Study on Processing Technology of Low Sugar Rose Jam

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Abstract: Taking fresh rosa rugosa as raw material, the health and nutrient low-sugar rosa rugosa sauce was developed and the processing technology of low-sugar rosa rugosa sauce was studied in this paper, thus providing safe options for the crowd who are not suitable for sugar products. The recipe of low-sugar rosa rugosa sauce and its optimum process were determined via single factor test, orthogonal analysis and sensory evaluation. The test results show that the low-sugar rosa rugosa sauce whose ratio includes 40g fresh rosa rugosa, 0.4g xanthan gum, 2.1g sodium cyclamate and 100g water has obtained the best quality.

1. Introduction

Originated in China, North Korea and Japan, rugosa rose has the characteristics of compactness and soothing, which is helpful for inflammation phenomenon. Due to its function of shrinking capillary, it becomes the magic weapon for the treatment of rupture of small vein [1]. Owing a strong scent of flowers, rose sauce could be used to treat kakostomia. If drinking rose sauce for a long time, the sleeping could be improved [2]. In addition, rose sauce could aid digestion and reduce weight [2]. Because of the astriction, constipation people are encouraged to drink little rose tea. Rosa rugosa also could be used to relieve depression and activate blood circulation. If the dried rose stem becomes the white powder, that is the collected coagulation of latex yield instead of mouldiness [3]. With the improvement of life level, the health protection function of rugosa rose has obtained more concern and recognition of people. High quality, health and special flavour have became the developing trend of rugosa rose [4]. As a new kind of food product, rosa rugosa could be adapted to maintain beauty and keep young as well as nourish body since the rose essential oil contained in rose has the characteristics of being natural, aromatic and pure. With the large market demand, high economic value and great development potential, rugosa rose possesses a bright prospect for development.

2. Material and method

2.1 Experimental material

2.1.1 Raw materials and additive materials

Rose (fresh) sold in Lijiang city, China
Xanthan gum sold in Dachanglong supermarket of Lijiang, China
Sodium cyclamate sold in Dachanglong supermarket of Lijiang, China
Purified water Lijiang Yuquan Pure Water Co., Ltd.
2.2 Experimental equipment and instrument
electromagnetic oven Midea Group (C21—RT2103)
electronic balance Jinnuo Balance Instrument Limited Company (TD3002)
water bath kettle (Size HWS26) Shanghai Yiheng Technology Co., Ltd.
glass bottle Sold in Lijiang city
stainless steel pot (C21—RT2103) Midea Life Appliance Manufacturing Cooperation

3. Experimental method

3.1 Technological process
sodium cyclamate, xanthan gum and water

Selecting rose → weighing → cleaning → draining → shredding → dissolving → heating for 2.5 min →
tinning → sealing → disinfecting → cooling → measuring the content of sugar → inspecting

3.2 Important points of operation

3.2.1 Selecting raw material
The new complete rose petals without pests and diseases, deterioration, putrefaction were selected,
thus ensuring the quality of rose sauce.

3.2.2 Cleaning and pretreatment
The electronic balance was used to weigh moderate xanthan gum, sodium cyclamate and water. At the
same time, the xanthan gum and sodium cyclamate dissolved in water. Then the selected rose petals
was weighed, cleaned by water, drained as well as rived. The purpose of cleaning was to reduce the
pollution of impurity, microorganism and partial pesticide residues, which was the basic measurement
to guarantee the quality of rose sauce.

3.2.3 Heating and tinning
The slow fire with 60℃ was used to heat for 2.5 minutes. When heating, the stirring all the time was
necessary, thus avoiding pot sticking phenomenon, rose petals burned and the occurring of the smell of
cooking. The process of tinning was finished as it was hot (inputting to the sterilized glass bottle) and
the bottleneck was sealed, thus avoiding the pollution of microbe.

3.2.4 Disinfecting
Water bath kettle was used to disinfect. The temperature of disinfecting was 93℃ and time was 10
minutes.

3.2.5 Detecting degree of sugar and inspecting
The degree of sugar was measured via hand-held syrup hydrometer and the data were recorded and
analyzed. At the same time, the color of sauce and the situation whether the corruption and
deterioration occurred were observed. And the taste was savoured.

3.3 Determination of each additive amount

3.3.1 Determining additive amount of rose
30 g, 40g, 50g, 60g and 70g cleaned rose were selected and added into five bottles of standby solution
that contained 100g water, 0.4g xanthan gum, 2.1g sodium cyclamate after draining water. The other
conditions were executed as the operating steps and important points required. When the end product
was finished, its form of organization, sheeny complexion and special flavour were evaluated.
3.3.2 Determining additive amount of xanthan gum
The prepared xanthan gum with the weight of 0.1g, 0.25g, 0.4g, 0.55g and 0.7g respectively were put into five bottles of standby solution that contained 100g water and 2.1g sodium cyclamate. After stirring, 40g clean rose was added. The other conditions were executed as the operating steps and important points required. When the end product was finished, its form of organization, degree of sugar and special flavour were evaluated.

3.3.3 Determining additive amount of sodium cyclamate
The prepare sodium cyclamate whose weight was 1.5g, 1.8g, 2.1g, 2.4g and 2.7g was added into five bottles of standby solution containing 100g water and 0.4g xanthan gum. After stirring, 40g clean rose was added. The other conditions were executed as the operating steps and important points required. When the end product was finished, its form of organization, degree of sugar and special flavour were evaluated.

3.3.4 Determining additive amount of water
The prepared water with the weight of 40g, 70g, 100g, 130g and 160g respectively was added into five bottles of standby solution containing 0.4g xanthan gum and 2.1g sodium cyclamate. After stirring, 40g clean rose was added. The other conditions were executed as the operating steps and important points required. When the end product was finished, its form of organization, sheeny complexion and special flavour were evaluated.

3.4 Orthogonal test
According to single factor experiment, the content of soaked roses, custer sugar, xanthan gum and final heating time were the major factors affecting the quality of products. L9 (34) orthogonal test was adapted, as shown in Table 1. The sensory evaluation of the product was carried out and the sensory evaluation standard of the product was determined.

| Level | Flower content (g) | Xanthan gum (g) | Sodium cyclamate (g) | Water (g) |
|-------|-------------------|----------------|----------------------|-----------|
| 1     | 40                | 0.25           | 1.8                  | 85        |
| 2     | 50                | 0.4            | 2.1                  | 100       |
| 3     | 60                | 0.55           | 2.4                  | 115       |

Based on the sheeny complexion, form of organization, special flavour and other standards as shown in Table 2, rose sauce was identified and scored.

| Sensory index | Scoring standard                              | Score |
|---------------|----------------------------------------------|-------|
| Color         | Dark red sauce with uniform color             | 17~20 |
| (20)           |                                              |       |
| Delicate taste, no sediment at the bottom | 25~30 |
| Form          | Delicate taste, no sediment at the bottom     | 20~25 |
| (30)           | The palate is delicate with less sediment at the bottom | 10~20 |

Table 1 Level of factor of orthogonal test

Table 2 Rubrics and scores of sensory Comprehensive Evaluation criteria for Rose Sauce
4. Results and analysis

4.1 Determination of each additive amount

4.1.1 Determination of additive amount of rose

According to the processes in section 2.5.1, the test was carried out and the color and smell of rose sauce were evaluated, as shown in Table 3.

| Rose/g | Color                                    | Flavor                                      |
|--------|------------------------------------------|---------------------------------------------|
| 30     | Dark red sauce with rose petals          | No smell. Roses have a very light fragrance |
|        | Low density, light color                 | Poor taste                                  |
| 40     | Dark red sauce with rose petals          | No smell, moderate rose fragrance           |
|        | Moderate viscosity and uniform color     | Delicate taste                              |
| 50     | Dark red sauce with rose petals          | No smell. Rich aroma of rose                |
|        | High density, slightly dark color        | Poor taste                                  |
| 60     | Dark red sauce with rose petals          | No smell. Roses have a strong aroma         |
|        | Density is bigger and colour is deeper.  | Poor taste                                  |
| 70     | Dark red sauce with rose petals          | No smell. Roses have a strong aroma.        |
|        | Viscosity is high and colour is deep.    | Poor taste                                  |

From Table 3, it is known that with 0.4g xanthan gum, 2.1g sodium cyclamate and 100g water, the single factor experiment of rose petals, whose content was 30g, 40g, 50g, 60g and 70g respectively, was carried out. The experimental results show that the sensory evaluation effect of rose is better when the content of rose petals is within the range 40g, 50g and 60g. With the content of 40g, the sensory evaluation effect is the best. Therefore, the the content of rose petals is determined to be 40g, 50g and 60g.
4.1.2 Determination of additive amount of xanthan gum

Based on the processes of section 2.5.2, the test was carried out and the viscosity of rose sauce was evaluated as shown in Table 4.

| Xanthan gum/g | Consistency                      |
|--------------|---------------------------------|
| 0.1          | The sauce is too low in consistency and tastes bad |
| 0.25         | The sauce has a slightly low consistency and a poor taste |
| 0.4          | The sauce has moderate consistency and delicate taste |
| 0.55         | The sauce has a slightly high consistency and a poor taste |
| 0.7          | The sauce is too thick and tastes bad |

From Table 4, it is found that with 40g rose petals, 2.1g sodium cyclamate and 100g water, the single factor experiment of xanthan gum, whose content was 0.1g, 0.25g, 0.4g, 0.55g and 0.7g respectively, was carried out. The results demonstrate that within the range of 0.25g, 0.4g and 0.55g, the sensory evaluation effect of xanthan gum is better and it achieves the best effect when the content of xanthan gum is 0.4g. Therefore, the contents of xanthan gum is determined to be 0.25g, 0.4g and 0.55g.

4.1.3 Determination of additive amount of sodium cyclamate

With the processes on section 2.5.3, the test was carried out and the degree of sugar of rose sauce was evaluated, as shown in Table 5.

| Sodium cyclamate/g | Sweetness                           |
|--------------------|------------------------------------|
| 1.5                | Too low sugar and too light sweetness |
| 1.8                | Lower sugar content, less sweetness |  
| 2.1                | Medium sugar, moderate sweetness    |
| 2.4                | The sugar content is higher and the sweetness is stronger. |
| 2.7                | Too much sugar and too much sweetness  |

From Table 5, it is seen that with 40g rose petals, 0.4g xanthan gum and 100g water, the single factor experiment of sodium cyclamate was carried out, the content of which was 1.5g, 1.8g, 2.1g, 2.4g and 2.7g respectively. The test results show that when the content of sodium cyclamate is within the range of 1.8g, 2.1g and 2.4g, its sensory evaluation effect is better. When the content is 2.1g, the sensory evaluation effect is best. Therefore, the content of sodium cyclamate is determined to be 1.8g, 2.1g and 2.4g.

4.1.4 Determination of additive amount of water

According to the processes in section of 2.5.4, the test was carried out and the form of organization of rose sauce was shown in Table 6.

| Water/g | Organization form                        |
|---------|-----------------------------------------|
| 70      | Dark red sauce with high density of rose petals |
| 85      | Dark red sauce with high density of rose petals |
| 100     | Dark red paste with moderate density of rose petals |
As shown in Table 6, with 40g rose petals, 0.4g xanthan gum and 2.1g sodium cyclamate, the single factor experiment of water was carried out, whose content was 7g, 85g, 100g, 115g and 130g respectively. The experimental results show that when the water content is in the range of 85g, 100g and 115g, the sensory evaluation effect is better. When the content of water reaches 100g, the best sensory evaluation effect is obtained. Therefore, the water content is determined to be 85g, 100g and 115g.

### 4.2 Results of orthogonal test

Based on single factor test, it is known that the additive amounts of rose, xanthan gum, sodium cyclamate and water are the main factors to influence the quality of products. To determine the optimal combination of those factors, L9(3^4) orthogonal test was adapted and its results were shown in Table 7.

| Experiment NO. | A   | B   | C   | D   | Score |
|---------------|-----|-----|-----|-----|-------|
| 1             | 1   | 1   | 1   | 1   | 70    |
| 2             | 1   | 2   | 2   | 2   | 90    |
| 3             | 1   | 3   | 3   | 3   | 85    |
| 4             | 2   | 1   | 2   | 3   | 78    |
| 5             | 2   | 2   | 1   | 2   | 80    |
| 6             | 2   | 3   | 1   | 2   | 73    |
| 7             | 3   | 1   | 3   | 2   | 88    |
| 8             | 3   | 2   | 1   | 3   | 79    |
| 9             | 3   | 3   | 2   | 1   | 75    |
| k_1           | 82  | 79  | 74  | 75  |       |
| k_2           | 77  | 83  | 81  | 84  |       |
| k_3           | 81  | 78  | 84  | 81  |       |
| r             | 5   | 5   | 10  | 9   |       |

From the experimental results, it is seen that A1B2C2D2 is the optimal combination, that is, the best recipe includes 40g rose, 0.4g xanthan gum, 2.1g sodium cyclamate and 100g water. The major factors affecting the taste of products are R_C>R_D>R_R>RA. From this, it is known that the content of sodium cyclamate and water has a larger influence on the product quality, the next is xanthan gum and the final is rose.

### 5. Conclusions

#### 5.1 Best processing conditions of low-sugar rose sauce

Being the main raw material, the fresh rose (40g) was cleaned, dried and rived. Then 0.4g xanthan gum and 2.1g sodium cyclamate were dissolved in 100g water and the handled rose was placed into the water and heated for 2.5 minutes with 60°C slow fire. While it was hot, it was put into a sterilized glass bottle and disinfected for 10 minutes in 93°C water bath kettle after being sealed. Until it cooled, the degree of sugar was detected. After passing the inspection, it is the product of low-sugar rose
5.2 Best recipe
The best recipe of rose sauce includes 40g fresh rose, 0.4g xanthan gum, 2.1g sodium cyclamate and 100g water.

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