

Time for science

Stay ahead of your freeze drying time



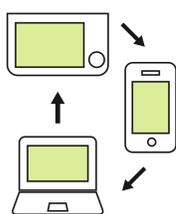
↑ Improve your experiment time by optimizing the process parameters

How to shorten freeze drying time:

| Parameter | How to do it |
|---|--|
| Surface area of frozen sample | Rotational freezing in a Dewar bath in combination with the BUCHI Rotavapor® R-300 increase the vial size or reduce the filling volume |
| Energy supply for the sublimation process | Use preferably heatable shelf at elevated temperature |
| Pressure in drying chamber | Increase the pressure to the maximum level allowed by sample temperature |

∞ Efficient process control

- Mobile process monitoring avoids product downtime
- Process control at instrument and remotely speeds up the process.
- BUCHI offers the Infinte-Control™ with:
 - Pro control unit**
Touch screen, connection to database and network
 - Monitor App**
Mobile process monitoring and push notification of error, warnings
 - Software**
Method programming, remote process start, data and method handling



❄ Ice condenser

- Temperature difference between ice condenser and frozen sample of 15-20 °C
- Consistent ice condenser temperature for efficient freeze drying
- Lyovapor™ L-200 with -55 °C for water mixtures and L-300 for organic applications
- Lyovapor™ systems with powerful cooling system for a quick startup within 5 min
- Infinte-Technology™ for a continuous freeze drying process
- Precisely controlled pressure in drying and condenser chamber

🔧 Vacuum Pump requirements

- Pump performance has to fulfill end vacuum and chamber size requirements
- Oil change every 2000 working hours is recommended
- BUCHI Lyovapor™ will remind the user when oil change is due



📏 Ice vapor pressure - Corresponding temperature

| Temperature [°C] | Pressure [mbar] |
|------------------|-----------------|
| 0 | 6.11 |
| -5 | 4.02 |
| -10 | 2.60 |
| -20 | 1.04 |
| -30 | 0.39 |
| -40 | 0.13 |
| -50 | 0.0395 |
| -55 | 0.021 |
| -60 | 0.0108 |
| -70 | 0.0026 |
| -80 | 0.00054 |
| -100 | 0.000133 |
| -120 | 0.0000031 |



⚙ Phases of a freeze drying process

1. Freezing → 2. Primary Drying → 3. Secondary Drying

1. Freezing

- Slow Freezing
- Freezer at -25 to -45 °C
 - Low vapor resistance
 - Short drying time



Fast Freezing

- Liquid N₂, CO₂-EtOH bath
- High vapor resistance
- Longer drying time



2. Primary Drying – Standard settings

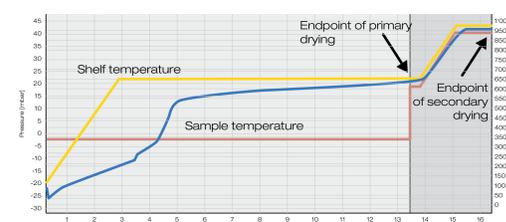
- Water removal via sublimation
- Pressure below vapor pressure of frozen sample e.g. 0.7 - 0.03 mbar
- Shelf 0 - 25 °C
- Safety temperature: 2-5 °C below such as glass transition (T_g) and eutectic temperature (T_e) of the frozen sample

3. Secondary Drying – Standard settings

- Water removal via desorption
- Pressure below vapor pressure of frozen sample e.g. 0.5 - 0.03 mbar
- Shelf 25 - 50 °C
- Safety temperature: 2-5 °C below collapse temperature of the solid such as glass transition (T_g), eutectic temperature (T_e)

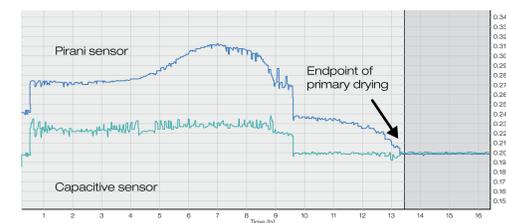
📈 Endpoint determination of drying phases

- Automatic proceeding with the next phase as soon as the endpoint of the single drying phase is reached
- Temperature difference test:



Endpoint is reached as soon as shelf and sample temperature are similar (delta of 1-2 °C)

- Pressure difference test



Endpoint is reached as soon as the attached pirani and capacitive sensors show similar result (delta of 0.025 - 0.05 mbar)

🏆 Extended warranty to reduce possible downtimes

BUCHI START "Extend"

Get your tailored maintenance agreement at the beginning of your BUCHI products' life cycle: this will add an additional years warranty and provide you with peace of mind throughout this period.

With BUCHI START «Extend», you take the first important step to reduce downtime and prolong the life-time of your BUCHI device.

🕒 Improve availability and life-time

BUCHI CARE "Circle" and "CirclePlus"

Regularly maintained devices and systems prove to not only have a higher year-round availability and a longer overall life-time but also provide you with a predictable cost of ownership.

Tailored maintenance packages provide optimal and cost-efficient solutions: customized lists of replacement parts combined with the correct amount of visits.

More tips on saving time for science are coming. Stay tuned!

www.buchi.com/time-for-science



Distributed by Fisher Scientific. Contact us today:

In the United States

Order online: fishersci.com

Fax an order: 1-800-926-1166

Call customer service: 1-800-766-7000

In Canada

Order online: fishersci.ca

Fax an order: 1-800-463-2996

Call customer service: 1-800-234-7437

