

Introduction to Freeze Drying

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UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

■ UC Master Food Preserver Program

Freeze Drying

(Sublimation/Lyophilization/Cryodesiccation)

UNITS

*Home

*Pharmaceutical

*Industrial

Commercial HR 100

2025 Brands:

Harvest Right, Cuddon, Fisher Scientific, Wave, Cube,
4Patriots, Blue Alpine. Stay Fresh



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History

- * Early—13th Century Incas in Andes Machu Picchu (low atmospheric pressure, extreme cold)
- * 1st patent--1934
- * WW II—developed to transport blood products and antibiotics to wounded
- * NASA—refined technology for lightweight, nutritious meals for astronauts
Ice Cream story
- * 1950, 1960--Pharma
- * Harvest Right—2018 for home preservation (Salt Lake City, Utah)
- * Prep4life, THE CUBE (Utah)—early 2023



Dehydrating vs Freeze Drying

Dehydrating

Heat/Fan

Wicks Moisture 60-70%

*Desiccant (silica packet)

mineral: silicon + O₂

absorbs moisture

Temp 105 F-165 F

Timer 0-26 hours

Shelf Life: 1 year

Freeze Drying

Sublimation ice->vapor) freeze & heat

99% moisture sublimation (vapor)

*Oxygen Absorber (Iron oxide)

Iron + O₂

absorbs O₂ (300cc)

Pre freeze: 24-48 hrs

Temp -40 F + Heat (95-145)

Time 24-36 hrs

Shelf Life: 25 years

Storage

eliminate O₂, light, moisture



Harvest Right App

- * **Settings**
- * **Register**
- * **Setup (Wifi, Bluetooth)**
- * **Machine communicates cycle**
- * **About Freeze Drying**
 - Maintenance, Manuals, Packaging, Rehydration**
- * **Drying tips (guidelines for all products)**
- * **Instant Support--AI**
- * **Helpdesk (tickets/support)**
- * **Store (Sales, Download Guide, Accessories)**



Maintenance Tips

- * Defrost and Drain after each cycle
- * Wash drum & freeze dryer trays with soap and water after every batch (no harsh chemicals)
- * Remove front gasket--washing with soap and water
- * Complete removal of interior trays
- * Never submerge trays as they have sensors
- * Minimal air flow/ mold
- * Can turn on heater for 20 min with door cracked (Leaf logo/Functional test)
- * Periodically check seal contact to door (adjustments)
- * Wash interior walls with soap and water or bleach (remove inner tray unit)
- * Empty bucket each cycle (prevent water from being pulled back and ruining product)
- * Check oil level before each cycle use (gauge between high/low)
- * 25 cycles usually before oil filtering/change
- * As alike a computer complete shut down is good



Maintenance of Pump

- * 25 cycles before oil change-machine generally tells you
- * Change if yellow, cloudy, particles appear
- * Easiest to change after a cycle as oil is warm
- * Shift pump to edge, place canister under valve, open drain & filter
- * To refill unscrew Demister and fill with new oil to half way mark
- * Make sure gasket is on correctly



Harvest Right Dongle

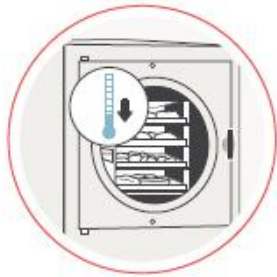
GAME CHANGER

- * USB port
- * Wifi Upgrade Kit (alike a router or modem, QR code scan ability)
(5.4v 5.5v)
- * \$70
- * Updated to 6.0
- * Remote control from smartphone
- * Monitor process and get notifications
 - Batches finished
 - Extend drying time
 - New patented Candy Mode
 - Save your own settings, recipes
 - Tips provided



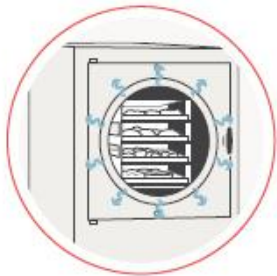
Brief Overview of Process

HOW IT WORKS



STEP 1

Fresh or cooked foods are placed on the shelves where they are frozen to -40°F or colder.



STEP 2

Once the food is frozen, the freeze dryer creates a powerful vacuum around the food. As the food is slightly warmed, the ice in the food sublimates and changes directly from a solid to a gas. That water vapor is then discarded.



STEP 3

When completely dry, food is removed from the freeze dryer and sealed in moisture and oxygen proof packaging to ensure freshness until opened.



STEP 4

When you are ready to eat the food, simply add water. It will regain its original fresh flavor, aroma, texture and appearance!



Information from Harvest Right Re: Shelf Life

25
YEAR

SHELF
LIFE

HOME FREEZE DRYING QUICKLY PAYS FOR ITSELF

When used to dry food daily, your Home Freeze Dryer™ will pay for itself much sooner than you might think. Considering the low cost of the appliance, most families will be able to dry enough food to fully return the investment in less than a year.

Refrigerated food, frozen food, and canned food just don't last very long. However, freeze dried foods will last up to 25 years. It does not need to be rotated as do other foods. Because of this it is perfect for home storage.

HOW FREEZE DRYING PAYS FOR ITSELF

FREEZE DRIED FOOD up to 25 years

DEHYDRATED FOOD up to 4 years

CANNED FOOD up to 3 years

FROZEN FOOD up to 2 years



Benefits

- *Emergency Prep: Emergency Supply/Lightweight/Survival/Backpackers
- *Garden/Orchard: Nutritional value/nutrients/vitamins/minerals
- *Camping/Hunting: Lightweight/easy to rehydrate (mylar bags)
- *Food Storage: No refrigeration/Easy to prepare
- *Healthy Living: No preservatives, emulsifiers, additives
- *Pet Food
- *Taste: Appearance/Color/Texture/Aroma/Flavor/Nutrition
- *Shelf Life: 25 years
- *Versatility: Fruits/Vegetables/Meats/Fish/Eggs/Dairy
Cheese/Snacks/Meals/Casseroles/Soups/Gravy/Sauces/Stock/
Desserts/Ice Cream/Candy, Flowers
- *Waste Not/Want Not: leftovers, excess foods, canned goods expiring, clear freezer



Freeze Drying

- Preserve food for up to 25 years with 95% its flavor, color, nutrition, vitamins, natural enzymes
 - polyphenols, anthocyanins, protein, amino acids.
- Process results in high quality food preservation/Superior method of preserving
- University Research—little thus far (quality, longevity, bacterial studies) Utah State Extension
- Process minimizes oxidation, but you can blanch or pretreat with ascorbic acid
- Doesn't do well...Honey, peanut butter, chocolate, high sugar items, baked goods, oils and fats/rancid
- Does not destroy bacteria/microorganisms...dormant (listeria, e coli, salmonella, others)
- Rehydration 1:1 ratio—spritz (Milk 1/3 c:1 c water)
- Easy-to-use – just press start & the freeze dryer will beep when finished allowing you to walk away and come back to it later
- Upgrade--Dongle
- Smart technology calculates the necessary dry time & automatically monitors the freeze dry process to completion (~20-40 hrs)
- Freeze dry up to 3,000 lbs. fresh food per year* (*This would require a person to use the freeze dryer 4 times a week for 50 weeks a year)
- ~ cost-\$1.25-2.80 per day
- Foraging, Cannabis, Taxidermy, Nutraceuticals (ferments), Seaweed, Placentas



Smart Technology

Easy to operate-pre programmed

USB/upgradable software (Dongle)

Prefreeze food 24/48 hours/-40degrees/heat/extra dry cycle

mTorr: pressure variance d/t elevation (vacuum pressure)

calculates extra dry time



- *Small: 4 trays/434 sq. inches (110 volt/15 amp)
6-10 lbs per batch ~\$ 2,295
- *Medium: 5 trays/675 sq. inches (110 volt/15 amp)
10-15 lbs per batch ~ \$ 2,895
- *Large: 6 trays/1107 sq. inches (110 volt/15 amp)
18-27 lbs per batch ~ \$ 3,600
- *X Large: 7 trays/ 2251sq. inches (110 volt/15 amp)
40-50 lbs per batch ~ \$5,000
- *Commercial- HRC100:9 trays/ 2925 sq. in (220 volt/30 amp)
90 lbs per batch ~ \$10,000 (EDC Food Bank)



Energy Usage

AC: 110 volts x 10 amps = watts

* 20-40 hours run time

Saving tips:

- Pre freeze foods 24-48 hours

- Process full loads

- Once stored there is no other costs

- Freeze Dryers have largest energy use of all processes

- Easily stored, portability, Light weight, flavor, nutrient value

* You can use generators and off grid systems-back up batteries



Harvest Right Pro-Freeze Dryer Specifications

Dimensions



Dimensions include door and vacuum fitting

Weight and warranty

- Fully Automated
- Software upgradable/USB (Dongle)
- Weight of freezer dryer 119 lbs
- Three year limited warranty
- Sizes: Small, Medium, Large, X-Large
- Commercial
- Medium Size-5 trays
- Dimensions (19" W x 29" Ht x 25" D)
- Commercial Grade-Stainless Steel (+\$200)



Harvest Right Pro Freeze Dryer Components

Appearance



Parts (stainless steel for commercial use)

- Freeze dryer Commercial grade vacuum pump (18" X 9" X 14")
- Five stainless steel trays (7.5"X18"X.75")
- Silicone liners/Parchment
- Mylar starter kit of 50 mylar bags, a mylar bag sealer and 50 oxygen absorbers
- Oil filter/Oil
- Insulator door pad/Gasket + (Backer Rod)
- Power cord (100V)
- Owner's manual
- *Guide to Freeze Drying*



Items included with purchase (cont'd)

Harvest Right 12" Impulse Sealer



**Harvest Right Freeze Dryer
Vacuum Premium Pump Oil/Oiless**



Items included with purchase (cont'd)

**Mylar bags starter kit – 50 bags
7 MIL Thickness**



**Harvest Right Home Freeze Dryer
Trays**



Items included with purchase (cont'd)

Freeze Dryer Oil Filter



100V Power Cord



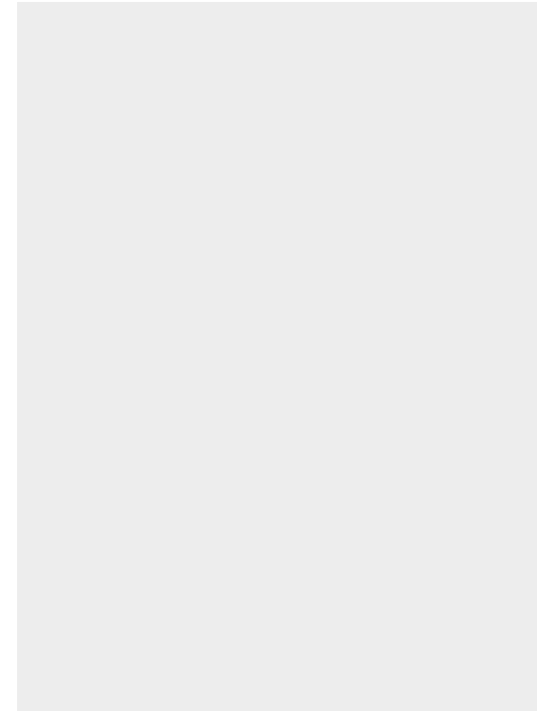
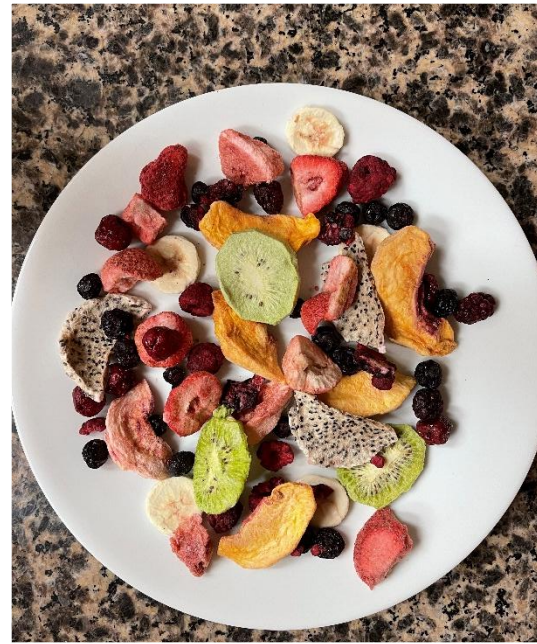
Options: Full Tray

Divide Portions: silicone, molds, Powder form



Fruit Meat Soups Candy

- Pre freeze products 24-48 hours
Reduces explosive events
- Adjust temperature:
Customize as needed:
Yogurt-95-110 degrees F
Candy-more heat
Herbs-less heat



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