

The principle of microwave heating and its application in puffed food

The microwave is an electromagnetic wave having a wavelength range of 0.001 to 1 m and a frequency range of 3.0×10^8 to 3.0×10^{10} MHz and having a transmission characteristic. The commonly used microwave frequencies are 915 MHz and 2450 MHz. Microwave heating technology is a new heating method. It relies on microwaves that change periodically at a rate of several hundred million times per second to penetrate into the material and interact with the polar molecules of the material. The polarity (such as water molecules) in the material is absorbed. After the microwave energy, the original molecular structure is changed, and the polar motion of the electric field is also performed at the same speed, so that the molecules collide with each other frequently to generate a large amount of frictional heat, so that the various parts in the material obtain heat energy at the same instant and heat up. . Since the thermal effect of the medium under microwave irradiation is internally heated as a whole, that is, theoretically referred to as "no temperature gradient heating", there is substantially no heat conduction inside the medium, and therefore, the microwave can heat the medium fairly uniformly. Compared with the conventional heating method, the microwave heating technology has the following characteristics: strong penetrating power, small thermal inertia, selective heating characteristics, reflectivity and transparency. In short, the microwave penetrates into the material and interacts with the polar molecules of the material, so that the polar orientation changes with the change of the external electromagnetic field, causing the molecules to sharply rub and collide, so that the various parts in the material obtain heat at the same instant and heat up. .

As a new type of heating technology, microwave heating technology has been widely used in the fields of food drying, blanching, thawing, insecticide, sterilization, etc. Microwave heating equipment has been popular in the market. Since the microwave heating causes the object to be heated to become a heating element, the microwave passes through the food from all sides, and the food is heated simultaneously inside and outside the food, neither heating medium nor convection is required, and the temperature inside and outside the food is simultaneously raised, the heating speed is fast and uniform, and It is better to preserve the nutrients in the food and the original color, aroma and taste of the food, which is beneficial to improve the quality of the puffed granule food. Therefore, the use of microwave technology to improve the conventional heating method (hot water, steam, resistance wire and electric induction heating method) has important application research value.

The material of the puffed food processing process is pretreated (pulverized, conditioned, preheated, mixed) and then rotated with the screw in the extruder, and is continuously subjected to extrusion, shearing and friction to gradually increase the temperature and pressure. After heating by microwave heater, the temperature at the resistance template reaches 120-170 °C, and the pressure reaches 3-10 MPa, forcing the material to continuously eject the discharge port from the die hole of the die (the discharge port is open to the atmosphere, at normal temperature and pressure).), at this moment, the pressure is released, the material expands, the water evaporates quickly, and the dehydration solidifies, that is, "flash expansion". When the material is cut by the cutter in the discharge hopper, the puffed food is obtained.