Study on microwave assisted extraction of curcumin from Curcuma longa

Abstract: The extraction conditions of curcumin from Curcuma longa by microwave drying equipment assisted with n-butanol and n-propanol were studied by single factor experiment and orthogonal experiment.The optimum volume ratio of n-butanol to n-propanol was 4:6 with the extraction rate of curcumin and the recovery rate of solvent as the index. The optimum conditions of extracting curcumin with mixed solvent assisted by microwave drying equipment were as follows: solvent dosage was 1:35, extraction temperature was 50 C, extraction time was 30 min and extraction power was 200 W. Under these conditions, curcumin content reached 4.10%.

Curcumin is the rhizome of Curcuma longa L. The main chemical constituents of Curcuma longa L. are curcumin and volatile oil. In addition, curcumin contains carbohydrates, sterols and trace elements. Among them, curcumin is a kind of alcohol-soluble diphenylheptadecane compounds, such as curcumin, Demethoxycurcumin and dimethoxycurcumin. Curcumin is an ideal natural pigment and the main component of turmeric which plays a pharmacological role. Studies have shown that curcumin has many pharmacological effects, such as gallbladder-stimulating, lipid-lowering, anti-cancer, anti-virus, anti-inflammatory, anti-oxidation, anti-tumor, anti-aging and prolonging life span, and has become a natural drug in recent years. Curcumin contains about 1.8% ~ 5.4% of curcumin. In order to fully extract its effective components and make it play a better pharmacological role, it is of great practical significance to study the extraction technology of effective components in curcuma. The maximum yield was 2.7%. Cellulose and hemicellulose in the cell wall and interstitium of Curcuma longa were degraded by cellulase and pectinase, and the extraction rate of curcumin was improved.

In this experiment, curcumin was extracted by microwave-assisted mixed solvent of n-propanol and n-butanol in Curcuma drying equipment, but there is no report about this. According to the principle of similar solubility, the weak polarity of curcumin was considered in selecting the extraction solvent. Material has good extraction effect only when the polarity of solvent is close to that of curcumin. Therefore, this study used two kinds of solvents to adjust the polarity to extract. Results Compared with single solvent, mixed solvents with a certain ratio not only achieved better extraction effect, but also relatively low price in parallel experiments. At the same time, microwave can make the temperature inside the cell rise rapidly, so that the pressure inside the cell exceeds the ability of the cell wall to expand, resulting in cell rupture, free flow of its effective components, and at a lower temperature dissolved in the extraction medium. Therefore, this method has the advantages of high yield, low cost, simple operation and suitable for industrial production.

The extracting method of curcumin is to weigh a certain amount of crushed turmeric, put it into a microwave extracting tank, add the corresponding volume of solvents and mixed solvents respectively. After opening the instrument, adjust the power, heat up, when the required temperature, open the cooling water to keep warm for a certain time. After extraction, the extract is cooled and carried out. After filtration, the filtrate is further concentrated in vacuum to obtain a yellow brown viscous liquid, which is frozen and preserved.

Microwave-assisted extraction of curcumin with a single solvent was carried out under microwave-assisted extraction. Three parts of dry Curcuma powder were precisely weighed and pulverized, and n-propanol and n-butanol were used for microwave-assisted extraction.

Microwave-assisted extraction of curcumin with mixed solvents was carried out in a container. Dry curcumin powders were crushed and extracted with mixed solvents of n-propanol and n-butanol in different proportions.

According to the literature and preliminary experiments, there are four factors related to the increase of extraction rate: the amount of solvent A, the extraction temperature of B, the extraction time of C and the extraction power of D. Each factor determines three levels.

The maximum absorption wavelength of curcumin was determined by weighing 2.00 g of curcumin powder, adding 50 mL absolute ethanol to extract for 12 hours, and extracting 0.1 mL filtrate for 400 times dilution.

Standard Curcumin Curcumin Curcumin Curcumin Curcumin Curcumin Curcumin Standard Curve Drawing: Precision weighing with anhydrous copper sulfate sealed and dried for 48 hours 1.0 mg, placed in 25 mL Brown volumetric flask, dissolved in 75% ethanol, diluted to the scale to prepare a reserve solution. The absorbance of the reference substance was measured at 425 nm. The standard curve was drawn with the absorbance A as the vertical coordinate Y and the concentration C as the horizontal coordinate X. The linear regression equation was obtained and the linear relationship and the linear range were investigated.

According to the method described in 1.2, the concentrated solution was diluted to a certain concentration with 75% ethanol as the solution to be measured. The absorbance of the sample solution was measured at 425 nm with 75% ethanol as the reference. The concentration of curcumin in the sample solution was obtained by regression equation. The curcumin content in the extract was calculated according to the following formula. Extraction rate.

Curcumin content = concentration of curcumin in sample solution (g/mL) * dilution multiple of the extract * total volume of the extract (mL) determination of total volume of the extract (mL), extraction rate of curcumin = curcumin content (g) / quality of medicinal materials (g) 100% selected the highest extraction rate of the test program.

Results and discussion

The linear regression equation was obtained as follows: A = 0.134C_0.001, correlation coefficient R = 0.9999. Curcumin concentration ranged from 0.8 ug/mL to 4.0 ug/mL, and the concentration had a good linear relationship with absorbance.

The effects of different solvents on the extraction efficiency of curcumin are as shown in Table 2. From Table 2, it can be seen that n-propanol is better than n-butanol in the extraction of curcumin. The main reason is that the polar solvent can quickly dissolve the target substance under microwave-assisted extraction. At the same time, because of their high solubility for many kinds of substances in organisms, the "wrapping" effect of impurities on the target substances is

reduced, and a better extraction effect is obtained.

Mixed solvents have strong penetration and good compatibility to plant. The alcohol volume fraction, microwave-assisted curcumin extraction rate of different solvents and solvent recovery rate are single solvents, the extraction effect is better. For mixed solvents, the polarity of different proportion is different, the extraction effect is also different. When the volume ratio is 9:1 and 8:2, the extraction rate of curcumin is higher, but the solvent recovery rate is lower. When the volume ratio is 5:5, although the solvent recovery rate is higher, the extraction rate of curcumin is lower. Only when the volume ratio is 4:6, the extraction rate of curcumin is the highest and the solvent recovery rate is the lowest. Compared with 5:5, the solvent recovery rate is slightly lower, and the volume ratio of n-butanol to n-propanol is 4:6, which is a better solvent ratio.

The orthogonal experimental results and analysis of microwave-assisted extraction showed that curcumin was extracted by different solvent dosage, extraction temperature, extraction time and extraction power at the volume ratio of n-butanol to n-propanol 4:6. The absorbance of the extract was measured at 425 nm. The content and extraction rate of curcumin were calculated according to the standard curve. In order to screen the best conditions for extracting curcumin from microwave assisted mixed solvents, the results are shown in table 4..

The R value of orthogonal experiment showed that the order of four factors affecting curcumin content was solvent dosage > extraction power > extraction time > extraction temperature. Therefore, the optimum extraction conditions were determined as follows: A2B2C3D2, solvent dosage 1:35, extraction temperature 50, extraction time 30 min and extraction power 200 W.

In order to further verify the optimum technological conditions, repeated experiments were carried out. Three parts of Curcuma were weighed and extracted according to the optimum technological conditions of orthogonal experiment. The content of curcumin was calculated according to the standard curve. The results were shown in Table 5.

Conclusion:

The content of curcumin in Curcuma longa L. is low. It has a good extraction effect in a certain proportion of mixed solvents assisted by microwave. In the experiment, the key factors affecting the extraction, such as the ratio of mixed solvents, the amount of solvent, the extraction time, the extraction power and the extraction temperature, were selected as the evaluation index, and the actual production operation was considered. The optimum extraction process of curcumin was determined as follows: the volume ratio of n-butanol to n-propanol was 4:6, the dosage of solvent was 1:35, the extraction temperature was 50 ~C, the extraction time was 30 min, the extraction power was 200 W, and the curcumin content reached 4.10%.