Microwave assisted extraction of water-soluble substances from coffee

Coffee is the fruit of the Rubiaceae shrub coffee tree of the genus Coffea. The bean-shaped seeds after the pulp is removed are called coffee beans. Coffee beans contain abundant components, including carbohydrates, carbohydrates, amines, fats, alkaloids, acids and other complex components. Coffee has the functions of refreshing and refreshing brain, preventing radiation, enhancing immune function and eliminating free radicals in human body. The processing technology of instant coffee mainly consists of three parts: extraction, concentration and drying. The extraction process is mainly used to extract water-soluble solids from roasted coffee as extractant. When microwave is applied to extract, the effect of microwave on the substance is shown as follows: when the extract and the solvent are together in the microwave drying equipment, the target component molecule is strongly oscillated by the action of high-frequency electromagnetic wave. When there is a certain concentration difference in the environment, the molecule can migrate from inside to outside in a very short time. A balance point, which is why microwave can achieve the purpose of extraction in a short time. Compared with the traditional extraction method, microwave extraction technology has the advantages of fast, energy saving and high extraction rate.

[Abstract] With roasted Yunnan coffee granules as raw materials and water as extraction solvent, the optimum extraction process parameters of water-soluble substances in coffee by microwave method were studied and optimized. The optimum extraction process was determined by single factor test and orthogonal test. At 1:20, the extraction power was 400W, the microwave time was 400s, and the particle size of coffee granules was 40 mesh.

Yunnan coffees (roasted beans). Equipment G8023ESL-V8 microwave oven; other equipment: coffee grinder, electronic balance, drying box. The analytical method accurately weighs and grinds the graded coffee powder 10.000-20.000 g into 500 mL conical bottle, adds a certain amount of hot distilled water, leaches under certain microwave power, extracts for a certain period of time and filters under hot decompression. The filtrate is mixed and cooled and transferred into 500mL volumetric flask. The 50 mL coffee filtrate was taken from the volumetric flask to a small beaker with a pipette. After steaming and drying in a boiling water bath, the coffee was put into a constant temperature drying box at 105 65 Extraction rate (%) = M1 100 M0 m 6550

The single factor experiment of microwave extraction of soluble solids in coffee was carried out to study the effects of different extraction ratio, microwave time, microwave power and coffee particle size on the extraction rate of soluble solids in coffee. According to the results of single factor experiment, the level of each factor was analyzed and determined by orthogonal experiment. The coffee drying equipment was used to extract the coffee. The extraction rate was selected as the main index. The extraction ratio, microwave time, microwave power and coffee particle size were taken as the influencing factors. The orthogonal experiment design was carried out. The optimum group was determined by data analysis. Together.

RESULTS AND ANALYSIS: The coffee powder with 40 mesh particle size was selected to

study the effect of different ratio of coffee to liquid on the extraction rate of water-soluble solids under the conditions of 400 s microwave time and 400 W microwave power.

It can be seen from the above that when the ratio of material to liquid is 1:20, the extraction rate of water-soluble solids reaches the maximum value of 23.2%. After that, the extraction rate has not changed much. Therefore, the ratio of material to liquid is best at 1:20.

The effect of microwave time on the extraction rate of water-soluble solids from coffee powder with particle size of 40 mesh was studied under the conditions of material-liquid ratio of 1:20 and microwave power of 400 W.

The extraction rate of water-soluble substances is higher; in the range of 100-300 s, the extraction rate rises quickly, in the range of 300-500 s, the extraction rate rises slowly, and reaches the maximum value of 23.3% at 500 s; in the process of experimental operation, it is found that the temperature of microwave treatment is difficult to control, its temperature rises too fast, the sample will boil, scorch, and other phenomena, damage. Aroma of coffee. The best microwave time is 400s. 3.1.3 The coffee powder of 40 mesh size was selected for microwave power. The effect of microwave power on the extraction rate of water-soluble solids was studied under the conditions of material-liquid ratio 1:20 and microwave time 400 s.

When the microwave power was 400W, the highest extraction rate was 23.2%. The effect of coffee particle size on the extraction rate of water-soluble solids was studied under the conditions of material-liquid ratio 1:20, microwave time 400 s and microwave power 400 W. When the size of coffee increased from 20 mesh to 40 mesh, the extraction rate of coffee water-soluble solids increased from 21.2% to 23.2%. When the size of coffee exceeded 40 mesh, the extraction rate increased slightly. Coffee particle size reaches a maximum of 24% at 60 meshes, but too fine particles will increase the difficulty of subsequent filtration process. Therefore, the 40 choice is to crush the particle size. Orthogonal test was used to optimize the extraction conditions. The orthogonal experiment L (934) with four factors and three levels was selected to optimize the extraction conditions. The design level of extraction factor was measured.

The optimum extraction conditions were determined by the extraction rate of water-soluble solids in coffee. The results showed that the optimum extraction conditions of water-soluble solids in coffee were A2B2C2D3, i.e. extraction ratio 1:20, microwave time 400s, microwave power 400W, and coffee particle size 50 meshes. From the range analysis, it was found that the order of influence of each factor on the extraction rate was D (particle size)>B (microwave time)>A (material-liquid ratio)>C (microwave power). That is to say, coffee particle size has the greatest impact on the extraction rate, followed by microwave time and the ratio of material to liquid, microwave power has the least impact on the extraction rate.

It can be seen that the extraction rate of water-soluble solids in coffee by microwave method is the highest, which is 106% and 107% of that by hot water method and ultrasonic method respectively, and its time-consuming is the shortest. The other two methods take 4.5 times and 6 times of that by microwave method.

Conclusion On the basis of single factor experiments of material-liquid ratio, microwave time, microwave power and coffee granule size, the orthogonal experiment was designed. The optimum extraction conditions of water-soluble solid in coffee by microwave were obtained as follows: extraction ratio 1:20, microwave time 400 s, microwave power 400 W, coffee granule size 50 mesh. However, according to the actual production situation, the finer the coffee particles, the more the amount of suspended particles in the extract, making the turbidity of the extract increased, the transparency decreased, to a certain extent, will affect the quality of instant coffee, especially when the number of particles is more than 40 mesh, so the coffee granularity of 40 mesh is appropriate. Compared with the hot water method and the ultrasonic method, the microwave extraction method has the highest extraction rate and the shortest time.