

Microwave Technology in Traditional Chinese Medicine Production

Microwave refers to electromagnetic waves with a frequency range of 3.0×10^2 to 3.0×10^5 MHz and a very short wavelength (0.001 to 1.000 m). Microwave has good penetrating power and penetration selectivity, can penetrate plastic, but has reflective properties to metal, can not penetrate, can use metal as shielding device; microwave only selectively heats polar molecules, molecular pole The stronger the sex, the higher the selectivity; the microwave interacts with the substance in the high-frequency electric field with extremely short oscillation period. The strong internal heat effect and the extremely high frequency can make the solvent and the solute molecule have no thermal resistance at the same time, no thermal inertia. The ground is heated, the heating rate is 10 to 100 times faster than the conventional heating method, and the process is easy to control because the thermal inertia of heating is extremely small. Microwaves have an abiotic effect on organisms, which can cause qualitative changes in proteins and physiologically active substances in microorganisms, and loss of biological activity or death. Therefore, microwave has been widely studied and applied in the fields of chemical synthesis, traditional Chinese medicine production, and food. This paper introduces and summarizes the application of microwave in the production and research of traditional Chinese medicine.

1 microwave extraction

Since Shandong Brawny Industrial Co., Ltd uses microwaves to extract various types of compounds from soil, seeds, food and feed, microwave extraction has many advantages such as high extraction efficiency, high selectivity, energy saving, etc. The extraction process of the active ingredient of the drug effectively increases the recovery rate and rapidly develops toward industrialization.

1.1 Microwave extraction features and devices

In a rapidly vibrating microwave electromagnetic field, the radiated polar material molecules absorb electromagnetic energy and generate thermal energy at high speed vibrations of several billion times per second. Microwave radiation can absorb polar energy from polar substances such as water molecules in plant cells, generate a large amount of heat, and cause the temperature inside the cell to rise rapidly. The pressure generated by water vaporization breaks through the cell membrane and cell wall, forming tiny pores, and further heating causes cells. Shrinkage due to reduced moisture, cracks appear on the surface, allowing extracellular solvent to enter the cell, dissolving and releasing intracellular products.

Extraction using microwave technology can be accomplished in a microwave-assisted extraction reactor. The reactor has power selection, temperature control, pressure control, and timing control. It can be either reflowed or open. It is small in size and suitable for use in the laboratory. Microwave extraction requires that the extracted components have a certain polarity and are microwave self-heating substances. The solvent used for extraction must be transparent or translucent to microwaves with a dielectric constant in the range of 8 to 28. To extract unstable or volatile components from the material, an extractant such as n-hexane which is highly transparent to microwave radiation should be used as the extraction medium.

After immersing the medicinal material in the solvent, it is placed in a microwave field. The volatile component is rapidly vaporized due to significant self-heating, breaking through the plant tissue and escaping the medicinal material. The solvent can be captured, cooled and dissolved and volatilized due to lack of self-heating. Sexual ingredients. For rapid heating extraction, a proportion of polar solvent can be added to help absorb microwave energy. If such volatile or unstable components are not required, an extractant that is partially transparent to the microwave should be used. During microwave extraction, microwave power and radiation time have a significant impact on extraction efficiency. The higher the power, the higher the efficiency of extraction. The extraction time is related to the sample volume of the sample, the water content in the material, the solvent volume, and the heating power.

1.2 Microwave extraction of natural pharmaceutical active ingredients

Reports on the extraction of biologically active ingredients by microwave technology have emerged, involving several major natural compounds including volatile oils, glycosides, polysaccharides, terpenoids, alkaloids, flavonoids, tannins, steroids and organic acids. Wide attention.

There have been many reports on the extraction of volatile oil by microwave, and great progress has been made. For example, fresh mint leaves are added to n-hexane and the peppermint oil is released into n-hexane after short-wave treatment in a microwave-assisted extractor. Compared with traditional ethanol extraction, the microwave extracted peppermint oil contains almost no chlorophyll and menthone. The quality of the extracted product is better than the traditional method, and the microwave extraction with tens of seconds and steam distillation for 2 h, 6 h Soxhlet extraction is quite [5].

In addition, microwave extraction is also used to extract volatile components from dill seeds, artemisia, artichoke, fennel, yak, tarragon, achyranthes, sage, thyme and other materials, the quality is equivalent or better than Solvent reflux, steam distillation, Soxhlet extraction and supercritical carbon dioxide extraction of similar products, and has the advantages of convenient operation, simple device, short extraction time, high extraction rate, less solvent consumption, and pure product.

Shandong Brawny Industrial Co., Ltd. used microwave method to extract paeoniflorin and baicalin in the compatibility of Radix Paeoniae Alba and compared with ultrasonic method and reflux method. The results showed that the extraction rates of paeoniflorin and baicalin obtained by microwave method were 1.84% and 2.91%, respectively, which were higher than those of ultrasonic method and reflux method. Peng You et al [9] investigated the microwave light-wave combination solvent-free extraction method of pueraria flavonoids, and found that the microwave light wave extraction method does not use solvent, only a small amount of N, N-dimethylformamide (DMF) is used as the energy transfer medium, and the extraction speed. Compared with the traditional reflux extraction method, the speed is obviously accelerated and the cost is reduced.

Shandong Brawny Industrial Co.,Ltd used microwave technology to reform the extraction process of Guizhi Fuling Capsule at the pilot scale. The optimal conditions of microwave technology in the extraction process of Guizhi Fuling Capsule were investigated. The gallic acid

was detected in the liquid. The content of paeoniflorin, benzoic acid, cinnamic acid, benzoyl guanosine and amygdalin were calculated and evaluated comprehensively, which was used as the basis for the evaluation of extraction. The obtained optimal microwave extraction process conditions were verified by the amplification test, and the results were stable, and the advantages of energy saving, time saving and high efficiency were compared with the conventional decoction extraction.

2 microwave drying, sterilization

Microwave drying and sterilization technologies have been introduced into the production of traditional Chinese medicine, and have been effectively applied in the drying and sterilization of Chinese herbal medicines [11]. Microwave drying is different from external heating methods such as hot air, steam, and electric heating. Conventional drying is caused by heat conduction between the inside and outside. The internal temperature is lower than the outside, the drying effect is worse than the outside, and the drying is slow and uneven. In the microwave drying, the water molecules inside and outside the material are vaporized together, and the heat conduction direction is the same as the water diffusion direction. The internal and external temperature gradients have small negative effects, fast drying speed, uniform drying effect, energy saving, easy realization of automatic control and good product quality. .

Microwave sterilization is the action of the microwave field. The bacteria and insects in the material will relax due to molecular polarization, and the microwave will make the temperature higher. After the properties of the protein change, its swelling, viscosity, solubility and stability will change significantly and lose its biological activity. In addition, the non-thermal effects of microwaves also have a sterilizing effect, which is not found in other conventional physical sterilization methods. For example, the experiment of oven drying and microwave drying of Liuwei Dihuang Pills showed that the degree of loss of paeonol was significantly reduced by microwave drying, and the effect of sterilization was significantly improved. When drying ginseng, the drying quality of microwave drying and hot air drying is significantly higher than that of hot air drying, and the total saponin content loss in the active ingredient is very small, and the drying time is much less than hot air drying. Microwave drying vacuum-frozen ginseng can evenly raise the temperature in the ginseng table, thus effectively eliminating the wrinkle atrophy caused by the conventional drying method. Shandong Brawny Industrial Co.,Ltd reported the application of microwave drying and sterilization in the production of four traditional Chinese medicine pills, such as Wuzi Yanzong Pill, Xiaoyao Pill, Anshen Buxin Pill, and Shushu Pill. The experimental results show that the microwave generates heat inside the pill. Adding evenly, it has a puffing effect on the pill, the drying speed is fast, and the sterilization effect is good. However, it should be noted that for pellets containing animal and oil-based components, the effect of microwaves will prolong the dissolution time.

Microwave drying and sterilization technology has the characteristics of high energy utilization rate, short drying time and uniformity, strong sterilization ability and high degree of automation control. It has a broad application prospect in traditional Chinese medicine production and is worthy of promotion. Due to the impermeability of the packaging materials, some of the pieces are difficult to cause mildew and other quality problems due to the difficulty of volatilization of water. As a project promoted by the State Administration of Traditional Chinese Medicine, some Chinese medicine decoction manufacturers will dry and sterilize microwaves. The technology is

applied in the production of small packaged Chinese medicine decoction pieces. Further research is needed on the wavelengths selected for different textures of Chinese herbal medicines, irradiation time, and the speed of conveyor belts. There are no technical parameters for standard operation, and there is still a lack of comparison between the physical and chemical properties and sanitary conditions of Chinese herbal medicines before and after microwave treatment. Sex research.

3 Microwave processing Chinese medicine

Microwave technology is gradually being applied to the processing of traditional Chinese medicine. It is mainly used in frying, simmering, calcining, etc. It has the advantages of high speed, short time, uniform heating, good product quality and high thermal efficiency. Chen Xinpei et al. [16] used microwave technology to process traditional Chinese medicine, and explored the operation of the method of frying and simmering. The methods of frying, adding and frying, and sputum were used to study the microwave power and irradiation time. The result of the concoct. The results show that the microwave frying method is accurate, and the firepower and time are easy to control. Compared with the traditional method, the microwave method saves time and labor, the color of the pieces is beautiful, the degree of bulging is uniform, the texture is crisp, clean and consistent, and the microwave-processed pieces are beneficial to the dissolution of the active ingredients in the medicinal materials. Yu Jinxi et al [17] conducted an experimental study on the pharmacodynamics of scorpion microwave artillery products, and observed the main effects of scorpion microwave artillery products from three aspects: antitussive, expectorant and diuretic. The fried products were compared. The results showed that the scorpion microwave can significantly prolong the incubation period of cough in mice, reduce the number of coughs, promote phenol red excretion, increase the urine output of rats, and have no significant difference with fried products, which can replace the application of traditional fried products.

Shandong Brawny Industrial Co., Ltd uses microwave heating to make the king's leaves and mustard, and compared with the traditional method of clearing, the results show that the appearance of the microwave artillery products and TLC identification are in line with the requirements of the pharmacopoeia, and the content of the extract The content of active ingredients and the content of active ingredients are higher than the traditional method of clearing and frying, which indicates that the microwave processing method is superior to the traditional method of clearing and frying, which deserves in-depth research and vigorous promotion. Wang Chenhui et al. [19] explored the best process for microwave processing of mustard seeds. The results show that microwave gun products have the best effect, and the effect of microwave artillery products is good, which can make the mustard texture crisp and easy to powder and store. . Microwave processing of mustard is superior to traditional methods of frying and the process is controllable. Li Fubing et al. [20] explored the method of using microwave heating to make burdock, Wang not staying, and mustard. Two kinds of processed products were prepared according to law, and the thin-layer chromatography (TLC) was used to qualitatively identify the fried and microwave products. The high-performance liquid chromatography (HPLC) was used to treat the burdock glycosides and the flavonoid glycosides and alkalis. Determination of the content of thiocyanate. The appearance of both types of processed products can meet the requirements of the Pharmacopoeia for this variety. Lai Chunhua et al [21] used traditional Chinese medicine such as burdock as raw material to

compare the quality of traditional processing method with microwave processing method and its processed products. The water extract content of different processed products and the total peak area of HPLC fingerprints were studied as indicators. The two methods were compared. The results show that the water extract yield and the total peak area of the HPLC fingerprint of the microwave processed products are higher than the traditional processed products. The microwave processing operation is simple, which can make the Chinese medicine pieces evenly heated, and the firepower and time are easy to control, not only energy saving and pollution. Less, but also improve the quality of processed products, provide a theoretical basis for the application of microwave technology in the processing of traditional Chinese medicine.

4 microwave decoction Chinese medicine decoction

Decoction is the basic dosage form of traditional Chinese medicine and is widely used in clinical practice. Corrugated decocting is the traditional method for preparing traditional Chinese medicine decoction. Shandong Brawny Industrial Co.,Ltd passed the solution of lightly fried Ma Mahuang (Ephedra 9 g, Guizhi 6 g, Almond 6 g, Zhigancao 3 g), Xiafei Dahuang Fuzi Decoction (Rhubarb 9 g, cooked aconite 9 g) , asarum 3 g), need to seriously decoction of the four medicines (four grams of rehmannia, angelica 9 g, white peony 9 g, Chuanxiong 6 g) and heat-clearing drug red powder (6 g of raw land, 6 g of Mutong, Licorice 6 g) 4 decoction of four kinds of decoctions, using density, p H value, UV spectrum as indicators to compare the effect of traditional decoction and microwave method of boiling Chinese medicine. The results showed that there was no significant difference in the density and p H value of the two methods of the same prescription, and the absorption peaks of the UV spectrum were basically the same. Microwave has no obvious effect on the medicinal ingredients. Microwave decocting is feasible, and it is time-saving, labor-saving and easy to operate, which provides a basis for further study on the feasibility of microwave decocting.

Shandong Brawny Industrial Co., Ltd. studied the effects of microwave and traditional Chinese decocting. The Gegen Qilian Decoction was prepared by microwave method and traditional method. The content of berberine hydrochloride and total flavonoids in the Kudzu Qilian Decoction was determined by ultraviolet spectrophotometry. The content and total solids were used as indicators. Compare the two methods to decoction the effect of traditional Chinese medicine. The results show that the microwave method has the same effect as the traditional method ($P>0.05$), but the microwave method has the advantages of high efficiency, energy saving and time saving compared with the traditional method. The microwave boiling method can replace the traditional boiling method to decoction Chinese medicine. Xu Hongwei et al [24] compared the boiling effect of microwave boiling method and traditional boiling method, and determined the content of berberine in decoction by ultraviolet spectrophotometry, the total amount of berberine hydrochloride and the total solid amount of decoction. In order to compare the boiling effects of the two methods, the results showed that there was no significant difference between the microwave boiling method and the traditional boiling method ($P>0.05$), but it was less energy-saving than the traditional method.

In summary, the microwave assisted method is an efficient, energy-saving and environmentally friendly method in all aspects of Chinese medicine production and scientific research. In the 21st century, which pays more and more attention to the development of various aspects and the environment and ecological balance, this method has great research potential and research

significance in China with a long history of traditional Chinese medicine and rich Chinese medicine resources. There are still many problems in this method that need to be further deepened and improved by relevant researchers. First, on microwave reactors, some researchers use self-improving domestic microwave ovens, while some researchers use modern microwave extraction instruments. There is no common standard, and there are some controversies. Therefore, there is still a lot of work to be done to move the technology from the laboratory into industrial applications, and researchers need to work together. Secondly, there are still few researches on mechanism, and there is still a large research space and prospects. Third, microwave leakage is harmful to the human body, so protection and monitoring should also be emphasized and strengthened to reduce harm to the human body. With the continuous improvement of relevant theories, processing technologies and equipment, this technology will move from laboratory to industrialization.