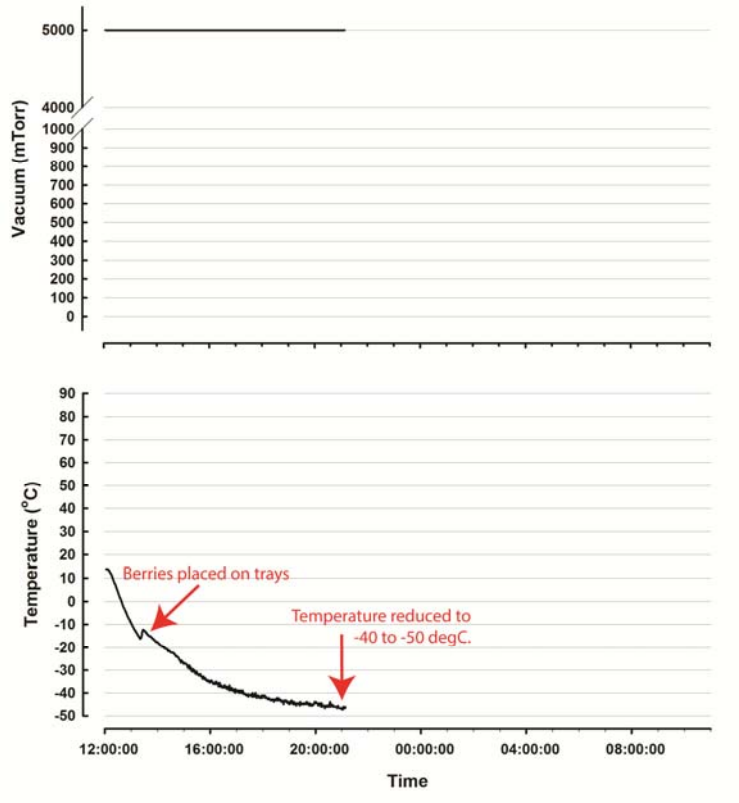
What is freeze-drying?

The *sublime* Tasmanian DEVIL Mountain Pepperberries are produced by… *sublimation*. That fount of all knowledge, Wikipedia, states that "Freeze-drying, also known as lyophilisation or cryodesiccation, is a low temperature dehydration process which involves freezing the product, lowering pressure, then removing the ice by sublimation. This is in contrast to dehydration by most conventional methods that evaporate water using heat" (https://en.wikipedia.org/wiki/Freeze-drying). They also state that "Freeze-drying results in high quality product because of the low temperature used in processing", however, that is only a small part of the story. The freeze-drying process takes place in the absence of oxygen, and because the process sublimes frozen water directly into water vapour (without going the liquid water phase), the berries are not exposed to those two "killers" of aroma and flavour.

What does a freeze-drier look like?

How does the system work?

1. *Freeze the berries to very low temperatures*

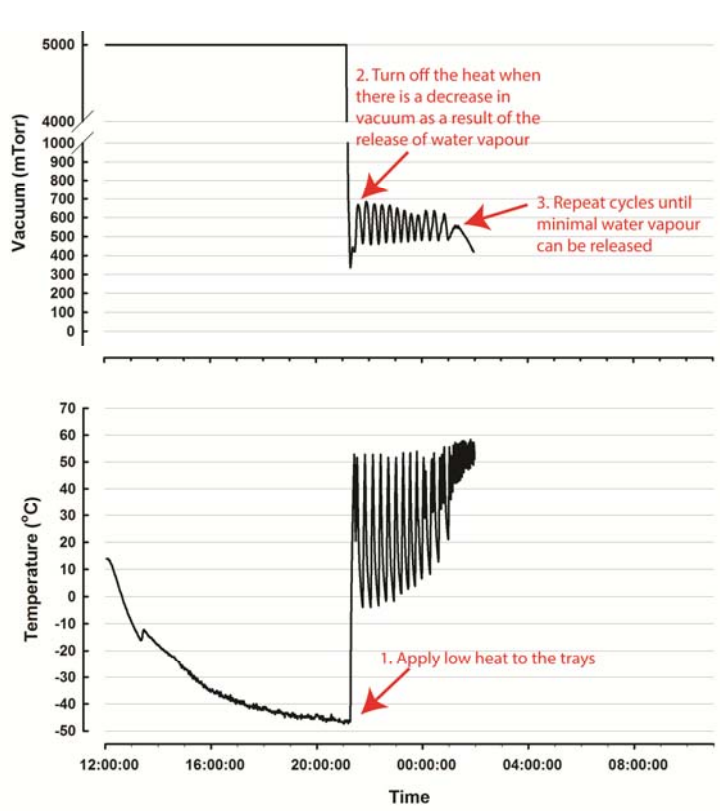


Firstly, the pepperberries are placed onto trays, a single layer thick, and then deep frozen to between -40°C and -50°C.

Fresh pepperberries can be used, but we typically freeze all our peppers to -18°C after harvest and so this speeds up the process.

The cold temperature of the freeze-drier's drum is essential as gases released from the berries (water vapour) will condense on the drum (and obviously freeze – hence the water is taken out of the 'system').

2. *Primary drying*

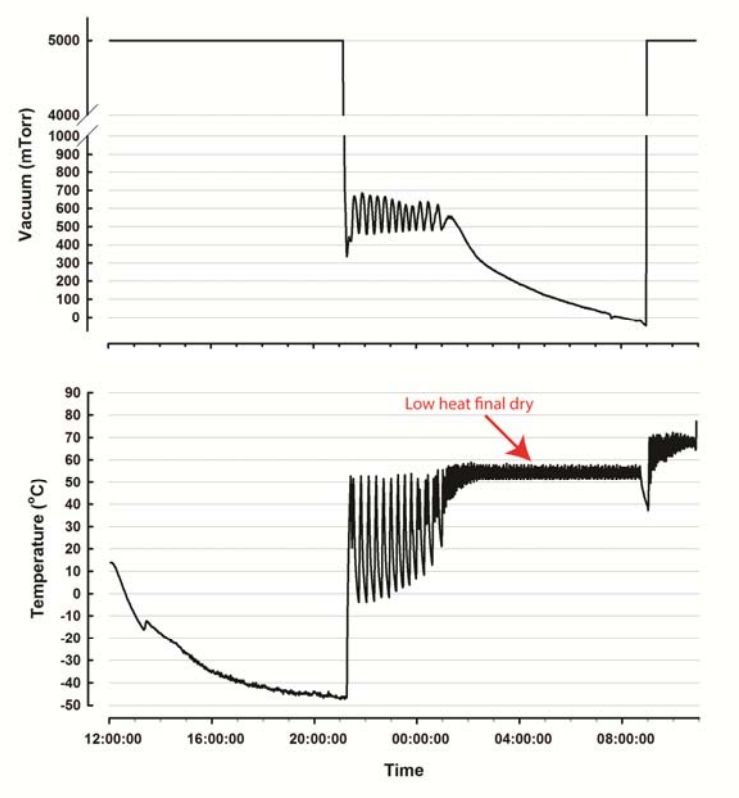


Secondly, once fully deep frozen, the vacuum pump removes the air from the camber. When the pressure in the camber reaches 0.066 kPa (500 mTorr), the trays are then gently heated (typically to around a maximum of 52°C).

The heating (under vacuum) results in the frozen water in the berries *subliming* to water vapour. This can be seen in the vacuum graph opposite as a pressure increase (even though the vacuum pump is still operating).

Once the pressure has increased to 0.08 kPa (600 mTorr), the tray heaters are turned off until the vacuum pressure again drops below 0.066 kPa. The process continues to cycle in this manner until the release of water vapour is so small that the vacuum pressure cannot reach 0.08 kPa.

3. Secondary drying



Thirdly, the final bound water is removed by continuous low heating of the trays.

The vacuum pump continues to operate and the extremely cold condensing drum continues to capture the released water.

At the end of the process, the freeze-dried berries look nearly identical to the fresh berries, and typically have a moisture content of 0.5%. The berries are easily crushed between your fingers to add exquisite flavours, aroma and colour to your foods.

The result?