



POWDER
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Nano Spray Drying Protocol for Submicron Powders

A practical guide for formulation scientists and process engineers

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About This Protocol

This protocol is designed for formulation scientists, lab technicians, and R&D engineers working with nano spray drying systems. It focuses on submicron particle generation (typically 200-500 nm) using heat-sensitive and high-value pharmaceutical or biotech actives. All guidance is based on practical lab experience and verified operating ranges for commercial benchtop nano spray dryers.



Quick Setup Checklist

- Check mesh condition (clean, undamaged)
- Select mesh pore size (typically 4-7 μ m)
- Prepare filtered feed solution (viscosity <10 mPas preferred)
- Confirm solvent compatibility with drying chamber and filters
- Fill feed bottle, ensure tight cap and tubing seals
- Power on system, select appropriate drying program
- Confirm collector voltage, fan rate, and drying temp
- Run initial 1 mL test spray to verify droplet and flow behavior



Suggested Parameter Ranges

Inlet temperature: 60-120C for most APIs

Outlet temperature: 35-70C (adjust feed rate accordingly)

Mesh: 4-7 m, stainless steel or piezo membrane

Airflow: 100-160 L/min

Voltage (collector): 4-10 kV

Feed rate: 0.1-0.5 mL/min

Collection: via electrostatic plate; check every 15-30 minutes



Expected Output Range

Particle size: 200-500nm (D50 typical)

Residual moisture: <5% with optimized drying

Recovery yield: 80-95% achievable

Particle shape: spherical (water), wrinkled/collapsed (organic solvents)

Charge: moderately negative or neutral-affects electrostatic capture



Solvent Behavior & Particle Morphology

Water solid, spherical particles

Ethanol quick-drying, hollow particles possible

Acetone risk of collapsed particles, high volatility

Methanol good charge retention, fast drying

Organic solvent blends adjust ratios to reduce wall loss

Drying rate affects final morphology. Faster drying produces porous or crumpled particles. Slower drying creates denser shapes. Particle surface energy and charge also influence collector adhesion and final yield.



Troubleshooting Guide

Issue: Low yield

- Check for wall loss; increase voltage
- Ensure electrostatic plate is clean

Issue: Sticky powder

- Raise inlet temperature slightly
- Reduce feed rate or solvent volume

Issue: Clogged mesh

- Lower viscosity; re-filter feed
- Check mesh for physical damage

Issue: Powder left in chamber

- Adjust airflow or drying time
- Check collector polarity and sealing

Note: Batches with high polymer or protein content are more prone to fouling. Clean promptly.



Cleaning & Maintenance Log

After each batch:

- Rinse feed bottle and tubing with solvent
- Remove and rinse mesh with filtered solvent
- Wipe chamber walls with lint-free cloth
- Empty electrostatic collector gently
- Inspect gaskets and seals

Weekly:

- Deep clean all surfaces and collector
- Inspect for wear, cracks, or powder buildup
- Verify mesh integrity with magnification

Monthly:

- Test voltage output and airflow calibration
- Perform a dry run and record baseline behavior



Real-World Case Examples

A protein formulation with BSA at 2% concentration in water + ethanol, dried at 75C inlet, 5 m mesh, produced 240nm particles with >90% activity preserved.

A peptide-polymer blend dissolved in acetone dried best at 65C inlet and 0.1 mL/min feed, producing 220nm wrinkled particles.

A nanoparticle suspension with mannitol carrier dried at 110C inlet, 4 m mesh, collected 92% yield with spherical morphology and low wall loss.



Batch Logging & Process Documentation

Use a spreadsheet to log all nano spray drying runs.

Include the following fields:

Run ID

Date & Time

Operator

Feed Composition

Feed Volume (mL)

Mesh Size (m)

Inlet/Outlet Temp (C)

Airflow (L/min)

Voltage (kV)

Duration (min)

Observations

Final Yield (% / g)

Residual Moisture (%)

Particle Size (if measured)

Store logs in a shared cloud folder. Use conditional formatting or dropdowns to highlight outliers or failed batches. Review regularly for process improvement.



Process Overview Diagram

[Insert simplified process schematic: Feed > Mesh > Drying Chamber > Electrostatic Collector]

A high-level process diagram helps technicians visualize dependencies between feed rate, mesh size, airflow, temperature, and collection. Each step affects final powder properties. Use this to train new operators and support troubleshooting.



Common Mistakes to Avoid

Using unfiltered or viscous feed clogs mesh

Overfilling collector arcing, lost powder

Misaligned electrostatic plate reduced capture

Ignoring solvent effects inconsistent morphology

Poor cleaning between batches cross-contamination

Assuming linear scale-up nano spray dryers are not scale models

Note: Always test small batches before adjusting key parameters.

