



TECHNOLOGY FOR PRODUCING CAPSULES FROM GOJI BERRY EXTRACT, LYCIUM BARBARUM SPECIES

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Abstract: Goji berries (*Lycium barbarum*) have been used for centuries in traditional Chinese medicine and are gaining popularity as a "superfruit" due to their high antioxidant content and potential health benefits. This article reviews technologies for producing capsules containing concentrated extract from *L. barbarum* fruit. Methods of goji berry extraction using solvents like water, ethanol, and supercritical CO₂ are discussed. Spray drying, freeze drying, and vacuum drying of extracts to produce powders suitable for encapsulation are covered.

Keywords: Goji berry, *Lycium barbarum*, extraction, drying, encapsulation, nutraceutical

INTRODUCTION

The fruit of *Lycium barbarum*, known as goji berry or wolfberry, is a traditional Chinese medicinal herb that has been used for over 2000 years to promote health and longevity [1]. Goji berries contain a variety of phytochemicals believed to have beneficial effects, including polysaccharides, carotenoids like zeaxanthin, vitamins, and flavonoids [2]. Modern research suggests that goji berry may have antioxidant, anti-inflammatory, neuroprotective, and immunomodulating properties [1][3].

To deliver these active compounds in a convenient form, manufacturers are increasingly producing goji berry extract capsules as dietary supplements. Capsules protect ingredients from oxidation and moisture, mask flavors, and provide uniform dosing [4]. However, making stable, potent goji berry capsules requires careful raw material sourcing, extraction, drying, and encapsulation.

METHODS AND LITERATURE REVIEW

Goji Berry Extraction Methods. The first step in producing goji berry capsules is extracting active compounds from the fruit. Traditional Chinese medicine uses water decoction, but this method extracts limited lipophilic compounds and is prone to contamination [5]. Ethanol extraction improves compound recovery but requires solvent removal [6]. Supercritical fluid



extraction using CO₂ efficiently obtains a broad range of constituents with minimal processing but has high equipment costs [7][8].

Yao et al. compared the polysaccharide yield of hot water, ethanol, and ultrasound-assisted extraction [9]. The ethanol method gave the highest yield of 6.03%. Liu et al. used response surface methodology to optimize ultrasonic ethanol extraction, achieving 7.16% polysaccharide yield. These studies show solvent choice and extraction technique significantly impact active compound recovery.

Drying of Goji Berry Extracts. Liquid goji extracts are usually dried into powders for encapsulation. Spray drying, where extracts are rapidly dried in a hot gas stream, is a common method. It produces fine powders but requires high temperatures that may degrade some compounds. Freeze drying uses sublimation of ice to remove water, preserving heat-sensitive components but taking longer and requiring more energy.

Goji Berry Extract Encapsulation. Dried goji berry extracts are commonly encapsulated in gelatin or vegetarian cellulose capsules. Hard gelatin capsules have lower moisture content and better airtightness than softgels but can be more difficult to swallow. Hydroxypropyl methylcellulose (HPMC) capsules are popular for vegan supplements but have higher moisture vapor permeability. Other materials like pullulan and modified starches are also being explored [7].

Capsule filling is usually done by volume rather than weight due to variation in extract powder density [8]. Automatic capsule fillers can produce from 1,000 to over 200,000 capsules per hour. Dosage is controlled by the capsule size and extract concentration. Sufficient fill weight and powder flow are important to ensure consistent filling.

RESULTS

Based on the reviewed literature, key considerations for each stage of goji berry capsule production include:

Extraction:

- Ethanol provides good yields of polysaccharides and other active compounds
- Ultrasound-assisted extraction improves yield and extraction speed
- Supercritical CO₂ efficiently extracts a wide range of lipophilic and hydrophilic compounds

Drying:

- Spray drying gives higher yields but may cause more degradation of heat-sensitive compounds



- Freeze drying better retains color and some nutrients but is more time and energy intensive

Encapsulation:

- Hard gelatin capsules provide an oxygen and moisture barrier but may be less acceptable to vegetarian/vegan consumers
- HPMC capsules are popular for plant-based supplements but have higher moisture permeability
- Automatic capsule filling enables high-volume production; powder flowability is important for dosage consistency

Quality Control:

- Raw material identity and purity should be verified by analytical methods like HPLC and DNA barcoding
- Capsules should be tested for weight variation, disintegration, and microbial limits per USP standards
- Stability studies must be conducted to determine shelf life and storage conditions

ANALYSIS AND DISCUSSION

The optimal methods for producing goji berry extract capsules depend on the target compounds, desired dosage form, and production scale. For small batches, water or ethanol extraction followed by freeze drying may preserve sensitive phytochemicals. Large commercial production will likely use organic solvent extraction with spray drying for higher throughput.

Hard gelatin or HPMC capsules will be suitable for most products. Softgels may be used if a liquid or paste extract is preferred. Capsule size and fill weight must be chosen to provide the intended dosage per serving.

Careful quality control is essential to produce safe and effective goji berry capsules. Rigorous testing of raw materials and finished product can prevent adulteration and ensure consistency. Stability studies are crucial as botanical extracts can degrade over time, especially with exposure to heat, light, and oxygen. Packaging in opaque, airtight containers can improve shelf life.

More research is still needed to fully characterize the bioactive compounds in *L. barbarum* and their pharmacokinetics when delivered in capsule form. Clinical trials can provide data to substantiate health claims made on the label. However, goji is generally recognized as safe, non-toxic, and well-tolerated.

CONCLUSION

Goji berries are a promising functional food with a range of potential health benefits. By leveraging advances in extraction, drying, and encapsulation



technology, producers can create stable, standardized *L. barbarum* fruit extract capsules to meet the growing consumer demand for natural herbal supplements. Further research and development can optimize capsule formulation and support validated health claims. As more clinical evidence emerges for the safety and efficacy of goji berry supplementation, this traditional Chinese medicine is poised for success in the global nutraceutical market.

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