Equipment Selection Guide

for Psilocybin Extraction Labs

Methods | Equipment | Scale | Compliance

A practical guide for lab planners and researchers

ROOT SCIENCES

Premium Extraction, Distillation, and Post-Processing Technologies
for the Hemp and Cannabis Industries

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www.rootsciences.com **(206) 452-1130** info@rootsciences.com

Who This Guide Is For

Whether you are planning a new psilocybin research facility, scaling an existing operation, or evaluating equipment vendors for the first time, this guide gives you a practical framework for choosing the right extraction method and lab equipment.

Research lab directors — planning new psilocybin extraction workflows

Facility managers — evaluating equipment for scale-up

Compliance officers — ensuring regulatory readiness

Investors & consultants — conducting due diligence on lab operations

> **Why equipment selection matters:** Psilocybin is a polar, thermally sensitive compound. The wrong equipment choice can lead to compound degradation, poor yields, and compliance failures. Getting it right the first time saves months of rework and significant capital.

Extraction Method Comparison

Three primary extraction methods are used in psilocybin research and production. Each has distinct advantages depending on your scale, purity requirements, and regulatory context.

	Ethanol Extraction	CO_2 Supercritical Extraction	Water-Based Extraction
Polarity Match	Excellent — ethanol is a strong polar solvent	Good — tunable polarity via pressure/temp	Good — psilocybin is water-soluble
Purity Potential	High (with winterization and filtration)	Very high (selective extraction)	Moderate (co-extracts many compounds)
Scalability	Excellent — simple to scale	Good — requires capital investment	Limited — best for small batches
Equipment Cost	$$ — Moderate	$$$ — Higher	$ — Low
Thermal Risk	Low (cold ethanol methods available)	Low (precise temp control)	Moderate (heat can degrade psilocin)

	Ethanol Extraction	CO_2 Supercritical Extraction	Water-Based Extraction
Best For	Most labs — versatile, proven, scalable	High-purity pharmaceutical applications	Initial screening and small-scale research

Our recommendation: For most psilocybin labs, **ethanol extraction** offers the best balance of cost, scalability, and compound compatibility. Labs targeting pharmaceutical-grade isolates should consider CO_2 systems for their superior selectivity.

Equipment Checklist by Lab Scale

Your equipment needs depend heavily on the scale of your operation. Below is a practical checklist organized by lab size, from benchtop research to commercial production.

Research Scale

Typical throughput: 1–10 kg/day | Budget range: $50K–$150K

✓ **Benchtop extraction vessel** — 1–5L capacity, glass or stainless steel

✓ **Rotary evaporator** — For solvent recovery and concentration

✓ **Vacuum filtration kit** — Buchner funnel, flask, membrane filters

✓ **Analytical balance** — 0.001g precision for sample prep

✓ **HPLC system** — For potency analysis and quality control

✓ **Vacuum oven** — Low-temp drying to preserve compound integrity

✓ **Ultrasonic processor** — Optional — improves cell disruption and yield

Pilot / Scale-Up

Typical throughput: 10–50 kg/day | Budget range: $150K–$500K

✓ **Closed-loop extraction system** — 20–50L capacity, ethanol or CO2

✓ **Industrial rotary evaporator** — 20L+ capacity for efficient solvent recovery

✓ **Centrifuge or filter press** — High-throughput solid/liquid separation

✓ **Short-path or wiped-film distillation** — For purification and isolate production

✓ **Freeze dryer (lyophilizer)** — Preserves thermally sensitive compounds

✓ **Chiller and heating circulator** — Precise temperature control throughout process

✓ **Chromatography system** — Preparative HPLC or column chromatography for isolation

Commercial / GMP Production

Typical throughput: 50+ kg/day | Budget range: $500K–$2M+

✓ **Industrial extraction platform** — 100L+ automated systems with CIP

✓ **Falling-film or rising-film evaporator** — Continuous solvent recovery at scale

- ✓ **Nanofiltration membrane system** — Concentration and purification without heat
- ✓ **Automated chromatography** — Continuous or SMB chromatography for high-purity isolates
- ✓ **Environmental monitoring** — Temperature, humidity, particulate sensors for GMP compliance
- ✓ **Quality management system (QMS)** — Documentation, batch tracking, deviation management
- ✓ **Dedicated analytical lab** — In-house HPLC, stability chambers, reference standards

Compliance Snapshot

Psilocybin remains a Schedule I controlled substance in the United States under federal law. However, several jurisdictions have created pathways for licensed research and, in some cases, therapeutic use. Any lab handling psilocybin must address the following compliance areas:

1. **DEA Schedule I Research License**

   Required for any facility handling psilocybin in the US. Application includes facility inspection, security assessment, and research protocol review. Plan for 6–12 months lead time.

2. **State-Level Authorization**

   Some states (Oregon, Colorado) have created regulated frameworks for psilocybin. Requirements vary significantly — verify state-specific licensing before procurement.

3. **Facility Security Requirements**

   DEA-compliant security includes vault storage, alarm systems, access controls, and inventory tracking for all controlled substances. Factor these into your facility build-out budget.

4. **GMP Readiness (if applicable)**

   Labs producing material for clinical trials or therapeutic use will need GMP-compliant processes, documentation, and equipment qualification (IQ/OQ/PQ protocols).

5. **Waste Disposal & Environmental**

   Solvent waste, biological material, and controlled substance waste all require documented disposal procedures compliant with federal and local regulations.

Important: This guide provides general compliance context only and does not constitute legal advice. Consult with a regulatory attorney and your state's controlled substance authority before purchasing equipment or beginning operations.

Which Method Is Right for Your Lab?

Use this decision framework to identify the extraction approach that best matches your operational needs.

If your priority is...	Choose this method	Why
Lowest startup cost	**Water-based extraction**	Minimal equipment, low solvent cost, simple setup
Best balance of cost and quality	**Ethanol extraction**	Proven, scalable, excellent polarity match for psilocybin
Pharmaceutical-grade purity	**CO2 supercritical**	Tunable selectivity, clean extracts, no residual solvent
Speed to market	**Ethanol extraction**	Fastest to procure, install, validate, and begin production
Maximum compound preservation	**Cold ethanol or CO2**	Low temperatures protect thermally sensitive psilocin
Regulatory simplicity	**Ethanol extraction**	Most familiar to regulators, simplest to document for GMP

Key Takeaway: For the majority of psilocybin labs — from university research groups to licensed production facilities — **ethanol-based extraction** provides the strongest starting point. It offers proven compatibility with psilocybin's polar chemistry, straightforward regulatory documentation, and a clear upgrade path as your operation scales.

Ready to Build Your Extraction Lab?

Root Sciences has helped hundreds of extraction facilities go from concept to production. Our team brings deep expertise in equipment selection, lab design, and GMP compliance — specifically tailored to the unique requirements of psychedelic compound processing.

Schedule a Free Lab Consultation

Our extraction engineers will review your requirements, recommend equipment, and provide a custom lab plan at no cost.

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What We Offer

Equipment Solutions: Ethanol, CO2, solventless extraction systems and full post-processing lines

Lab Design & Setup: End-to-end consulting for extraction lab build-outs

GMP Consulting: Process development, documentation, and qualification for regulated production

Ongoing Support: Training, maintenance, replacement parts, and technical support

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