Study on microwave drying process of coated cardboard

Abstract: through orthogonal test to find out the best parameters, Microwave drying equipment coated cardboard was studied.

The results showed that:

(1) microwave drying equipment has better applicability to coated cardboard. The drying efficiency is high and the equipment is simple.

(2) the microwave intensity is medium dry, and intermittent heating or cardboard preheating should be applied.

(3) Microwave drying increased folding resistance of coated paperboard, but had little effect on stiffness and ring compression strength.

Microwave drying equipment is a kind of heating technology by using ultrahigh frequency electromagnetic wave from 300 MHz to 300 *103 MHz. When a substance in a microwave field contains a microwave absorbing medium, the medium will absorb the microwave energy and convert it into heat energy, thus realizing its own heating. Microwave drying machine is a new technology for drying paper. The traditional drying method uses contact conduction and convection heating, that is, heat energy is slowly transferred from the outside to the inside of the object, resulting in a temperature gradient, which is easy to cause uneven heating and large heat loss. These shortcomings can be overcome by microwave heating.

Paperboard drying equipment: when microwave acts on polar water molecules, the microwave energy field changes the positive and negative polarity continuously at the speed of 300 million to 300 billion times per second, so that the water molecules inside the paper will produce high frequency steering under the action of microwave field, and in the process of high-speed movement between water molecules and water molecules and fiber friction and collision each other Bumping produces a lot of heat. When heat is converted into water vapor, the liquid phase escapes from the page. Because the heat generated in the paper is transferred in the same direction as the mass transfer of steam, the moisture in the paper can be discharged quickly in a short time. Therefore, microwave heating is very suitable for drying paper and is especially suitable for drying cardboard.

Microwave drying equipment has been applied in food, textile, tobacco and so on. Since the 1980s, microwave drying technology has been introduced into paper machine abroad, which has reduced the cost of paper machine, energy consumption and production costs, and greatly increased the speed of vehicles.

Drying characteristics of microwave:

(1) Fast drying speed of microwave heating is the effect of microwave field, electromagnetic wave propagates to the heated object inside the instant from wave energy into heat source, the

heated object itself as a heating body, so it can significantly shorten the drying time and achieve uniform heating.

(2) When microwave drying is applied uniformly, the heat generated in the body is directly proportional to the dielectric constant and tangent value of loss. The dielectric constant of water is about 80, the tangent value of loss is about 0.1, the dielectric constant of fiber is about 2-4, and the tangent value of loss is lower than that of water. Therefore, the more moisture in the wet paper, the more microwave energy absorbed, the faster drying, making the paper drying uniform.

(3) energy penetration is strong, and microwave has a good penetrating effect on most non-metallic materials. When heated, a non-contact heating field with strong penetration is formed.

(4) Controllable strong microwave heating inertia is very small, the power supply immediately after the heat, when the power cut off the heat source immediately disappeared. Accurate control of time delay in heating is conducive to automation.

(5) The thermal efficiency of the microwave system with high drying efficiency can reach more than 50%, while the other heating methods are about 20%-30%.

Selection of base paper and preparation of paint; coating according to quantitative requirements; microwave heating drying (stopwatch timing); weighing test. This experiment was completed on a modified household microwave oven. Microwave intensity, heating time and coating amount were selected as experimental factors, and three levels were selected for each factor. Choose 120 g/m 2 base paper for coated base paper. The test indexes include the lateral bending resistance, stiffness and ring crush strength of the coated paper after drying.

The drying rate decreases rapidly with the drying time. The drying rate is very high at the initial stage of drying and low at the later stage of drying. The reason is that there are more water molecules in the paper at the beginning of drying. Under the action of microwave field, polar water molecules collide and rub violently, resulting in a lot of heat and water vaporization speed is faster. In the middle and late stage of drying, the water vaporization rate decreases because of the decrease of water molecule and the decrease of polar molecule friction. It can be seen that drying rate at the early stage of drying is an important feature of microwave drying.

Transverse bending resistance of coated paper:

(1) when the microwave intensity is 625W, the folding resistance of the paper is better. This is because when the microwave intensity is large, the water vaporizes faster, the paper structure is relaxed, and the folding resistance is slightly worse. However, when the microwave intensity is relatively small, the drying of the paper is not complete during certain drying time.

(2) Folding resistance of paper decreased with microwave heating time. In the initial stage of microwave drying, the heating energy mainly acted on the evaporation of moisture. With the decrease of moisture, microwave energy will affect the adhesive in the coating, and make the folding resistance decrease.

(3) The folding resistance of the paper is not affected by the amount of coating. This is because the microwave penetration is strong, so the folding resistance of the drying paperboard does not change much. The average drying resistance of the paper is 12.5 times. The experimental results showed that the bending resistance of coated paper was slightly higher than that of ordinary drying.

Lateral stiffness of coated paper: the change of microwave parameters has little effect on lateral stiffness. The average lateral stiffness of the ordinary drying method is 44.8 mN m. The results showed that microwave drying had little effect on the stiffness of coated paper compared with ordinary drying.