Freeze-Drying

Home freeze dryers have become a popular food preservation method to extend the shelf life of food. Many curious food preservers are now investing in these machines.

Freeze-dried food lasts longer and is more lightweight than dehydrated food. Freeze-dried food also retains its color and shape better than dehydrated food. Additionally, more types of food such as ice cream, milk, eggs, and complete meals can be freeze-dried. Despite these advantages, freeze-drying systems are an expensive initial investment, take up a lot of counter space, and use more electricity than a dehydrator.

The following information is based on using the Harvest-Right® medium home freeze dryer and reference materials provided by the manufacturer.

Freeze-Drying Process
Trays of food are placed in the freeze dryer’s chamber. The machine freezes the food to a temperature between -30° and -50°F (-34° and -45°C). Next, a vacuum pump pulls the air out of the chamber and the trays are slightly heated. As the water in the food heats, it sublimates (ice is directly converted from solid to water vapor) and is removed from the product. This process automatically removes up to 98 percent of the water in the food.

Appliance Location and Setup
A freeze dryer consists of two main components: the vacuum pump and the freeze dryer. Those components weigh 35 pounds and over 100 pounds, respectively, so you will need a sturdy location to set up your system, such as on a countertop, sturdy cart, or table. The vacuum pump and the freeze dryer both make a droning noise when they are running—similar to a vacuum cleaner. The system beeps when the cycle is complete or if there is an error, which may be distracting if it happens in the middle of the night. The optimal room temperature range for freeze drying is 45°–75°F (7°–23°C). Consider these factors when choosing a location for your freeze dryer.

Some vacuum pumps use oil that must be filtered, while other vacuum pumps are oil free. If the pump you choose uses oil, it is a good idea to purchase extra oil before your initial setup in case you spill any when filling it. Additionally, as the oil is filtered and consumed by the running pump, it will need to be replenished. It is also helpful to purchase a funnel to use when filling the pump with oil.

Preparation of Food
Start with clean countertops and utensils. Wash hands with soap and warm water. All produce should be properly washed before it is consumed or preserved by rinsing, gently rubbing, or scrubbing with a clean vegetable brush under cold running water. Do not soak produce in water.

Some foods need to be pretreated before they can be freeze-dried to prevent browning. This color change is due to the action of enzymes that act like chemical scissors and cause the food to break down. An example of this process is when an apple is sliced; the exposed flesh turns brown and begins to soften. To control enzymes, follow the same process to pretreat fruits and vegetables for dehydrating as described in “Let’s Preserve: Drying Fruits and Vegetables.” Food should also be cut into equal-sized portions so that the product freeze-dries at the same rate. The rate at which food freeze-dries should also be considered, and foods with a similar drying time should be processed together. Drying times can vary from approximately 24 to 48 hours. Consult your machine’s manual for average drying times.

When loading the trays, make sure the food is evenly spaced and does not come above the edges of the pan, as some products expand when freeze-dried.

Food Safety
Raw and cooked meat and eggs can be freeze-dried. However, the freeze-drying process does not kill harmful bacteria that can cause foodborne illness. Therefore, it is important to carefully label raw meat and handle it appropriately before and after freeze-drying.

1. Wash hands with soap and warm water for at least 20 seconds after handling raw meat or eggs.
2. Wash utensils, mixing bowls, and countertops that come in contact with raw meat or eggs.
3. Clean and sanitize the freeze dryer trays once the freeze-drying process is complete.
4. Store and prepare raw meat away from ready-to-eat food to avoid cross-contamination.

5. Cook meat and eggs to the proper internal temperature before consuming them. For safe cooking temperatures, see https://extension.psu.edu/cooking-temperatures-magnet.

Storage
After taking the time and resources to freeze-dry your food properly, be sure to package it correctly so it lasts long enough for you to consume. Freeze-dried items can be stored safely for many years under the right conditions and with the correct packaging. To increase shelf life, include properly sized single-use oxygen absorbers—small packets that attract and retain the oxygen in a package—in whatever type of packaging you choose.

- Zip-top bags or food storage containers can be used for short-term storage (a few months).
- Glass canning jars can be used to store freeze-dried food. To get the longest shelf life, put an oxygen absorber in the jar or remove the air from the jar using a vacuum sealer.
- Vacuum packaging removes most of the oxygen from the bag. This would be better for more midterm storage (about two to three years) since water and oxygen can still pass through plastic bags.
- Mylar® bags (multilayer, metalized, sealable bags) block out air and light during storage but must be used with an oxygen absorber and heat-sealed with an impulse (heat) sealer. Bags can be resealed once opened and take up less space than glass jars or cans.
- Metal cans provide airtight, dark storage of food, but all the food should be used as soon as possible once the can is opened.

Store freeze-dried and packaged products in a cool, dry place that does not get a lot of exposure to light, such as a basement, dark cupboard, pantry, or closet.

Usage
Freeze-dried food has many uses, including fast meal prep, emergency preparedness, harvest preservation, and outdoor recreation. The food can be eaten “as is” (except for raw meat, poultry, seafood, and eggs), added directly to recipes, or rehydrated and used the same as you would fresh food.

When eating freeze-dried food as is, be sure to drink water since freeze-dried food has a very low water content. Freeze-drying concentrates the flavor of most fruits and vegetables, making them great snack in their freeze-dried state.

Vegetables can be rehydrated and prepared by adding them to a bowl of hot water (or warm water that you microwave or cook on the stovetop). They can also be used directly in cooking, especially when making something like a soup or stew. Do not soak leafy greens because they may get mushy. You can either spray them with some water to rehydrate them or crush them up to be included in sauces, meatballs, or smoothies for added nutrition.

Fruit can be rehydrated by either soaking in a bowl of water or spraying it with water. Fruit is great to use in pies and smoothies, on cereal or oatmeal, or cooked in recipes that call for fresh fruit.

Milk and dairy products can be rehydrated with water or added to smoothies, baked goods, or dips.

Full meals such as casseroles can be rehydrated by mixing in water in 1/3 cup increments to reach the desired consistency and then heated in the oven or microwave.

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Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture. Where trade names appear, no discrimination is intended, and no endorsement by Penn State Extension is implied.

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