7 | 100 | 0.13 |
| 0.7mm        | 20              | 556.55 | 11.74 | 17.09 | 0.05 | 1237.8 | 5 | 53.46 | 99.99 | 0.08 |
| 0.7mm        | 20              | 555.15 | 17.2 | 17.07 | 0.04 | 1266.8 | 5 | 59.41 | 100.1 | 0.07 |
| 0.7mm        | 20              | 559.85 | 16.15 | 17.08 | 0.06 | 1274.2 | 5 | 71.14 | 100.1 | 0.1 |
| 0.7mm        | 20              | 555.2 | 14.86 | 17.08 | 0.06 | 1257.9 | 5 | 57.64 | 100 | 0.1 |
| 0.7mm        | 20              | 559.25 | 12.24 | 17.11 | 0.07 | 1305.3 | 5 | 83.97 | 100.1 | 0.13 |
| 0.7mm        | 20              | 557.6 | 16.72 | 17.11 | 0.05 | 1262.4 | 5 | 78.59 | 100.1 | 0.15 |
Table 4 Hardness test results of the cigarette with a different cut width

| Cut width mm | Serial number | Mean of hardness | SD of hardness |
|--------------|--------------|-----------------|---------------|
| 0.7mm        | 1            | 58.92           | 3.582         |
|              | 2            | 59.01           | 2.828         |
|              | 3            | 58.51           | 3.141         |
|              | 4            | 59.45           | 2.842         |
|              | 5            | 58.72           | 3.039         |
|              | Average      | 58.92           | 3.0864        |
| 0.8mm        | 1            | 57.78           | 2.721         |
|              | 2            | 58.5            | 3.32          |
|              | 3            | 57.42           | 3.185         |
|              | 4            | 57.97           | 3.118         |
3.4. The density of tobacco rod

According to the criterion of 555-560mg/cig, the cigarette with 0.7mm and 0.8mm cut width was selected by weight and tested. The cigarette condition is as follows: the length of the cigarette is 100 mm, the filter rod length is 30 mm, the interference of the metal ring is removed by 5 mm, and the valid density data segment is kept at 65 mm; according to the density curve, the valid density section of the cigarette is divided into three sections, namely (0-13) mm, (14-59) mm and (60-65) mm, respectively. The detection and analysis data are shown in table 5.

Under the same single cigarette weight, the average density of 0.8 mm cut width cigarette is greater than 0.7 mm cut width; the head and tail density of 0.8 mm cut width cigarette is higher than 0.7 mm cut width, but the middle section is lower than 0.7 mm cut width; the standard deviation of 0.8 mm cut width tobacco is more significant than 0.7 mm cut width.

In conclusion, a 0.7mm cut width is better than 0.8mm cutting width in cigarette uniformity control.

Table 5 Detection and analysis results of the density of tobacco rod with different cut width

| Cut width | 0.7mm | 0.8mm |
|-----------|-------|-------|
| Sections  | Mean of the head | SD of the head | Mean of the middle | SD of the middle | Mean of the tail | SD of the tail | Mean of the head | SD of the head | Mean of the middle | SD of the middle | Mean of the tail | SD of the tail |
| 1         | 271.7 | 10.11 | 235.83 | 8.57 | 270.31 | 9.11 | 270.85 | 15.63 | 216.63 | 13.49 | 276.11 | 10.64 |
| 2         | 265.4 | 12.67 | 232.07 | 9.4 | 262.15 | 9.2 | 272.11 | 15.26 | 221.8 | 13.23 | 273.73 | 9.65 |
| 3         | 271.58 | 12.96 | 229.07 | 10.36 | 271.64 | 10.23 | 272.67 | 15.83 | 222.53 | 10.25 | 269.32 | 9.44 |
| 4         | 264.89 | 10.35 | 234.91 | 8.18 | 270.08 | 9.29 | 264.93 | 17.31 | 216.65 | 11.74 | 270.17 | 9.9 |
| 5         | 273.54 | 7.44 | 234.29 | 9.44 | 265.57 | 8.53 | 285.49 | 18.13 | 225.52 | 14.08 | 267.6 | 8.75 |
| 6         | 274.28 | 14.87 | 230.74 | 8.11 | 264.46 | 9.88 | 279.09 | 14.45 | 225.98 | 11.52 | 268.22 | 9.46 |
| 7         | 263.16 | 10.13 | 236.08 | 8.41 | 273.93 | 8.61 | 278.2 | 17.92 | 220.26 | 13.65 | 276.19 | 9.95 |
| 8         | 271.48 | 13.93 | 233.79 | 9.91 | 270.44 | 9.31 | 277.14 | 16.12 | 222.53 | 13.72 | 273.6 | 11.77 |
| 9         | 269.61 | 10.25 | 235.76 | 8.01 | 273.65 | 9.34 | 277.22 | 16.51 | 223.67 | 11.72 | 267.58 | 9.07 |
| 10        | 279.74 | 12.15 | 236.42 | 10.13 | 270.67 | 8.56 | 272.36 | 13.43 | 222.81 | 14.16 | 270.87 | 9.23 |
Average & 270.54 & 11.49 & 233.9 & 9.05 & 269.29 & 9.21 & 275.01 & 16.06 & 221.84 & 12.76 & 271.34 & 9.79  

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4. Conclusion and discussion

By analyzing the differences of cut tobacco structure, Short rejection rate, physical indicators, and density between 0.7mm and 0.8mm cut width, the results showed that 0.7mm cut width was better than 0.8mm cut width in processing characteristics, short rejection rate, reducing draw resistance, weight stability and uniformity of density. 0.7mm cut width was more suitable for the production of slim cigarettes.

Based on the work carried out under the special topic "Research on the control technology of cut tobacco size and distribution" in the research section of "cutting processing technology" under the systematic research route of "slim cigarette" blending formula, this study mainly evaluated the influence trend of different cut tobacco size and distribution, quality indicators and economic performance indicators, and determined the suitable cut tobacco size control for "slim cigarette" rolling. Finally, the improved adaptability between the cut tobacco size and the slim cigarette was completed, which provided important support for "the final blending formula of the system of tobacco processing control technology for the compatibility of cut tobacco characteristics and slim cigarettes."

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