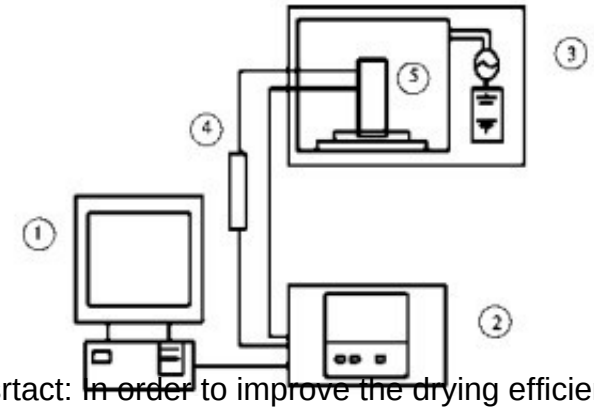
Drying characteristics of apple slices under different microwave environments



Absrtact: In order to improve the drying efficiency and quality of fresh apple slices, the moisture transfer and thermal image characteristics of apple slices in three drying processes, i.e. microwave hot air fluidized bed drying, microwave vacuum drying and electrothermal blast drying, were studied by low field nuclear magnetic resonance analysis and imaging (NMR/MRI). The color of dehydrated apple slices under different drying conditions was studied by color difference meter. Texture and microporous structure.

The results show that with the continuous drying process, the peak value of main signal A2i shifts to the left, and the main state of water gradually becomes difficult to flow and bound water. Among them, the total signal A2 decreases rapidly in the first half of the drying cycle of hot air drying process, which indicates that the crust on the surface of materials hinders the water transfer and the drying of water becomes more difficult; the temperature field of microwave hot air fluidized bed drying becomes more difficult. The uniformity of microwave vacuum drying is higher than that of microwave vacuum drying, which indicates that hot air and fluidized bed have positive effects on improving the uniformity of microwave drying.

In terms of material properties, negative pressure environment can improve the oxidative browning of apple slices, but the stability of microwave drying equipment on the color difference parameter E needs to be improved. At the same time, microwave vacuum drying process has expansion effect, the product has the smallest compressive stress and obvious microporous structure, which is most suitable for developing apple slices.

Key words: microwave drying of apple slices; nuclear magnetic resonance; infrared thermography analysis

Apple is rich in nutrients, besides crude fiber, it also has a large number of vitamins and minerals necessary for human body. Apple contains a lot of water, which is easy to spoil during transportation and storage. Drying can remove most of the moisture from the material, ensure the microbial stability of the product, and minimize the physical and chemical changes in the process of material storage and transportation. Reasonable drying method can produce high value-added dehydrated apple crisp snack food, which is an important deep processing method.

Microwave drying is a new generation of drying technology, which has the advantages of fast drying speed, sensitive drying power and easy control. Because the microwave drying process depends on the dielectric properties of materials and the distribution of electric field, the simple microwave drying often has the problems of uneven drying and difficult water dispersion. Vacuum and hot air environments are often used to remove the water vapor lost during microwave drying, while affecting the moisture status and drying quality of microwave drying.

Low-field NMR analysis and imaging is an important method to analyze the water state and distribution of materials in drying process. The free water relaxation time T 21, the non-flowing water relaxation time T 22 and the free water relaxation time T 23 curves and water distribution maps of samples are detected by the transverse relaxation time T 2 of protons in materials, and the water content in samples is explained from the microscopic point of view. The law of migration. In this paper, the color, texture and micropore size of apple chips were studied by hot air drying, microwave drying and combined drying, as well as the moisture state in the drying process.