A Really "Cool" Approach to Drying

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Someone once asked me to name the favourite things I had ever dried. This was a bit of a puzzler, but my eventual answer was strawberries and ginger root. My reasons were quite simple and not very scientific – they were the ones that gave the room the most pleasant smell.

On the flip side of this coin were the ones that were my least favourites. Without a doubt, the two top contenders were onions and garlic. Fortunately, I dried these in the garage, and the experience was certainly memorable. The smell of the garlic was so strong that even the dog wouldn't go into the garage for several days. As for the onions, this is probably the only time that my drying work literally brought tears to my eyes.

Sadly, even though the smells may be pleasant, this means that you are losing many of the delicate aromatic compounds that cannot be replaced in the food that you are drying. Heating just naturally causes them to escape from the food. This doesn't mean that conventional drying is "bad" or harmful to the product – it's just that some products need to be handled in a more gentle manner.

Freeze drying is one approach that avoids excessive heat. It is based on a natural process called "sublimation", where water molecules go from their frozen state as ice directly to water vapour without passing through the liquid state. Sublimation is how the ice on a frozen sidewalk disappears on a sub-zero day in February. It's also how some berries dry as they cling to the vine over the winter.

Food processors have used freeze drying for years in specialized applications. One of my projects in the late 70's was extracting protein from soybean meal and freeze drying it. In this way, the functional characteristics of the proteins were protected so that they could be used in developing specialty food products.

Those who are into wilderness camping and hiking are probably quite familiar with freeze dried foods. Packaged in water-proof protective pouches, they are a light-weight alternative to carrying heavier versions of the same foods without the water removed.

Recently, freeze dried products have become more mainstream. Some leading manufacturers of baby foods have introduced freeze dried snacks made from yoghurt mixed with fruit and vegetable purées. As with many freeze dried foods, these snacks have a light, airy texture that makes them dissolve easily in the baby's mouth.

While the actual freeze drying process requires some rather sophisticated equipment, the overall concept is not terribly complicated. The material to be dried can be spread in a thin layer (or deposited in dollops) on a metal tray. It is then frozen to a

temperature below -50ºC, which is considerably colder than the temperature in a typical household freezer.

As in all drying processes, it's a good idea to focus on what is happening to the water. In this case, the water is definitely in its crystalline or ice form. As ice, there is no liquid water available to support the growth of undesirable microorganisms, nor allow adverse chemical reactions to occur. Both of these require liquid water and heat to take place.

The trays of frozen material are then place on metal racks in a freeze dryer and kept at their very low temperature. Once loaded, the dryer is closed and a vacuum is drawn on the chamber. A small amount of heat is applied through the metal racks so that the material remains frozen, but there is just enough heat to promote sublimation of the water molecules into the vapour state.

After most of the water is removed by sublimation, any remaining water which is held more tightly in the product can be removed by applying more heat – but not enough heat to create any quality issues. Overall, the freeze drying process can take from 24 to 48 hours.

Freezing does more than prevent the loss of aromatic compounds. It also sets up the structure of the product so that when the ice crystals disappear, they leave an open network that speeds the rate of rehydration when water is added back into the product. This explains the melt-in-your-mouth appeal of the baby snacks.

Amazingly, all this originated by applying the simple concept of sublimation to the complex structures of the food we eat.

These baby snacks made from freeze dried yoghurt, fruit, and vegetables have an open, airy texture.