



# Development of a pilot scale freeze drying facility in an ISO 5 environment

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## Lab Introduction

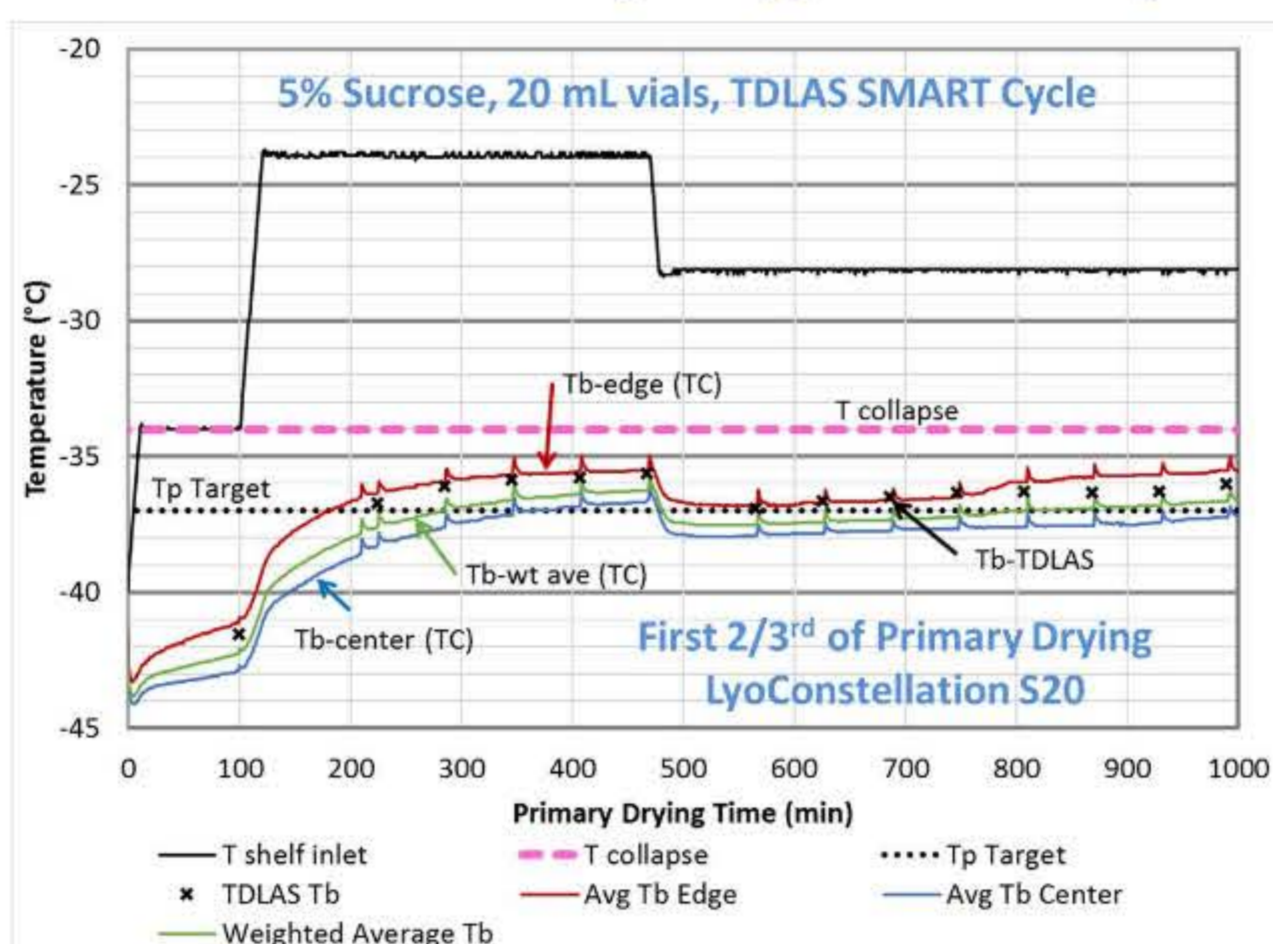
- ❖ An aseptic pilot scale lyophilization facility is installed at UMass Lowell including lyophilizer (model S20, SP Scientific) and CIP skid.
- ❖ An ISO 5 environment LyoBay was specially constructed for the pilot scale lyophilization equipment. Two rooms are included: clean side and dirty side divided by a hard wall. The lyophilizer will be located at the dirty side, while the material preparation will be at the clean side.
- ❖ Cleaning: Clean in place (CIP) system with 99.9% coverage, with features of 250 gallon tank, rinse cycle, recirculation loop and heater to maintain up to +80 °C, integration to Lyo control system.
- ❖ Process control and monitoring: equipped with 16 thermocouple probes, capacitance manometer and Pirani gauges, ControlLyo Technology, and LyoFlux® water vapor mass flow rate monitor (TDLAS), SMART FD technology.
- ❖ Other key facilities in the LyoBay: Vial drying oven, Process water chiller, air cooled condenser, water purification system (DI water) and Fumehood.
- ❖ Funding from Massachusetts Life Science Center (MLSC), National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and UMass Lowell supported the lab construction and equipment procurement.

## Equipment Performance

### Key Features & Benefits:

- ✓ Cover cycle development, stability, pilot and clinical batch production, through full aseptic production.
- ✓ S20 - 5 shelves with total shelves area 1.93 m<sup>2</sup>.
- ✓ Accommodates vials up to 30ml.
- ✓ Clean-in-place (CIP) as standard.
- ✓ Full suite of PAT tools and technologies enables cycle development and scale-up.
  - LyoFlux TDLAS mass flow measurement and inference of critical data.
  - ControlLyo ice nucleation.
- ✓ Validation ports in chamber and condenser.
- ✓ LyoS 2.0 software with 21 CFR part 11 compliant signatures.
- ✓ Top-Down Hydraulic stoppering.

### TDLAS-based SMART cycle (generated by PSI)



### LyoConstellation Freeze Dryer (SP Scientific s20)



### Performance Specifications

Lowest Shelf Temperature (50 / 60 Hz)	- 60 °C
Shelf Temperature Control Range	- 55 to 65 °C
Shelf Temperature Control Accuracy	± 0.5 °C
Shelf Pull-Down from 20 °C to -40 °C	≤ 25 minutes
Shelf Temperature Uniformity	± 1.0 °C
Lowest Condenser Temperature	- 65 °C
Condenser Surface Area	19.4 ft <sup>2</sup> (1.8 m <sup>2</sup> )
Condenser Pull-Down from 20 to -45 °C	≤ 20 minutes
Maximum Sublimation Rate	2,050 g/hour
Number of Compressors	1
Compressor Horsepower	10 hp (7.45 kW)
System Refrigerant	R410A (CFC free)
Vacuum Time to 100 mTorr	≤ 20 minutes
Vacuum Rate of Rise	≤ 30 mTorr/hour
Volume-Based Leak Rate	≤ 0.010 mbar·L/sec (7.5 mTorr·L/sec)
Lowest System Vacuum	≤ 15 mTorr

## Facility Utilization

- ✓ Test bed for new technologies in R&D.
- ✓ User facility for preclinical process development.
- ✓ Lyophilization process scale-up site supporting the local biotechnology economic ecosystem.
- ✓ Training site for workforce development .

### Cooperation:

Looking for industry collaboration opportunities, includes but not limited to data sharing, facility operation training, grant joint application and sponsored research.

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