Application of Microwave Technology in Extracting Chemical Components of Natural Products

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Abstract: The advancement of science and technology has brought about tremendous changes in human production and life. Microwave technology is one of the typical representatives. In recent years, with the continuous innovation and development of this technology, its application field has become more extensive. In particular, the application of microwave technology in the extraction of chemical components of natural products in the chemical industry not only enhances the production capacity of chemical companies but also enhances product quality. In this paper, the author further explores the application level of microwave technology in the field of chemical production by analyzing the relevant extraction principle of microwave technology and the application of microwave technology in the extraction of chemical components of natural products.

1. Introduction

The products in the field of chemical composition extraction of chemical products in the chemical industry have been widely welcomed by the market, but as the demand continues to increase, chemical companies are facing increasing production pressure. The traditional solvent and steam extraction methods are not only inefficient and the product quality is not ideal, and it is basically difficult to meet market demand. In recent years, microwave technology, which has been favored in this field, is being used more and more widely because of its unique low cost, high efficiency and good product quality. Next, the author discusses how to improve the application of microwave technology in the chemical composition of natural products from the following aspects.

2. Microwave concept

Microwave refers to an electromagnetic wave between the infrared radiation of the electromagnetic spectrum and the radio wave with a frequency between 300MHz and 300GHz, that is, an electromagnetic wave with a wavelength between 1mm and 1m. According to the wavelength and frequency, it can be divided into four bands, respectively. Meter wave, centimeter wave, millimeter wave and submillimeter wave. In recent years, microwave electronic technology has developed rapidly, people's understanding of microwave has been deepened, microwave application technology has been deepened, and the applicable fields have been continuously expanded. In order to avoid mutual interference with devices that use microwaves for radar applications, the microwave heating frequency has been specifically regulated internationally. The microwave heating frequencies currently widely used are 0.915 GHz and 2.45 GHz.

3. Microwave heating principle

Microwave mainly has three characteristics of penetration, reflection and absorption. The polar molecules of water molecules in the medium can be heated by microwave. Under the action of rapidly changing microwave, the polarity of the polar molecules will change with the change of the external electric field; the microwave heating will cause the spin motion of the water molecules, and then the microwave energy will be converted into the heat energy of the material to be heated, resulting in The temperature of the material rises rapidly, and a series of physicochemical processes such as heating are generated, and finally the purpose of microwave heating and drying is achieved.

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The speed at which the microwave energy can pass through the material to be heated is close to its propagation speed in vacuum, which is 3.0×108 m/s, so the time for penetrating the material is extremely short, and the inside and outside of the material can be simultaneously heated by the microwave. Compared with the traditional heating method, the traditional heating method is to first heat the outside of the material, and then use heat transfer to slowly transfer the heat to the inside of the material, and the heating efficiency is low. Liu Haili et al. [1] compared traditional electric heating with microwave heating, and found that microwave heating is much faster than electric heating. For example, using 140 ° C high temperature electric heating takes 9060 s, which is 10.8 times that of 750 W microwave heating. 6.6W microwave heating 26.6 times. Yan Hanming et al. used traditional heating and microwave heating (300W, 500W, 650W, 1000W microwave power) to heat the apple. The experimental results show that microwave heating can rapidly increase the temperature of the sample and rise to the same temperature. The heating time is 1/5 of the conventional heating, which shortens the time the sample is exposed to high temperatures.

The microwave heating equipment adopts a fully enclosed device. At the same time, the microwave passes through the interior of the material at the speed of light, the time is converted into heat energy, and the material is directly heated, so that the wet material can substantially completely absorb the microwave energy, and the heating process is substantially free of heat. Dispersed, the energy saving of the microwave heating process is realized, and the energy utilization rate is high. Liu Haili and others found that microwave heating has obvious energy-saving effect. The same load, microwave heating energy consumption is less than 10% of electric heating. Yang et al. [3] conducted a comparative study on the microwave and hot air regenerative properties of silica gel. It was found that the electric energy consumed by the microwave regenerative power above 136W was less than 15% of the hot air regeneration when the same degree of regenerance was achieved.

4. Microwave technology extraction principle and other related analysis

Theoretically speaking, microwave is an electromagnetic wave with a wavelength between 0.001 and lm. Since the frequency of the microwave and the frequency of the molecular motion have extremely high similarity, after a series of operations, it can act on the molecular structure of the substance and accelerate the movement of the molecule, thereby causing tear, friction and heat generation reactions, and finally The breakdown of the material cells provides a convenient condition for the extraction of the target substance components. However, at the same time, due to the difference between different substances, the intrinsic molecular composition has different reaction intensity to microwave. Therefore, when using microwave technology to extract the chemical components of natural products, it is necessary to analyze the characteristics of different substances, and then Provide conditions and support for extracting target components.

In terms of the development history of microwave extraction technology, it belongs to a new type of extraction technology. When using microwave extraction technology to extract the chemical components of natural products, the factors that can affect the technical operation are solvent, temperature, time and matrix materials. To sum up, the advantages of microwave extraction technology are as follows: First, high efficiency. Compared with the traditional solvent and water vapor extraction methods, the microwave in the microwave extraction technology can quickly penetrate the intrinsic molecular composition of the substance, and the internal temperature of the stimulating substance is rapidly increased, thereby further increasing the extraction speed of the target substance. This advantage of microwave extraction technology has an important impact on improving the production efficiency of chemical companies and reducing the total cost of production.

Second, stability. Microwave technology can stimulate the intrinsic molecular temperature rise of a substance in a very short period of time, so the technique can also achieve the effect of extracting a target substance at a low temperature. In other words, microwave technology guarantees the stability of the substance. Third, energy saving. Energy conservation is one of the important features of microwave extraction technology. Because the power of the microwave itself is small, and the radiation efficiency is high, and the selection of the solvent is wide, the energy-saving and

environmental protection features of the microwave extraction technology are more prominent.

5. Application of microwave technology in extracting chemical components of natural products

Microwave technology extracts natural products with a wide range of chemical constituents. Based on production practices, microwave technology extracts natural chemical constituents mainly including flavonoids, alkaloids, glycosides, volatile oils and polysaccharides.

5.1 Flavonoids

Microwave technology is very mature in the extraction of flavonoids and has achieved remarkable results. Microwave extraction of flavonoids is mainly carried out by means of orthogonal experiments. The components in different parts of the plant are unique, especially for the roots and stems of plants, which should be placed in a closed environment for microwave extraction. This method is an excellent method for extracting flavonoids from chemical companies with less time-consuming extraction, high extraction efficiency and less solvent consumption.

5.2 Alkaloids

With the continuous innovation and development of technology, the application of microwave technology in the extraction operation of alkaloids has become quite common. When using microwave technology to extract alkaloids, it is necessary to perform specific analysis and selection based on the characteristics of the extracted objects. For example, for camptothecin extraction, the microwave technology and the traditional alkaloid component extraction method are combined in an orderly manner, which takes only 3 minutes. When using microwave technology to extract alkaloids, the details to be noted are due to differences in solvents and time, and the parameters selected are different. The effects obtained by using microwave technology are also different.

5.3 Glycosides

The market demand for glycosides has been increasing year by year, so how to improve the content of glycosides has become a major research topic for chemical companies. The traditional glycoside extraction process is mainly based on ultrasonic technology. With the advent of microwave extraction technology, its advantages of high efficiency, stability, and low cost have greatly improved the output value of glycoside components.

5.4 Volatile oil components

The material composition of volatile oils has always been difficult to extract in the traditional extraction technology. This is mainly because the boiling point of volatile oil compounds is low, and the traditional extraction process is difficult to control the temperature, which leads to the failure of extraction. The microwave extraction technology not only does not require high temperature, but also greatly shortens the extraction time. Therefore, this technology has been rapidly promoted and applied in the extraction of volatile oil components. However, when microwave technology extracts volatile oil components, there is one detail to be noted. In the process of extracting volatile oil components, the microwave power should not be too high, otherwise the yield of volatile oil components will be reduced.

5.5 Polysaccharide

Polysaccharides mainly refer to natural macromolecular compounds composed of monosaccharides, which are widely present in plants, animals and microorganisms. They play an active role in regulating blood sugar lowering. Traditional polysaccharide extraction methods are mainly decoction and alcohol precipitation, which will generally be extracted. The time is controlled at 8 hours. In addition to the above chemical composition extraction, microblog extraction technology is also widely used in other component extraction work, such as: pigments, organic acids and amino acids [2]. In the future, with the continuous development of science and

technology, the extraction technology will also be further developed, and combined with traditional extraction technology, give full play to various technological advantages, improve extraction efficiency and quality, and promote sustainable and healthy development of related fields.

6. Conclusion

In summary, the microwave extraction technology plays an important role in promoting the chemical composition of natural products. Therefore, in the production practice, we must actively explore the microwave technology and combine the microwave technology with the extraction of the chemical components of natural products in chemical production. In this way, the ingredients exert the advantages of microwave technology and promote the extraction efficiency and quality of chemical components of natural products. In the above article, the author shared some research results on the extraction of chemical components of natural products by microwave extraction technology, and hoped to inspire and help the industry peers.

References

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