

# Production and process optimization of coffee fresh fruit skin and flower cake

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## ABSTRACT

In order to explore the use of coffee fresh fruit skin in food, make a coffee fresh fruit skin flower cake. Through one-factor test and orthogonal test, study the effects of residue, glutinous rice flour and sugar on the filling, determine the best proportion of filling, sugar, water and oil on the filling. Through the test, in the water oil skin of coffee fresh fruit skin crisp cake, the water is replaced by the coffee fresh fruit skin filtrate, and the ratio of coffee fresh fruit skin to water is 1:1. The formula of coffee fresh fruit skin and flower cake is: filling white sugar 2g, glutinous rice flour 2g, coffee fresh fruit skin filter 4g; water oil skin white sugar 10g, high gluten flour 37.5g, coffee fresh fruit skin 5g powder, oil 14g. Under this process of coffee fresh fruit skin flower cake, from the inside to the outside has the taste of coffee fresh fruit skin fusion, very fragrant and crisp.

## KEYWORDS

Coffee fresh fruit skin; Coffee fresh fruit skin flower cake; Technology optimization

## 1. INTRODUCTION

### 1.1. An Overview Of The Coffee Peel

Generally speaking, the main purpose of growing coffee is to harvest coffee beans, so the peel is usually peeled off during the production process. In the process of wet processing of fresh coffee fruit, the fruit peel and pectin waste account for about 69% of the weight of the fresh fruit [1]. Irrational use of these substances will cause serious pollution to the environment. It is not only a pity to discard the coffee peel directly but also cause pressure on the environment. Coffee farmers usually compost the coffee peels to reduce the waste of resources. China's coffee planting area increased from 366,000 mu in 2008 to 1, 856, 100 mu in 2014. In 2015, although China's coffee planting area declined, it continued to increase in 2016, and China's coffee trade in the international market increased. In 2019, China's coffee planting area reached a peak of 1.93 million mu. By 2020, China's coffee planting area was relatively stable, with a specific coffee planting area of 1.844 million mu. From the change of coffee planting area in China in the past 13 years, the scale of coffee planting is constantly expanding, which shows that China's coffee industry is also constantly expanding and developing [2]. With the increase of coffee planting area, the environmental pressure and resource waste brought by coffee skin have gradually attracted attention. Studies have shown that coffee peel is rich in organic nutrients and mineral nutrients, which can have high application value and be widely used in many aspects. For example, the coffee peel is rich in caffeine, anthocyanins, and dietary fiber [3], Crude protein and various minerals and other beneficial ingredients, can help the human body to eliminate [4]. Promote intestinal peristalsis to help the body detoxification and other functions.

## 1.2. Overview Of The Cake

Pasta is no stranger to the Chinese people, especially in the Yellow River basin and its region, where every family is do from pasta. Cake, as a kind of pasta first appeared in the Han Dynasty. During this period, Chinese pasta production skills have been greatly improved. There are many written records of pasta, and a rich variety of cake products have appeared. And Liu Xi of the Han Dynasty recorded in the interpretation of fame and Diet: "Cake, and also, make the merger of noodles, hu cake, big diffuse also. He also wrote with flax. Steamed cake, soup cake, cake, pulp cake, gold cake, rope cake, all with the shape and name also [5]." This also shows the love of the ancients for cakes. With the development of the society, more and more cakes have come into the public's eye. For example, pancake in Shandong, spring cake in Chaozhou, flower cake in Yunnan, throw cake in India and so on. At present, all kinds of cakes sold on the market are also loved by consumers, among which the crisp cakes are not only not greasy, but also distinct, crispy and comfortable [6].

## 1.3. The Use Of The Coffee Peel

The routine use of coffee peel is mainly the seasoning of drinks, poultry animals and soil fertilizer. Its application in the field of food processing is very rare. Hu Rongsuo [7]. By comparing AS2.399, AS 2.39, total ester content, total acid, sense and other indicators, respectively. It provides favorable conditions for the industrial development of coffee peel and brewing. Zhang Kun, Liu Xiaogang, et al [8] We compared the physical and chemical properties, bioactive substance content, antioxidant activity and storage stability of coffee peel sauce, and analyzed the influence of heating time and initial sugar content on the quality of coffee peel sauce. In addition, there are coffee peel tea, coffee peel biscuits and other innovative food. If the full use of the fresh coffee fruit skin, and flour organic combination to make the fresh coffee fresh fruit skin flower cake, the fresh coffee fruit skin into grain, can not only make the fresh coffee fruit skin is well used, reduce the pollution to the environment, but also can increase the source of food ingredients and rich food.

## 2. MATERIALS AND METHODS

### 2.1. Materials And Equipment

Materials: Fresh coffee skin is collected from Nandaohe, Simao District, Pu'er City, Yunnan Province. High gluten flour, low gluten flour, glutinous rice flour, white granulated sugar, oil and mineral water are sold on the market.

Equipment: electric heating food oven, electronic balance

### 2.2. Experimental Method

#### 2.2.1. Operation Points

Coffee fresh fruit skin destringent, juice and filtration: separate the fresh coffee skin and coffee grains, treat the fresh coffee skin for a few minutes, mix the fresh coffee skin and water in a certain proportion, and use the juicer to get the coffee fresh fruit skin filter and coffee fresh coffee skin filter residue.

Water and oil skin production: mix the oil, high-gluten flour, coffee fresh fruit skin filtrate and white granulated sugar in a certain proportion, knead into a smooth dough, cover with plastic wrap, and wake up.

Supastry: mix low gluten flour with oil and knead into a dough.

Wake up: divide the made water and pastry into equal parts, mix each portion of water and oil skin into a pastry, and wake up for a few minutes.

Filling production: mix the granulated sugar, glutinous rice flour and coffee peel in a certain proportion, evenly divide into the portions equal to the pastry, and set aside.

Pilling: roll the pastry into a thin skin with a rolling pin, each thin skin with a filling, to get the unbaked coffee fruit pastry cake.

Baking: Preheat the oven in advance, put the wrapped coffee fruit pastry into the oven, and get the finished product.

### 2.2.2. Single-Factor Test Of Fresh Fruit Skin

The amount of other ingredients remains the same, and the way of coffee fresh fruit skin (coffee fresh fruit skin filter, coffee fresh fruit skin powder) is added to the water and oil skin of coffee fresh fruit skin cake to explore its influence on the sensory quality of coffee fresh fruit skin cake.

The amount of other ingredients remained the same, and they were added to coffee fresh coffee skin cake in the form of coffee fresh skin filtrate to explore the influence of the ratio of coffee fresh skin and water (5:1, 4:1, 3:1, 2:1, 1:1) on the sensory quality of water and oil skin.

The amount of other ingredients remains the same, add the ingredients to the pastry of coffee fresh fruit skin powder to explore the effect of adding coffee fresh fruit powder (5g, 10g, 15g, 15 g, 20g, 25g) on the sensory quality of coffee fresh fruit pastry oil skin.

### 2.2.3. Filling Test

(1) Fill filling in a single-factor test

The amount of other ingredients remains the same to explore the effect of the addition of coffee fresh fruit skin filter (3g, 4g, 5g, 6g, 7g) on the sensory quality of coffee fresh fruit pastry filling.

The amount of other ingredients remained the same, to explore the effect of adding glutinous rice flour (1g, 2g, 3g, 4g, 5g) on the sensory quality of coffee fruit skin pastry filling.

The amount of other ingredients remained the same, to explore the effect of adding white granulated sugar (1g, 2g, 3g, 4g, 5g) on the sensory quality of coffee fresh fruit skin pastry filling.

(2) The filling is orthogonal

On the basis of single-factor test, the orthogonal test was conducted at three factors and three levels to optimize the amount of coffee fruit skin filter, glutinous rice flour and white granulated sugar in the filling and determine the ratio of filling.

### 2.2.4. Water Oil Skin Test

(1) Single-factor test

The amount of other ingredients remains unchanged, to explore the effect of adding coffee fresh fruit powder (2.5g, 5g, 7.5g, 10g, 12.5g) on the sensory quality of fresh coffee pastry.

The amount of other ingredients remained the same, exploring the effect of adding white granulated sugar (6g, 8g, 10g, 12g, 12 g, 14g) on the sensory quality of coffee fruit pastry.

The addition amount of other ingredients remained unchanged, to explore the effect of added oil (8g, 10g, 12g, 14g, 16g, 16 g) on the sensory quality of coffee fruit skin pastry.

(2) Orthogonal test

On the basis of single factor test, the orthogonal test was conducted with three factors and three levels to optimize the amount of coffee fresh fruit skin filtrate, oil and white sugar in water and oil skin, and determine the ratio of water and oil skin.

### 2.2.5. Orthogonal Test

On the basis of the above single-factor tests and orthogonal tests, the orthogonal tests were conducted at three factors and three levels to optimize the coffee fruit pastry and determine the ratio.

### 2.2.6. Sensory Scoring Table

#### (1) Filling sensory scoring table

The sensory scoring table of the filling is provided in Table 1.

**Table 1.** Filling sensory scoring scale

project	evaluation criterion	value
Color and color (20 points)	The color is uniform and the coffee peel color is bright, no other abnormal color	15-20
	The color is not uniform, the color of the coffee peel is not obvious, and other abnormal colors appear slightly	10-15
	The color is not uniform, the coffee skin color is not very obvious, and the abnormal color is obvious	0-10
Tissue morphology (20 points)	Uniform and consistent, better shape, soft and moderate	15-20
	Large viscosity, should not be finalized	10-15
	Excellent or too soft to finalize	0-10
Taste taste (30 points)	The entrance is smooth and delicate, crisp and comfortable, not sticky teeth	20-30
	The filling is delicate, some tough, sticky teeth	10-20
	The filling is rough and harder; or it is soft and sticky	0-10
Flavor (30 points)	Have a good coffee peel flavor, moderate sweetness, no odor	20-30
	Coffee peel flavor is light, the sweetness is basically moderate, have a weak smell	10-20
	Coffee peel flavor is too heavy or too light, the smell is more heavy	0-10

#### (2) Coffee fresh fruit skin crisp cake sensory scoring table

For the sensory scoring table of coffee fresh fruit pastry, refer to Ma Dejuan et al [9] The development of the rose flower crisp cake filling. See Table 2

**Table 2.** Sensory rating Scale of coffee fresh fruit crust pastry

project	evaluation criterion	value
Color color (25 points)	Surface is golden yellow, with a coffee peel color, uniform, No focal black and other abnormal colors	15-20
	The surface color is slightly changed, it is slightly scorched black, not too uniform, slightly appear other abnormal color	10-15
	The surface color changes seriously, showing coke black, uneven, abnormal color Ze obvious	0-10
Morphology (25 points)	Specification and size of the same, uniform thickness, beautiful, not exposed	20-25
	Size, thickness is more consistent, no drum filling, dew stuffing	10-20
	Size, thickness is uneven, revealing serious	0-10
Shoring and structure (20 points)	The skin filling is uniform, clear, the filling is moderate, symmetrical, no big opening or hole in a utensil	15-20
	Skin filling is more uniform, the level is more clear, slightly partial skin, partial filling	10-15
	The level is not clear, the skin is rough, skin, filling serious	0-10
Flavor (30 points)	Have a good coffee peel flavor, moderate sweetness, no odor	20-30
	Coffee peel flavor is light, the sweetness is basically moderate, have a weak smell	10-20
	Coffee peel flavor is too heavy or too light, the smell is more heavy	0-10

### 3. RESULTS AND ANALYSIS

#### 3.1. Study On The Addition Of Fresh Fruit Skin

##### 3.1.1. Coffee Fresh Fruit Skin Filtrate Is Added

Wash the fresh coffee skin and mix it with water for juice. The resulting coffee peel filtrate is added to the filling in a ratio of 1:1. Take the principle of pressing now.

##### 3.1.2. Fresh Fruit Coffee And Skin Powder Is Added

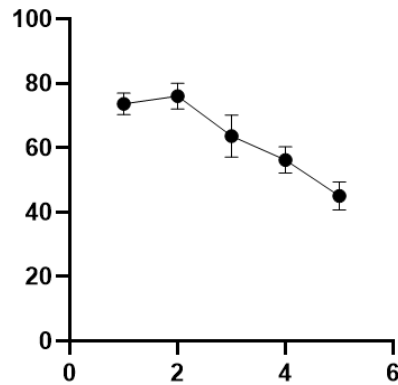
The fresh coffee peel is first dried to remove the astringent, and then the dried fresh coffee peel is processed with a shredder. The processed coffee skin powder is screened with a 200 purpose screen and placed in a cool place.

#### 3.2. Filling Test

##### 3.2.1. Fill Filling In A Single-Factor Test

Too little addition of coffee peel filter in the filling will make the fresh coffee peel in the coffee fresh fruit cake lighter flavor, which is not easy to perceive its unique flavor. If the coffee peel filter is added too much in the filling, the coffee peel flavor in the coffee fruit peel cake will be too heavy, and the astringency will affect the taste. From Figure 3-1, we can conclude that 4g is the optimal amount of coffee peel filter residue. The ordinate in the figure is all shown for the sensory evaluation.

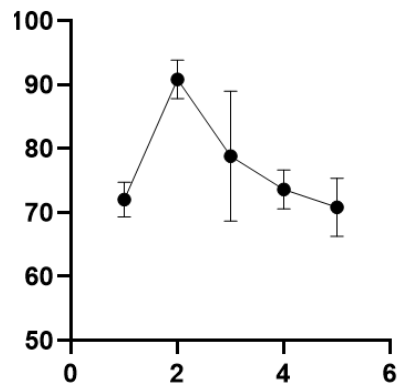
(1) The amount of glutinous rice flour added in the filling



**Figure 1.** Total score of sensory amount of glutinous rice flour added in filling

The addition of glutinous rice flour can make the filling easier to finalize and delicate. But adding too much glutinous rice flour is easy to stick to the teeth, making the filling produce a bad taste. Too little glutinous rice flour in the filling can lead to be too soft to shape. Therefore, Figure 3-2 adds 2g of glutinous rice flour to the filling.

(2) The amount of granulated sugar added in the filling



**Figure 2.** Total score of sugar added in filling

White granulated sugar is usually used as a sweetener and preservative in the pastry. Suitable addition of white granulated sugar can not only play the role of regulating the sweet taste and increasing the taste, but also reduce the water content in the pastry to prolong the shelf life. Excessive addition of granulated sugar can lead to weight gain, dental caries and other hazards. From Figure 3-3, it is not difficult to see that the optimal amount of granulated sugar in the new peel cake filling is 2g.

### 3.2.2. The filling is orthogonal

**Table 3.** Results of orthogonal experiments and extreme analysis of fillings

Experiment al number	factor			Sensory score
	A	B	C	
1	3	1	1	58.2
2	3	2	2	56.8
3	3	3	3	64.8
4	4	1	2	81.4
5	4	2	3	74
6	4	3	1	52.2
7	5	1	3	62
8	5	2	1	57.4
9	5	3	2	58.8
K1(mean)	0	201.6	167.8	
K2	0	188.2	197	
K3	179.8	175.8	200.8	
k1	0	67.2	55.9	
k2	0	62.7	65.7	
k3	59.9	58.6	66.9	
R(range)	59.9	8.6	11	

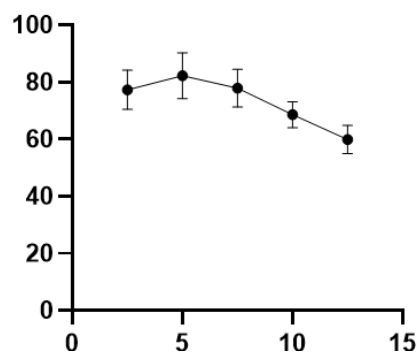
Regulation A: amount of coffee peel filter residue (g), B: amount of glutinous rice flour (g), C: amount of white granulated sugar (g)

According to the single factor experiment, orthogonal experiment, by orthogonal experiment, the above three factors on the influence of the degree of coffee fruit crust filling order: A>C>B, coffee peel filter add>white sugar add>glutinous rice flour, and compare the size of the mean, get the A4B1C2 combination optimal, sensory score is 81.4, its sensory score is greater than the eight groups in the table.

### 3.3. Water Oil Skin Test

#### 3.3.1. Single-factor test

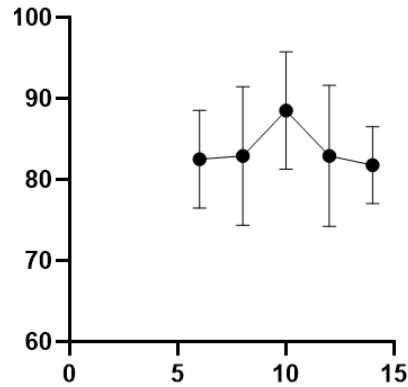
(1) The amount of coffee fresh fruit skin powder in water oil skin



**Figure 3.** Total score of coffee peel powder added in water oil skin

Adding coffee peel powder to the water oil peel can not only adjust the color of the crust but also increase the unique flavor of the coffee peel. The excessive addition of coffee peel powder in the water and oil skin will deepen the color of the cake crust, and the bitter taste of the coffee skin will increase with the increase of the added amount, affecting the flavor. Figure 3-4 shows that the addition amount of mesocarp powder in water and oil skin has the best flavor at 5g.

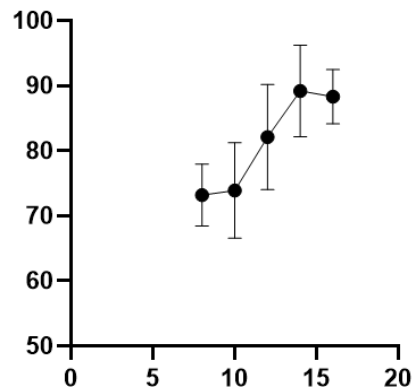
(2) The amount of white granulated sugar added in the water and oil skin



**Figure 4.** Total score of sugar added in water oil skin

White granulated sugar can adjust the bitter taste of the coffee peel powder itself, making the coffee peel cake more acceptable. As can be seen from Figure 3-5, the addition of granulated sugar in 10g is the highest and most appropriate.

(3) The amount of vegetable oil added in the water-oil skin



**Figure 5.** Total sensory score of vegetable oil addition in water oil skin

From a health point of view, the oil in the water oil skin is selected from vegetable oil. The added oil is too little, the crust is not crisp, the layer is not obvious and the taste is rough, the added oil is too greasy and not good for health. Combined with those shown in Figures 3-6 and health considerations, the best vegetable oil in the coffee crust was 12g.

### 3.3.2. Orthogonal test

**Table 4.** Orthogonal experimental results and extreme analysis of water oil skin

Experiment al number	factor				Sensory score
	A	B	C	D	
1	42.5	6	2.5	12	57.4
2	42.5	8	5	14	54.2
3	42.5	10	7.5	16	35.8
4	40	6	5	16	77.6
5	40	8	7.5	12	63.1
6	40	10	2.5	14	75.1
7	37.5	6	7.5	14	74.7
8	37.5	8	2.5	16	78.3
9	37.5	10	5	12	79.1
K1(mean)	147.4	209.7	210.8	199.6	
K2	215.8	195.6	210.9	204	
K3	232.1	190	173.6	191.7	
k1	49.1	69.9	70.3	66.5	
k2	71.9	65.2	70.3	68	
k3	77.4	63.3	57.9	63.9	
R(range)	28.3	6.6	12.4	4.1	

Regulation A: high gluten flour (g), B: white granulated sugar (g), C: vegetable oil (g), D: added amount of coffee peel powder (g)

According to the single factor experiment, orthogonal experiment, by orthogonal experiment, the above three factors on the influence of coffee fruit filling degree of the order: A>C>B>D>high gluten flour add>vegetable oil add> add>white sugar add>coffee powder, and compare the size of the mean, get A 37.5B 10C 5D 12 combination optimal, sensory score is 79.1, its sensory score is greater than the eight test in the table.

## 4. CONCLUSION

This experiment makes its own contribution to the development and utilization of coffee peel. Combine coffee peel and flower cake, add 2g of white sugar and 4g of coffee fruit filter to the filling; add 10g of medium white sugar, high-gluten flour 37.5g, 5g of coffee fruit skin powder, and 14g of oil in water oil skin. The flower cake under the process has the highest sensory score, which is more in line with the public taste.

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