Lab/Business Name	Standard Operating Procedure Freeze Drying Kit
	Created: 08/04/2022
Director of Extraction:	Revision: 1 .0

BUILDING **VISION AND VARIETY**

Standard Operating Procedure Freeze Drying Kit

Standard Operating Procedure
Freeze Drying Kit

I. Purpose

The following procedures describe the operation of the Freeze-Drying Kit.

II. Objective

The objective of these procedures is to prioritize the safety of personnel while producing a consistent, quality controlled final product that has been freeze dried to lengthen its shelf life.

III. Responsibility

This SOP is the responsibility of the following personnel:

- Freeze Drying Technician

IV. Definition of Terms

The following terms are used in this document:

Dry Ice – The solid form of carbon dioxide that sublimates from a solid state to a gas state at Earth atmospheric pressure

Personal Protective Equipment (PPE) - Specialized clothing or equipment worn by employees for protection against health and safety hazards.

Standard Operating Procedure (SOP) - established or prescribed methods to be followed routinely for the performance of designated operations or in designated situations.

Materials/Equipment Needed:

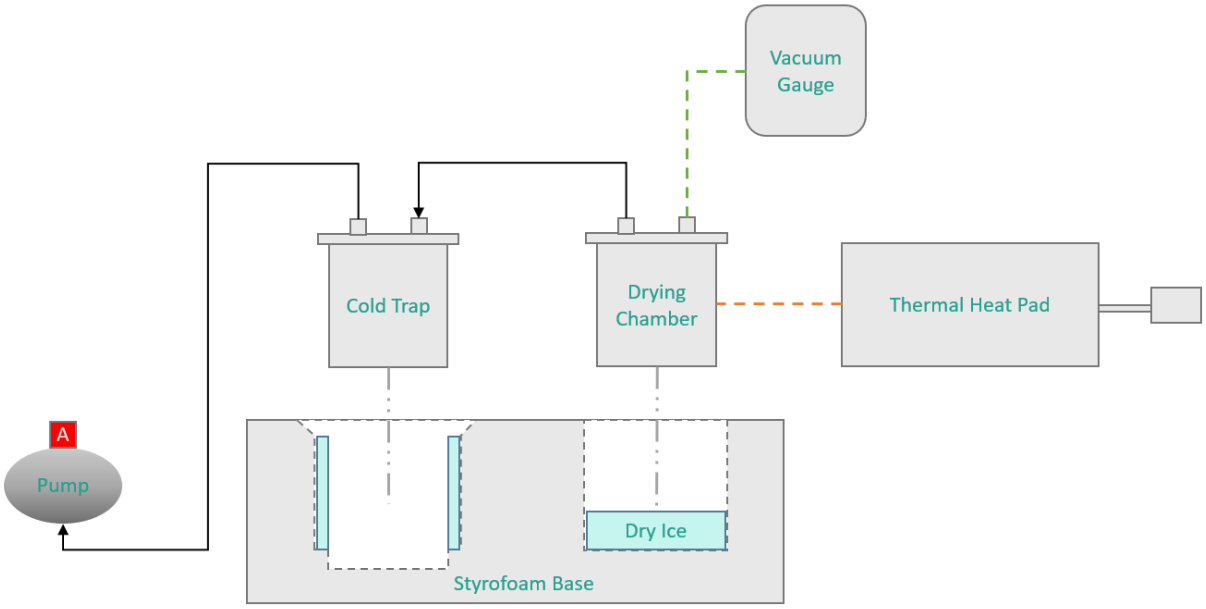
- 2 Quart tall Vacuum Chamber Kit
  - BVV2QTSS
- 2x SS JIC hose
- Digital Vacuum Gauge
- Biomass
- BVV Vacuum Pump
- Dry Ice
- Outlet Timer (optional)
- Drying Rack
- Styrofoam Base
- Thermal Heat Pad

Personal Protective Equipment (PPE):

1. Heavy Walled Nitrile Gloves
2. Lab coat
3. Safety glasses
4. Hairnet or lab hat
5. Cryogenic Gloves

Note: All PPE must be worn for the duration of all procedures except for the Cryogenic Gloves. Use the Cryogenic Gloves when handling dry ice.

V. FREEZE DRYER KIT DIAGRAM



LABEL	NAME
A	*Butterfly Control Valve*

Image 1: Freeze Drying Kit Setup

Image 2: Freeze Dryer Kit Top View

VI. Procedure

A. Setup

1. Collect biomass and freeze them completely (two methods):
    i. At least 6 hours in a freezer.
    ii. At least 1 hour in dry ice.
2. Assemble the Freeze-Drying Kit like the diagram above without the dry ice.
    i. Do NOT plug the thermal pad into an outlet during assembly.
    ii. If you have an Outlet Timer, plug only the Thermal Pad into it.
3. Vacuum test the chambers, checking for any leaks.
    i. We highly recommend tightening all fittings with a wrench to help reduce any potential vacuum leaks.

B. Running The Freeze-Drying Kit

1. Remove the Drying Chamber from the Styrofoam Base and place it on a flat surface (appendix, image 3).
2. Fill the Drying Chamber with the frozen biomass.
    i. Make sure the Drying Rack in inside the Drying Chamber (appendix, image 4)
    ii. DO NOT overfill and block the openings of the bulkheads (appendix, image 5).
3. Once the Drying Chamber is loaded, place the lid back on the drying chamber and turn on the vacuum pump.
    i. Make sure the Butterfly Control Valve is closed when you turn on the vacuum pump.
4. Surround the Cold Trap with dry ice and place the Styrofoam Cover over the dry ice (appendix, image 6 and 7).
    i. DO NOT cover the Cold Trap's acrylic lid with dry ice; this could cause blockage in the hoses.
    ii. Adding dry ice helps with pulling a deeper vacuum and prevents moisture from going into the vacuum pump.
5. Fill the Drying Chamber's slot in the Styrofoam Base with about 3lbs of dry ice (appendix, image 8).
    i. Start with 3lb and adjust the amount based on desired results.
6. Place the Drying Chamber back into its slot in the Styrofoam Base on top of the dry ice (appendix, image 9).
    i. Make sure the Drying Chamber is level on top of the dry ice for more contact.
7. Plug the Thermal Heat Pad into the outlet and set the temperature to 92°F and set a timer for "X" hours.
    i. If you have an outlet timer, set the timer to "X" hours (appendix, image 10).
    ii. We recommend X=14 as a starting time and adjust as needed to obtain desired results.
    iii. "X" has a direct correlation to the amount of biomass being dried.
        1. Ex: More biomass can lead to a longer drying time.
    iv. The temperature can also be adjusted based on your desired results.
8. Monitor the Digital Vacuum Gauge by making sure that it reads under 300 microns (appendix, image 11).
    i. If the Digital Vacuum Gauge doesn't read under 300 microns, the run may yield an undesirable outcome.

ii. It can take up to an hour before it reaches the desired micron level.
iii. Occasionally check the cold trap to see if it needs a refill on dry ice.

9. After “X” hours, unplug the Thermal Heat Pad and leave the vacuum pump on for 2 more hours.
    i. Turning off the Thermal Heat Pad allows the biomass to cool down.
10. After about 2 hours, slowly open the Butterfly Control Valve and release vacuum from the system.
    i. This allows the biomass to cool down from the heat from the Thermal Heat Pad.
11. Remove the lid from the Drying Chamber and check dryness of the biomass.
    i. The biomass should be very brittle and light while keeping its shape and color.
    ii. If the material doesn’t seem dry enough, put the biomass back into the Drying Chamber and restart steps 1-10 and monitor your drying time until you achieve your desired results.
    iii. **Caution:** Over drying the biomass can lead to decreased aroma and flavor.
12. Transfer and store the dried biomass into an airtight container (appendix, image 12)
    i. Reducing exposure of the product from humidity and air will preserve the freshness.

VII. Revision Log

Date	Initials	Revision	Modified By	Description of Changes
08/04/22	JB, MO, DO	1.0	BVV ENGINEERING	First version
03/30/22	JB, MO, DO	1.1	BVV ENGINEERING	Updated photos and procedure

Document Release

Name:	Signature:	Date:

VIII. Appendix

Image 3: Drying Chamber on Flat Surface

Image 4: Drying Rack Inside Chamber

Image 5: Drying Chamber Filled with Biomass

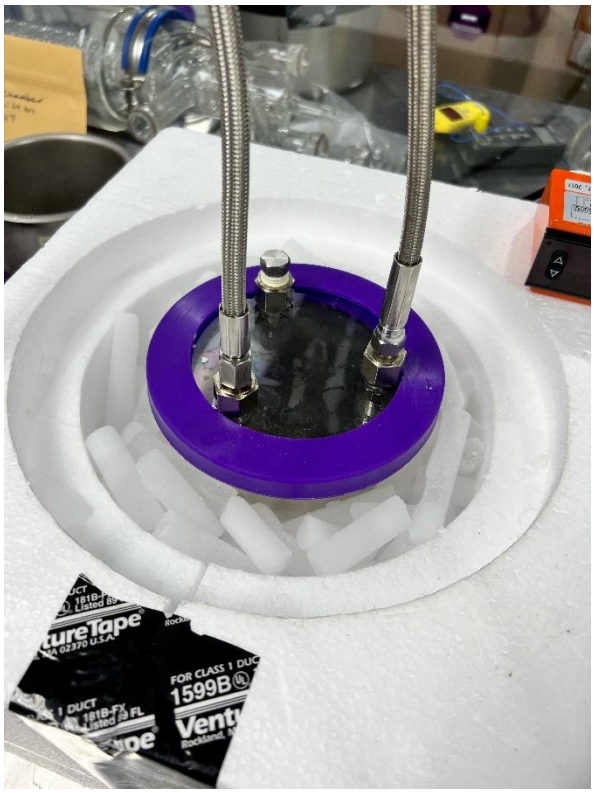


Image 6: Cold Trap with Dry Ice

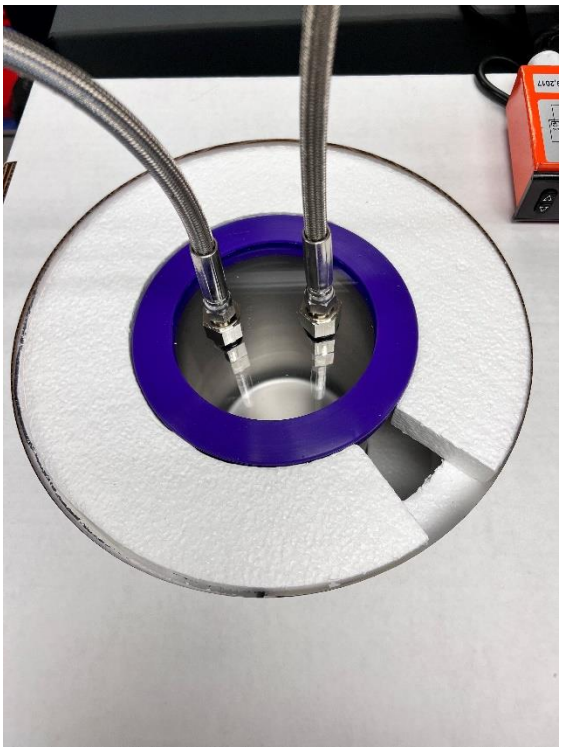


Image 7: Cold Trap with Cover

Image 8: Drying Chamber Slot with Dry Ice

Image 9:Drying Chamber on Top of Dry Ice

Image 10: Outlet Timer Set for 14 Hours

Image 11: Vacuum Gauge Reading Under 300 Microns

Image 12: Biomass in Vacuum Sealed Jar