Temperature control strategy of tea dryer based on Improved Particle Swarm Optimization IPSO algorithm

Aiming at the problems of low thermal efficiency, unstable temperature and difficult guarantee of tea quality of tea dryer, the coal-fired hot air drying furnace was studied. Microwave tea drying machine/tea drying machine

Through chaotic processing of particle swarm optimization (PSO), an improved particle swarm optimization (IPSO) algorithm was obtained. (IPSO), then the parameters of the fuzzy PID controller are optimized by IPSO. Microwave drying machinery and equipment

In order to solve the shortcomings of particle swarm optimization, such as premature, inefficient optimization and the inability of real-time online adjustment of PID parameters. According to the real-time temperature of the hot blast stove, the amount of smoke discharged from the hot blast stove can be automatically adjusted to keep the temperature of the dryer constant.

At the same time, the optimized fuzzy PID control strategy is used to simulate and test the system. The results show that the method used in this study can effectively control the flue gas discharge amount of hot air stove according to the temperature of dryer, so as to control the hot air temperature in real time and achieve the purpose of constant temperature control.

Drying is the last process of tea processing. It is an important step to increase the taste of tea and promote the formation of organic substances such as color, aroma and taste of tea [1-2]. At present, coal-fired hot air stove is often used as heat source in tea dryer, and hot air temperature is an important factor of tea quality.

Therefore, the control of hot air temperature is the key to tea drying. At present, manual control of the opening of smoke exhauster and induced draft fan is often used. This method has high labor intensity, low utilization rate of coal, serious waste of energy, and unsatisfactory temperature control effect, seriously affecting the quality of tea.

In order to obtain a constant hot blast temperature, scholars have been devoting themselves to the study of temperature control of hot blast stoves. Reference [5] Aiming at the problems of low precision and poor robustness of temperature control in traditional PID control, a tea dryer based on dynamic matrix control is designed and put forward.

DMC-PID cascade temperature control method improves the dynamic response ability and robustness of the temperature control system. Literature [6] considers that the hot air temperature can be changed by adjusting the speed of fan or the opening of intake valve to adjust the air flow rate of hot air stove, so as to achieve constant temperature control.

In reference [7], a constant temperature control method based on fuzzy PID is proposed. Fuzzy rules are used to regulate the parameters of PID to suit the real-time change of temperature. Based on this, this paper designs a fuzzy PID based on Improved Particle Swarm optimization. The control algorithm, through improving the particle swarm optimization (PSO), obtains an improved particle swarm optimization (IPSO), and then optimizes the parameters of the fuzzy PID controller through IPSO, in order to achieve real-time online tuning of system parameters. Intelligent frequency conversion technology is applied to the smoke eliminator of hot blast stove.

According to the real-time temperature of hot blast stove, the amount of smoke emitted from hot blast stove is automatically adjusted to achieve the constant temperature of hot blast and ensure the drying effect.

Drying Principle and Energy Saving Way of Coal-fired Hot Blast Furnace

Coal-fired hot blast stove is mainly composed of drying box, furnace tube, fan, smoke extractor and other components. Its principle is to use coal-fired heating furnace tube to heat the introduced air through heat transfer and send it into the drying box to evaporate the moisture in the tea, so as to achieve the purpose of drying.

The fan is used for conveying hot air of tea. The smoke extractor makes the flue gas flow from inside to outside, which reduces the pressure of the furnace. The outside air enters the furnace under the negative pressure. Coal-fired thermal efficiency is the main production index of coal-fired hot-blast stove type tea dryer.

The Manual-Controlled hot-blast stove has high energy consumption and low thermal efficiency.

The exhaust gas loss accounts for about 70% of the heat loss of the hot-blast stove. The main factors affecting the heat loss of the exhaust gas are the exhaust gas temperature and the exhaust gas volume. The real-time change of hot blast temperature in hot blast stove makes it difficult to achieve constant, which makes it difficult to guarantee the quality of tea drying.

The control of hot air temperature usually adopts the control of the amount of air drawn from the dryer and the amount of smoke discharged from the hot air stove. The former is based on the inlet air temperature of the hot blast stove, and adjusts the amount of air introduced to the dryer by the induced draft fan.

This method is simple and feasible, but the change of the amount of air introduced will change the heat supply of the coal-fired hot blast stove.