METHOD FOR PROCESSING *PORIA COCOS*

Field of the Invention

The present invention relates to the technical field of traditional Chinese medicinal material processing, and specifically to a method for extracting, purifying, and processing and forming a *Poria cocos* polysaccharide, which is applicable to deep processing and standardized product preparation of *Poria cocos*.

Background to the Invention

As a traditional medicinal fungus, *Poria cocos* contains *Poria cocos* polysaccharides as its main active ingredient, which has important pharmacological effects and market value. The existing methods for processing *Poria cocos* have the following technical problems:

1. Lack of standardization in raw material processing: traditional processing has no unified standards for the screening of *Poria cocos* sclerotia, slice thickness, and drying conditions. This results in raw materials with many impurities and poor uniformity, which affects subsequent extraction efficiency;

2. Low efficiency of active ingredient extraction: simple water extraction or alcohol extraction fails to break through the cell wall barrier of *Poria cocos*. The extraction time is as long as 2-4 hours, the polysaccharide extraction rate is only 3-5%, and high temperature easily leads to polysaccharide degradation;

3. Rough purification process: impurities are not completely removed, the total ash content of the product often exceeds 5%, and the purity is less than 20%, which cannot meet the medicinal standards; and

4. Single product form: most of products exist in the form of coarse powder or slices, with inaccurate dosage, prone to moisture absorption and deterioration, and low added value.

Statement of Invention

In view of the deficiencies in the prior art, the present invention provides a systematic method for processing *Poria cocos*, aiming to solve the above technical problems.

The technical solutions adopted by the present invention to solve the technical problems are as follows:

A method for processing *Poria cocos*, including steps of:

raw material pretreatment: performing screening, purification and crushing treatments on

a fresh *Poria cocos* sclerotium to obtain a *Poria cocos* raw material meeting an extraction requirement;

active ingredient extraction: extracting a *Poria cocos* polysaccharide and the like active ingredients from the *Poria cocos* raw material using solvent extraction combined with an auxiliary means to obtain an extract;

purification and refinement: separating and purifying the extract for impurity removal and concentration to obtain a high-purity refined *Poria cocos* polysaccharide; and

processing and forming: mixing the refined *Poria cocos* polysaccharide with an auxiliary material, and producing a standardized *Poria cocos* processed product through granulation, drying, and the like processes.

Preferably, the raw material pretreatment includes: screening a high-quality *Poria cocos* sclerotium, slicing after purification treatment, drying to a preset moisture content, and then crushing into uniform particles.

Preferably, the high-quality *Poria cocos* sclerotium is a fresh sclerotium with a diameter of ≥ 10 cm and no mildew; a slice thickness is 0.5-1 cm; a drying temperature is 40-50°C, and a moisture content after the drying is ≤ 10%; and after the crushing, the sclerotium is sieved through an 80-100-mesh sieve.

Preferably, in the active ingredient extraction, a solvent is water, the auxiliary means includes enzymatic hydrolysis and/or ultrasonic treatment, and an extraction temperature is 40-60°C.

Preferably, a mass-to-volume ratio of the *Poria cocos* raw material to the water is 1:10-1:15; the enzymatic hydrolysis uses a compound enzyme of cellulase and pectinase (a mass ratio of 1:1), at an addition amount of 0.1-0.3% of a mass of the raw material; and power of the ultrasonic treatment is 200-300 W, and extraction time is 30-60 minutes.

Preferably, the purification and refinement includes: performing solid-liquid separation on the extract, separating a polysaccharide using an alcohol precipitation method, and then obtaining the refined *Poria cocos* polysaccharide through low-temperature drying.

Preferably, the solid-liquid separation is performed by centrifugation (4,000-5,000 r/min, 15-20 minutes), combined with microfiltration (a 0.22 μm membrane); in the alcohol precipitation method, a final ethanol concentration is 70-80%, and standing is carried out at 4°C for 12-24 hours; and the low-temperature drying is vacuum freeze-drying (-40 to -50°C, a vacuum degree of ≤ 10 Pa), and the refined polysaccharide has a purity of ≥ 30%.

Preferably, the processing and forming includes: mixing the refined *Poria cocos* polysaccharide with an excipient to prepare a soft material, and performing press forming

after the granulation and the drying.

Preferably, the excipient is maltodextrin, and a mass ratio of the refined *Poria cocos* polysaccharide to the maltodextrin is 3:1-5:1; the granulation uses a 16-20-mesh sieve, and a drying temperature is 50-60°C; and tableting pressure is 5-8 kN, and each produced tablet contains ≥ 200 mg of the *Poria cocos* polysaccharide and has a hardness of 3-5 kgf.

Compared with the prior art, the beneficial effects of the present invention are reflected in the following aspects:

1. The extraction rate of *Poria cocos* polysaccharides is increased to more than 8%, and the extraction time is shortened to less than 1 hour;

2. The purity of the product is improved, so that the *Poria cocos* polysaccharide content is ≥ 30% and the total ash content is ≤ 3%; and

3. *Poria cocos* polysaccharides are produced into standardized tablets, which are convenient for taking and storage, and the added value of the product is improved.

Brief Description of the Drawings

FIG. 1 is a flow chart of a processing process of the present invention.

Detailed Description

Example 1: Processing of *Poria cocos* polysaccharide tablets

1. Raw material pretreatment: fresh *Poria cocos* sclerotia with a diameter of 12 cm were selected, peeled, washed, then cut into 0.8 cm thin slices, dried at 45°C to a moisture content of 8%, crushed, and sieved through a 100-mesh sieve;

In this example, this step ensured the uniformity of raw materials through a standardized process of "screening-purification-slicing-drying-crushing."

High-quality sclerotia with a diameter of ≥ 10 cm were screened to remove mildewed parts; a slice thickness of 0.5-1 cm ensured uniform heating; low-temperature drying at 40-50°C avoided polysaccharide denaturation (a retention rate ≥ 95%); and crushing into particles through an 80-100-mesh sieve increased the contact area for subsequent extraction (extraction efficiency was improved by 20%).

2. Active ingredient extraction: water was added at a mass-to-volume ratio of 1:12, 0.2% compound enzyme (cellulase:pectinase = 1:1) was added, and ultrasonic extraction was conducted at 50°C with 250 W power for 45 minutes;

In this example, this step adopted a mild extraction means combining water extraction with enzymatic hydrolysis and/or ultrasonic assistance. A liquid-to-solid ratio of 1:10-1:15 balanced extraction efficiency and costs. The compound enzyme (cellulase + pectinase) destroyed the cell wall structure. 200-300 W ultrasonic vibration accelerated polysaccharide dissolution. Mild conditions of 45-55°C reduced degradation. The synergistic effect increased the extraction rate to 8-10% and shortened the time to 30-60 minutes.

3. Purification and refinement: the extract was centrifuged at 4,500 r/min for 18 minutes, and the supernatant was passed through a 0.22 μm membrane; ethanol was added to a concentration of 75%, and the mixture was allowed to stand at 4°C for 20 hours, and the precipitate was collected by centrifugation; and vacuum freeze-drying was performed at -45°C for 30 hours to obtain refined polysaccharides (a purity of 32%).

Since the extract contains a large quantity of impurities (starch, cellulose, etc.), it is difficult for traditional purification methods to separate them, resulting in low product purity. In this example, this step achieved polysaccharide purification through a combined process of solid-liquid separation-alcohol precipitation-low-temperature drying.

Specifically, macromolecular impurities were removed by centrifugation + microfiltration (0.22 μm) (the ash content was reduced by 40%); polysaccharides were specifically precipitated with 70-80% ethanol (the purity was increased to more than 30%); and the destruction of polysaccharide activity by high temperature was avoided through vacuum freeze-drying (-40 to -50°C) (an activity retention rate ≥ 90%).

4. Processing and forming: the refined polysaccharides and maltodextrin were mixed at 4:1 to prepare a soft material, which was then passed through an 18-mesh sieve for granulation. After drying at 55°C, the granules were sized and compressed under a pressure of 8kN to obtain tablets containing 220 mg of polysaccharides each.

In this example, this step adopted a standardized forming process of mixing "polysaccharide + excipient" for granulation and tableting.

Maltodextrin (in a ratio of 3:1-5:1) improved formability and taste; granulation through a 16-20-mesh sieve ensured tablet uniformity; drying at 50-60°C controlled the moisture content (≤ 5%); and tablets compressed under a pressure of 5-8 kN had moderate hardness (3-5 kgf) and an extended shelf life of 24 months, and each tablet containing ≥ 200 mg of polysaccharides achieved precise dosing.

The quality of the *Poria cocos* products obtained by the processing method of the present invention needs to be verified by the following detection methods, specifically including the determination of *Poria cocos* polysaccharide content, total ash determination, and tablet

stability detection:

1. Determination of *Poria cocos* polysaccharide content (high-performance liquid chromatography)

① Preparation of reference solution: 10 mg of glucose reference substance was precisely weighed, dissolved in ultrapure water, and diluted to a constant volume of 100 mL to obtain a 0.1 mg/mL reference solution;

② Preparation of test solution: 0.1 g of refined *Poria cocos* polysaccharides (or powder equivalent to 0.1 g of polysaccharides after grinding the tablets) was taken, mixed with 5 mL of 80% ethanol for defatting, and centrifuged (3,000 r/min, 10 min), and the supernatant was discarded; 20 mL of ultrapure water was added to the residue, extracted in an 80°C water bath for 1 h, cooled, then diluted to a constant volume of 50 mL, and passed through a 0.22 μm filter membrane;

③ Chromatographic conditions: an amino column (4.6 mm × 250 mm, 5 μm), acetonitrile-water (75:25) as a mobile phase, a flow rate of 1.0 mL/min, a differential refractive index detector, a column temperature of 30°C, and an injection volume of 10 μL; and

④ Determination and calculation: the reference solution and test solution were injected separately, the chromatograms were recorded, and the polysaccharide content (calculated as glucose) was calculated by the external standard method.

2. Total ash determination (ignition residue method)

① A porcelain crucible that had been brought to constant weight was taken, and 2 g of *Poria cocos* tablet powder was precisely weighed and spread evenly in the crucible;

② First, the powder was carbonized at a low temperature until no smoke was produced (about 200°C, 30 min), and then placed in a muffle furnace for ignition at 600°C for 4 h;

③ The crucible was taken out, allowed to cool to room temperature, and 2 mL of dilute hydrochloric acid was added to moisten the residue. After evaporation to dryness, the residue was ignited again at 600°C for 30 min; and

④ After cooling, the residue was precisely weighed, and the total ash was calculated (residue weight/sample weight × 100%).

3. Tablet stability detection (accelerated test method)

① 200 *Poria cocos* tablets were taken, divided into 4 groups, and placed in a constant temperature and humidity chamber under the set conditions of 40°C ± 2°C and relative humidity of 75% ± 5%;

② Samples were taken at 0 days, 1 month, 2 months, 3 months, and 6 months separately to test the appearance (whether discolored or cracked), hardness (determined by a hardness tester), and polysaccharide content (as the method in 1.3); and

③ If the change rate of each indicator was ≤ 5% within 6 months, the stability was determined as qualified.

Test results and method validation:

Poria cocos polysaccharide content: detected by the above method, the polysaccharide content in the tablets was 31.8% (RSD = 1.2%, n = 3), meeting the standard of ≥ 30%;

Total ash: detected by the above method, the result was 2.5% (RSD = 0.8%, n = 3), meeting the standard of ≤ 3%; and

Stability: after 6 months of the accelerated test, the tablets showed no cracks in appearance, the hardness remained at 4.2 kgf (an initial value of 4.5 kgf), and the polysaccharide content decreased to 30.9% (a change rate of 2.8%), so the tablets were determined as stable.

The above detection methods were subjected to methodological validation: the glucose reference substance showed a good linear relationship in the range of 0.05-0.5 mg/mL (R^2 = 0.9998), and the polysaccharide spiked recovery rate was 98.5%-101.2% (RSD = 1.5%), indicating that the detection results are accurate and reliable.

Test results: the total ash of the tablets was 2.5%, and the polysaccharide content was 31.8%, meeting the standards in "Pharmacopoeia of the People's Republic of China." The stability was good after 6 months of the accelerated test (40°C, RH 75%).

The above descriptions are only preferred examples of the present invention and are not intended to limit the present invention. Any modifications, equivalent substitutions, improvements, or the like made within the spirit and principles of the present invention shall all be included within the scope of protection of the present invention.