Microwave vacuum dehydration of fruit and juice

Some fruits and fruit juice that are not sensitive to high temperature can be dehydrated by heating under normal pressure (in syrup, apple or spray dried tomato powder), but in most cases (such as grass poison, raspberry, citrus), if you want to keep fruit flavor and make Guo Fenrong Easy to dissolve, it should be dehydrated under the condition of microwave drying equipment. In fruit, fruit juice and concentrated juice (Brix is up to 35. Or 40. On the other hand, the 0.1~ 1 vacuum cryogenic freeze drying technology is more widely used. It can also be dried in a vacuum at medium temperature and 1 to 10 Tuo. Generally speaking, the cost of vacuum drying is much higher than that of atmospheric drying. Taking one kilogram of dry matter as an example, the price of extrusion drying is 4 times that of atomization method and 7.5 times that of freeze-drying method. The main reason for this high cost is the poor efficiency of converting heat to a dry state by using a general heating form of flying conductivity, convection, radiation plate. In order to reduce costs, energy forms are needed, which are not prevented by the insulation formed by nearly a thousand dry-like fruit organs. Microwave is very consistent with this idea. Over the past more than 10 years, a great deal of microwave drying experiments of 915 or 2450 MHz have been done successfully. We performed three and a half hours of microwave drying of raspberries in a 30-liter test with a 1,SK W (2450MHz) Philip magnetron. Within one and a half hours before the end of dehydration, the temperature exceeded 300 C (up to 38 o C) and the average evaporation rate was 2.5 kg/m Z/h. This shows that the theory of microwave drying is of superiority. However, due to the danger of gas ionization in the body, it will encounter technical difficulties in the implementation. When the value of the electric field is higher than the critical voltage, the arc is triggered on the thin metal surface or on the protruding part. It is these difficulties that prompt us to consider microwave vacuum drying under positive conditions. A continuous dryer has been used. Over the past 5 years, the performance of the machine has been greatly improved.

The present situation of fruit drying equipment technology. The characteristic of the microwave continuous dryer is 7.S K W microwave dryer. The components of the microwave continuous dryer have been inspected continuously for more than 200 hours. Microwave flow into the seal is a stainless steel horizontal cylinder (diameter 0.63 m, length 6 m), the interior of the smooth, two-door locking device to close. Teflon plastic with glass fiber, soft continuous conveyor belt is located in the middle of the dryer, and driven by the rear drive shaft, the speed is 1-30m Z hours. In the front of the cylinder is equipped with a double device for transporting 1000-drying raw materials:'A feeding hopper with a nozzle or notch is connected to 10 cm above the conveyor belt to facilitate the transportation of juice concentrate or extract; two screens consisting of three pneumatic valves controlled by a chuck programmer can transport the whole fruit and fruit slices. At the rear end, a rotating scraper is installed behind the rotating brush to scrape up the dry material on the conveyor belt and drop it right in front of the scraper through a 140 m diameter throttle valve in the vacuum container. A cooling plate is installed under the conveyor belt to solidify the dry material before it is removed if necessary. On the L side of the front of the dryer, two magnetrons (5K W Philip Y J l 91 and 2. SK W Philip Y J l 6 O) are connected to a transmitter antenna mounted on a vertical circular cavity resonator. The microwave is attenuated or equalized by two cavity resonators; then, it enters the dryer through a polyethylene window. The microwave energy distribution over the length of the dryer was

unequal, with 56 per cent of the energy dispersed in the first half and the latter divided into three sections by a baffle, used only through the conveyor belt. The last baffle is then placed outside the microwave field, where the extraction and cooling devices can be installed without arcing. The observation hole on the side can be used to observe the dry condition of the extract. In addition, a number of holes have been installed in the upper part to measure the surface temperature of vacuum and dehydrated substances (using infrared instruments). The seal is connected to a vacuum consisting of two steam ejectors (30kg/h steam), a tubular condenser and a 5K W liquid annular pump. High-voltage direct current is supplied by 1.1 ampere, 220V/7300 V distribution panels and 0.75 ampere, 220V/4600 V distribution panels.

The period of dehydration and dehydration of fruit juice showed that the extract boiled when entering the vacuum dryer, in order to avoid a large number of substances splashing on the wall, the Brix sugar content of 1000 substances should be higher than 50%, and the viscosity should be higher than 10 CP. When juice is not concentrated, sucrose and maltodextrin can be added. The concentrated juice with a Brix 65 "can dehydrate directly. After the char is broken, sugar and maltodextrin are added before entering the dryer to form a thick dough. Within two meters from the start of the 1000-meter dryer, the extract loses 90% of the water by 50 tones and gradually expands; in the next two meters, the water continues to evaporate, but slows down. The last two meters of electricity passed through a very weak microwave field, similar to milk.

A swelling substance similar to the baking protein of the butter clipping, which completes its own drying at the same time of cooling. After the conveyor belt is scratched, dry matter (11.3% residual moisture) can be obtained in the internal container. Its density is. 05 ~. Between 5, the greater the expansion, the smaller the density; this powder can be dissolved in cold water immediately. The dielectric constant dielectric constant ("`protection and g t s') determines the energy dissipation per unit volume. The formula is a s follows: P 255.61.10 1'summon x]x E Z x 6 Yinr T g a This formula can be used to select the 1000-drying parameters (temperature, cycle time, hour, flow rate) for a variety of juice and juice concentrates.).

When microwaves are heated, the water is slower than the juice heated. Experiments have shown that water evaporates faster than sugary juices or concentrates when heated by microwave. In our working conditions, it is not the transfer of energy, but the material changes that limit the speed of drying.

Because the fruit can't expand, it evaporates much slower than extracts and concentrates. 1 hours of drying can reduce the residual humidity to 3%. The local dehydrated fruit can also be dried by syrup.

Nutrient quality was not changed because the drying was carried out at moderate temperature, especially sugar, organic acids and proteins, and there was no gazelle methyl furfural during the treatment. Titration shows that the loss of vitamin C is light or no loss. The color of fruit has not changed, such as grass poison, raspberry and red grapes. Dragon pigment has been dehydrated without deterioration of absorption spectrum.

Generally speaking, in the process of vacuum distillation, there is always a loss of volatile

substances, but the need to ensure that the loss is as small as possible, but also does not change the original flavor of the fruit. It can be observed in the first stage that volatile substances generally decrease and change after drying. The retention rate of these substances was proposed by H U-E-R. The results showed that n% of fog-dried juice, 3% of freeze-dried juice and 82% of vacuum-dried juice were obtained. He also measured the composition of the volatile part and believed that the retention rate increased with the molecular weight, because the higher the molecular weight of the substance in the liquid medium containing more sugar, the slower the volatilization rate. We have also observed that the loss of methanol and ethanol is greater, but it does not affect the quality of the aroma products. We can compare the orange juice with microwave drying and freeze-drying, and the Brix is 65.

The results are as follows:

1. Triangulation: The first panel of fifteen trained people and the second panel of twenty believed that microwave drying would change the final product (the statistical limit was 5%). The results of freeze drying were similar (the limit was 1%).

2. Pair test: 14 out of 20 people (below the limit of 5%) thought that the two kinds of resynthetic juice were different, and the freeze-dried juice was slightly better.

3. Priority Test: For the 60-member panel, the two resynthetic juices were the same, but lower than the original product. It can also be seen that the results of chemical analysis and sensory analysis are very close when determining whether the aroma of orange powder is worse than that of the original concentrate, that is, the quality of vacuum-dried products is the same as that of freeze-dried products. In general, it can be observed that the test results have been confirmed by the first industrial application. This indicates that microwave is suitable for dehydration of fruit juice. All kinds of equipment invented in succession have made the quality of fruit powder the same as that of freeze-dried fruit powder. In terms of economy, microwave dehydration can be used to treat high concentration (65') juice directly compared with several existing methods.