

## Research Article

### An Experimental Study on Honeysuckle Drying by Microwave

Geng Yuefeng and Ge Xinfeng

College of Electrical and Information Engineering, Xuchang University, Xuchang 461000, China

**Abstract:** In order to identify the relationship between the microwave and the drying effect and apply microwave to dry the honeysuckle, studied the honeysuckle drying process by microwave. The results show, microwave can effectively remove the moisture in honeysuckle and the drying quality and drying effect would not be affected. Compared with the traditional drying technology, the microwave drying characteristics are short time, fast speed and high efficiency. The craft provides the basis that the microwave is used in honeysuckle drying.

**Keywords:** Craft, drying, honeysuckle, microwave

#### INTRODUCTION

Since the Raytheon discovered the microwave, the microwave technology more broad application has been opened, especially in recent years, the microwave technology has been attracted great interest in chemistry metallurgy, sterilization and food drying. The microwave drying the food craft has been studied in recent years and reported about the microwave drying fruits and vegetables in foreign countries (Hatibaruah *et al.*, 2013; Sripinyowanich and Noomhorm, 2013; Akbudak and Akbudak, 2013; Zielinska *et al.*, 2013); At home, a lot of research reports about microwave drying in drying or sterilization process of rice, wheat, rapeseed, fruit and vegetable (Zheng *et al.*, 2013; Geng *et al.*, 2013a, b), but drying honeysuckle by microwave have rarely been reported. The honeysuckle microwave drying craft has been analyzed, discussed and in-depth researched in this study, the condition of microwave drying honeysuckle and the best drying craft are found and the basis is provided for designing the microwave drying honeysuckle equipment.

#### MATERIALS AND METHODS

**Materials:** The fresh honeysuckles come from Henan Fengqiu county, Bluish white, straight.

**The main equipment:** The microwave drying equipment in experimenting (operating frequency:  $2450 \times 10^6$  Hz), Optical balance ( $1.0 \times 10^{-4}$  g), Electronic balance, Medicinal balance, the photogenic acid content meter.

**Experimental method:** Take a different weight (10, 20 and 30 g, respectively) of fresh honeysuckles, continuous, interval drying experiments are carried out

in microwave drying equipment; Also the influence experiments about drying effect have been carried out in different power, different drying time and different distance; Then take the same weight with the same quality of fresh honeysuckle, different drying methods (natural drying, coal drying and microwave drying) are used to dry and determine the content of photogenic acid after drying respectively.

#### Experiment index:

**The sensory:** The color is turquoise that the whole fresh flowers have and no black, too dry phenomenons which are the best.

**Content of photogenic acid:** The content of photogenic acid is the higher and the drying effect is the better.

#### RESULTS AND ANALYSIS

**The influence on the honeysuckles quality of microwave power and the drying time:** Microwave power is one of the main factors that affect the drying speed, in turn, influencing the quality of honeysuckle. Appropriate microwave power not only can improve the drying speed and can improve its sensory quality.

In order to obtain the relationship between microwave powers, drying time and drying quality, firstly take 10, 20 and 30 g, respectively fresh honeysuckle and drying, respectively under power of 850 W, the drying results are shown in Table 1. With the increasing of the weight, the drying time needed to be extended, the sensory quality of honeysuckle is being worse.

Second, take three bags of fresh honeysuckle and every bag weight is 10 g, drying in a different microwave power, the results are shown in Table 2.

**Corresponding Author:** Ge Xinfeng, College of Electrical and Information Engineering, Xuchang University, Xuchang 461000, China

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Table 1: The sensory quality that drying under the same power, different weight and time

Sample No.	The weight of fresh honeysuckle (g)	Drying power and time	The weight of dried honeysuckle (g)	The sensory index
1	10	850 W×180 sec	3.3	The color is turquoise that the whole fresh flowers have, individual black
2	20	850 W×240 sec	6.3	Good green on the whole, most are bud black
3	30	850 W×300 sec	9.8	Overall is in dark color and browning

Table 2: The sensory quality that drying under the different power

Sample No.	The weight of fresh honeysuckle (g)	Drying power and time	The weight of dried honeysuckle (g)	The sensory index
1	10	600 W×180 sec	3.3	The color is turquoise on the whole, the bud head is black
2	10	850 W×180 sec	3.1	The color is turquoise that the whole fresh flowers have, individual black, over dry
3	10	850 W×180 sec 0 W×60 sec 850 W×60 sec	2.6	The color is turquoise that the whole fresh flowers have, individual black

Table 3: The influence on the honeysuckles quality of phase drying

Sample No.	The weight of fresh honeysuckle (g)	Drying power and time	The weight of dried honeysuckle (g)	The sensory index
1	10	850 W×180 sec	3.1	The color is turquoise on the whole, individual black bud head is black, shrinking significantly
2	10	850 W×120 sec 0 W×60 sec 600 W×60 sec	3.1	The color is turquoise that the whole fresh flowers have, individual black bud head is black, shrinking obviously
3	10	850 W×180 sec 400 W×90 sec	3.2	The color is turquoise on the whole

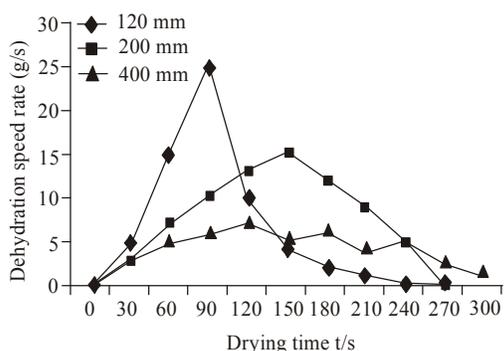


Fig. 1: The influence on the dehydration speed rate of distance

Low power prolonged drying time, but the dried honeysuckle browning seriously, high power can make fresh honeysuckle loss water rapidly, but appear black head and severe contraction, the sensory quality is worse.

**The influence on the honeysuckles quality of distance:** In order to find out the optimum distance that Microwave drying, the three bags same weight fresh honeysuckle are distributed where from microwave source is 120, 220 and 400 mm, respectively and drying in the same time, the drying speed is shown in Fig. 1.

The Fig. 1 shows that the microwave drying process is smooth with the increasing of distance, but the drying speed is reduced; the distance from the microwave source is relatively close, the drying speed is instability and the sensory quality is poor. The distance from the microwave source is relatively far,

the dried honeysuckle sensory quality is good but the drying speed is slow. We found that the drying speed is stable and the drying 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 honeysuckle and the microwave source.

**Relationships between microwave drying effect and honeysuckle layer thickness:** Microwave has a strong penetrating capability. In order to compare influence on the drying effect of the different layer thickness, microwave drying experiment of honeysuckle are carried out under the different power and different thickness. The experimental results show that layer thickness in microwave drying is not more than 20 mm.

**The influence on the honeysuckles quality of phase drying:** The moisture content of fresh Honeysuckle is more than 80%; drying process consists of 3 stages: overall quickly heating, rapid dehydration, dehydration. If the temperature rose slowly in first stage, the honeysuckles color is prone to browning; if second stage continued a long time, the color also appears bad; if there is still in high power heating in third stage, the honeysuckles are prone to appear too dry and then get damp. So the drying method in stages is used in microwave drying, as shown in Table 3.

Table 3 shows that the microwave drying best craft are: high power at first, enabling the rapid dehydration and later with a relatively lower power to accommodate the characteristics of evaporation water.

Table 4: Content of photogenic acid in different drying method

Drying method	Sample No.	Content of photogenic acid (peak area/peak height)
Natural drying	1	6536218/383143
Coal drying	2	8903332/519366
Microwave drying	3	9681787/557369

**Content of photogenic acid under different drying methods:** The prerequisite that microwave drying of honeysuckle is used is that the efficiency and quality are better comparing traditional drying method. In order to prove it, the determination of the amount of photogenic acid in dried honeysuckle in different drying methods (natural drying, coal drying, microwave drying), content of photogenic acid is shown in Table 4.

Table 3 shows that content of photogenic acid is the highest in microwave drying, the content of photogenic acid is higher in coal drying and the content of photogenic acid is minimum.

### CONCLUSION

Experiments shows that microwave drying honeysuckle has a good effect, the better dried honeysuckle than traditional drying in color, shape, taste, can be got as long as the following craft is taken:

- The distance between honeysuckle and the microwave source is around 200 mm.
- Honeysuckle layer thickness that will be dried is not more than 20 mm.
- Two stage method is adopted in drying process, the first stage is rapid dehydration in high microwave power and the second stage is slow dehydration in low microwave power.

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