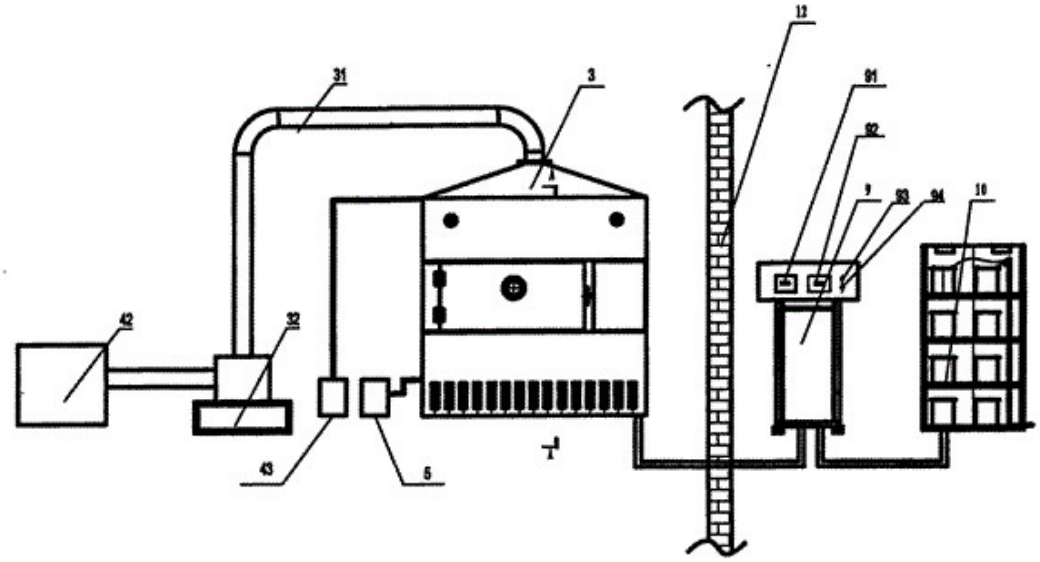
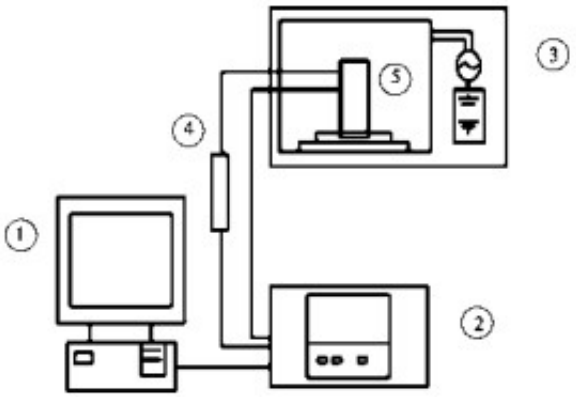
Study on Correlation between Dielectric Properties of Apple and Microwave Drying Moisture Content



Abstract: The coaxial probe method is suitable for measuring the dielectric properties of high-loss materials such as fruits and vegetables. The correlation between the coaxial dielectric properties of fruits and vegetables and the dry moisture content is important for monitoring the change of water content during the processing of fruit and vegetable microwave dryers. Guiding significance. To this end, apples were used as test materials, and 500 to 8 were measured using a coaxial probe and a network analyzer. Dielectric properties of apples during microwave drying in the 5 GHz frequency range.

The results show that with the increase of frequency, the dielectric constant of apple samples decreases, and the dielectric loss factor decreases first and then increases. By fitting the dielectric properties to the dry water content, the frequencies of 915 MHz and 2450 MHz are established. The equation of relationship between relative dielectric constant, dielectric loss factor and water content of apple. The research results can provide a basis for online monitoring of microwave drying moisture content by using coaxial dielectric properties.



Key words: microwave drying of fruits and vegetables; dielectric properties; moisture content

introduction

Microwave drying uses an internal heating method in which the direction of heat conduction is the same as the direction of water diffusion. The traditional drying methods are external heating and drying, such as hot air, solar energy, flame and electric heating. Compared with the traditional drying method, microwave drying has the advantages of large drying rate, energy saving, high production efficiency, uniform drying and clean production, and the nutrient composition of the material is not easily decomposed and destroyed, so it is more and more affected in various fields of drying. Pay attention to it. As early as in the 1960s, foreign countries have conducted extensive research on the application and theory of microwave drying technology, and have further developed in recent decades.

Microwave drying technology requires real-time online detection of the moisture content of the product during the drying process of the agricultural product to monitor the drying time and quality of the product. Moisture content is one of the main factors affecting the dielectric properties of fruits and vegetables. Establishing the correlation between water content and dielectric properties helps to monitor the microwave drying process of fruit and vegetable materials.

The coaxial probe technology is a widely used dielectric characteristic measurement technology, which overcomes many shortcomings of the transmission line measurement technology. The open-circuit coaxial test probe is inserted into the liquid sample or contacted with the flat surface of the solid sample to obtain a reflected signal. Phase and amplitude to calculate the dielectric parameters of the sample. This technology has become the most popular dielectric property testing technology at home and abroad due to its advantages of simple measurement, high precision and wide test range. Nelson et al. studied the variation of the dielectric constant of hard red wheat flour and found that at any given moisture content, 10 MHz ~ 1. In the 8 GHz frequency range, the dielectric constant and dielectric loss of wheat flour decrease with increasing frequency.

Guo Wenchuan et al. measured the dielectric properties of cantaloupe juice, watermelon juice, apple and pear using the open-ended coaxial probe technology and impedance analyzer, and analyzed the dielectric properties of three kinds of melon juice and four watermelon juices. The

relationship between sugar content, and the relationship between coaxial dielectric properties, physiological properties and internal quality of apples and pears. Many scholars at home and abroad have tested the dielectric properties to detect the moisture content of grains and herbs, such as Sanqi powder, glutinous rice, soybeans, and wheat. Based on the advantages of coaxial probe technology, coaxial probe technology can be applied to explore the correlation between dielectric properties and moisture content.

In this study, the application of microwave drying of fruits and vegetables was carried out. The research explored the use of coaxial dielectric properties of fruits and vegetables to express the dynamic moisture changes of apples during microwave drying process, and realized the application of fruit and vegetable dielectric parameters to measure and control the microwave drying process of fruits and vegetables.