Battling Ice Crystals

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How many times has this happened to you? You go to the freezer to get a package of frozen vegetables and find that the inside of the plastic bag is completely covered in ice crystals. When you open the bag there is also ice stuck in every nook and cranny between the pieces. While this is frustrating enough, if the vegetables were from your own garden, it's even more aggravating. It really makes you wonder about spending all that time and effort into preparing things only to have this happen.

Some people with whom I have spoken blame the problem of ice crystal formation on moisture leaking into the bags during storage in the freezer. However, the same thing can happen even when frozen fruits or vegetables are sealed inside a glass jar which is totally impervious to the penetration of moisture. Surprisingly, freezers are very dry environments providing that they are kept cold enough so that any frost that builds up on their inner surfaces doesn't start to melt.

So how do all these ice crystals get there? The frost on the inside of your freezer itself typically comes from warm moist air that enters each time you open the door. Once the door is closed, this air cools rapidly. The moisture condenses and freezes on the cold walls of the freezer to form an ever-thickening layer of ice. If you have a frost-free freezer, there will be a periodic cycling where the temperature of the freezer walls rises sufficiently to vaporize the ice and remove it in an exchange of cold air.

Ice crystals inside packages of frozen fruits, vegetables, meats, and even ice cream are actually formed from water leaving the food. There may be several causes of this. In one case, if there are sufficient temperature fluctuations, slightly elevated temperatures may encourage moisture within the food to change from ice directly to water vapour through a process known as "sublimation". The water vapour then circulates within the package until it finds a cold enough surface onto which it can freeze directly into ice through the reverse form of sublimation. As more and more moisture is lost from the food, more and more ice crystals form, or existing ones become larger.

Even without temperature fluctuations, ice crystals can still form inside packages due to a natural equilibrium process. Nature loves to keep everything in balance. While it is a very slow process, there is a tendency to create an equilibrium between the moisture in the frozen food and the air surrounding it in the package. Initially, moisture will leave the food to increase the moisture content of the air and establish a balance. The amount of moisture required to do this is very small under such cold conditions. However, once the water vapour comes in contact with the cold surface of the package, it will freeze, thereby lowering the moisture content in the cold air and upsetting the

moisture equilibrium. Sensing the imbalance, more moisture leaves the food in the form of water vapour to re-establish the equilibrium. Once again, the water vapour crystallizes on the cold inner surface of the package, or on the food surface itself. Over a period of months, a great deal of moisture can be lost from the food in your freezer, which ultimately causes “freezer burn”, and the annoying build-up of ice crystals.

The contents of your freezer do not have to have to reach the melting point of water (0°C) for all this to happen. Even well below 0°C, moisture can still escape from the food.

There are a few things you can do to minimize ice crystal growth, but you may not be able to avoid it completely. First, make sure that your freezer is functioning properly. Check to see that the cooling coils are clean and free of dust which can collect there over time. There also needs to be good air circulation around the coils to permit efficient operation of the freezer.

Your freezer needs to be set at a sufficiently low temperature to keep everything frozen -18°C (or a bit lower) is a reasonable set-point temperature. Fluctuations in temperature need to be minimized, so don’t stand with the door open too long. Remember, having the door open lets warm moist air into your freezer, as well as allowing the contents themselves to warm up ever so slightly. If your freezer is full, there will be less warm moist air that can enter when the door is open; so you may notice ice build-up on the inner walls is a bit slower than when the freezer is relatively empty.

An easy, but very important thing you can do is minimize the amount of air inside each package. When using plastic bags, try to squeeze out as much of the trapped air as possible. You may want to use a long drinking straw to suck out the last bit of air just before you finish sealing the plastic bag. The bag will now cling tightly to the contents and reduce the space required in your freezer as well. Using bags specifically designed for freezing purposes will also go a long way to enhancing the quality of your frozen foods.

As a final step, don’t forget to label each bag with the contents and date it was frozen. Include the year in the date since it is quite possible that some of your frozen foods may celebrate many birthdays languishing while forgotten at the bottom or back of your freezer.

Not only has there been substantial formation of ice crystals in this package of frozen rhubarb, but the structure of the rhubarb has been seriously damaged as well.