

Research Article

Experimental Study on Concentrating Apple Juice by Microwave

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Abstract: In order to use microwave in concentrating apple juice and find the law of the relationship between the microwave and the concentrating effect and apply microwave to concentrate the apple juice, studied the apple juice concentrating process by microwave. The results show, microwave can effectively remove the moisture in apple juice and the concentrating quality and concentrating effect would not be affected. The process provides the basis that the microwave is used in apple juice concentrating.

Keywords: Apple juice, concentrating, microwave

INTRODUCTION

Apple is one of the Chinese main fruit and its output ranked first in the world (Zhou and Hu, 2013). Apple is one of the main fruits of the people's consumption, the market demand is large, but even so, there are still a lot of fresh fruit unmarketable, backlog, rotten, resulting in great economic losses. Currently, many companies have been concentrated fruit juice, but almost all adopted by vacuum concentrated, frozen concentrated and permeate concentrated, these methods have characteristics of low energy consumption, low efficiency, losing more juice and destructing nutrients (Wang *et al.*, 2012; Su and Jiao, 2008), it is difficult to meet the needs of the domestic market. Therefore, problems to be solved immediately are seeking new concentrated methods, improving the concentrated efficiency and the concentrated nutrition and meet the market demand.

In concentrated apple juice study, Guo *et al.* (2013) concentrated apple juice using Headspace Solid Phase Micro-Extraction (HS-SPME) and optimized the extraction parameters by fuzzy evaluation method, the process is also different because of different parameters; Candrawinata *et al.* (2013) studied the nutrients in concentrating apple juice process, analyzed the influence of storage conditions on its nutrients. Martin *et al.* (2013) discussed sterilization in concentrating apple juice process. But for concentrating apple juice the conventional techniques were used, microwave was not employed in juice concentrating. A number of studies are conducted on application of microwave and are used in sterilizing and drying field (Geng and Ge, 2013; Geng *et al.*, 2013). Therefore, microwave is used to in concentrating fresh apple juice, the law of the relationship between microwave and concentrated effect and the microwave concentrated craft are the studied objectives, these objectives will be realized by experiment.

MATERIALS AND METHODS

Materials: Freshly squeezed apple juice.

Instrument: Microwave equipment (2450 MHz), Juicer (220 V, 250 W), Refrigerator (SIMEENS), Current meter (BM822), MultiMate, Electronic Balance, Digital Thermometer and Beaker.

Quality indices:

Sensory index: The color of the juice is becoming darker and homogeneous.

Quantitative index: Defined concentrated ratio R:

$$R = (w_i - w_j) / w_i$$

where,

w_i = Weight before concentrating

w_j = Weight after concentrating

Methods: Take the same weight of fresh apple juice and continuous, interval concentrating experiments are carried out in microwave equipment. Also the influence experiments about concentrating effect have been carried out in different power, different concentrating time and different distance.

RESULTS AND ANALYSIS

The effect of microwave power and concentrating time to concentrated juice quality: Microwave power is one of the main factors that affect concentrating speed, in turn, influencing the concentrated quality. Appropriate microwave power not only can improve the concentrating speed and efficiency and can improve its sensory and taste quality.

In order to obtain the relationship between microwave powers, concentrating time and

Table 1: The influence of different concentrating mode to concentrated juice quality

Sample no.	Concentrating mode	Concentrated ratio (%)	The sensory index
1	1.80 KW×120s	76	The juice color is dark and flavored with paste
2	1.08 KW×120s	73	The juice color is lighter, viscous and evenly
3	1.08 KW×90s	54	The juice color is color as fresh and diluted

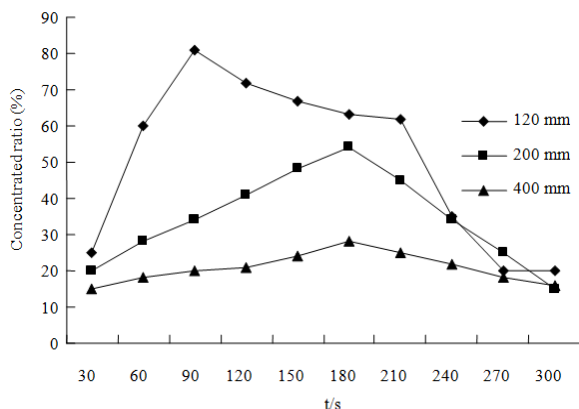


Fig. 1: The influence on the concentrated ratio of distance

concentrating quality, firstly take fresh apple juice and concentrating respectively in different power and same concentrating time, observe color and taste of the concentrated juice, calculate concentrated ratio; then concentrating respectively in same power and different concentrating time, observe color and taste of the concentrated juice, calculate concentrated ratio. The concentrating results are shown in Table 1.

It can be seen from Table 1 that in same concentrating time, the microwave power is greater, the concentrated ratio is greater and the concentrated efficiency is higher; in same microwave power, concentrating time is longer, the concentrated ratio is greater and the concentrated efficiency is higher. Microwave power is great, the concentrated ratio and efficiency are high, but the concentrated fruit juice quality is bad, because the microwave power is great, temperature rising sharply and there appeared charred for local overheating.

The influence of distance to the apple juice quality:

In order to find out the optimum distance that microwave concentrating, the three berakers same weight fresh apple juice are distributed where from microwave source is 120, 200 and 400 mm, respectively and concentrating in the same time, the concentrated ratio is shown in Fig. 1.

Figure 1 shows that the microwave concentrating process is smooth with the increasing of distance, but the concentrated ratio is reduced; the distance from the microwave source is relatively close, the concentrated ratio is instability and the sensory quality is poor. The distance from the microwave source is relatively far, the concentrated juice sensory quality is good but the concentrated ratio and efficiency are slowly. We found

that the concentrated ratio is stable and the concentrated effect is good which the distance is around 200 mm after comparing multiple experiments, therefore, 200 mm is selected the best distance that between the apple juice and the microwave source.

Relationships between microwave concentrating effect and juice depth:

Microwave has a strong penetrating capability. In order to compare influence on the concentrating effect of the different juice depth, microwave concentrating experiment of apple juice are carried out under the different power and different depth. The experimental results show that apple juice depth in microwave concentrating is not more than 50 mm.

CONCLUSION

The effect is good for concentrating fruit juice using microwave. Concentrating fruit juice using microwave can preserve color, aroma, taste of fresh juice, therefore Concentrating fruit juice using microwave is entirely feasible. The follow conclusions can be drawn by analyzing the fruit juice concentration process:

- The distance between juices and microwave source is about 200 mm when concentrating juice.
- The microwave power is 1200 W; the depth of juice is about 50 mm and in stages when concentrating juice.

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