Solar Drying: Let the Dryer Beware

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Anyone who has ever stepped into a closed car on a hot summer day will definitely know the power of the sun's rays to heat a confined space. The same principles that cause the interior of a car to heat up can provide a "green" opportunity for drying various fruits and vegetables without additional energy inputs.

I have always looked upon solar drying as a highly promising technology for food preservation and feel that it is capable of addressing many of the issues faced in developing countries. It might be thought of as a solution looking for a problem. However, after some first-hand on-site experience, my impression has changed a bit. I still think it has many merits, but there are a few concerns that need to be kept in mind. Let's take a closer look at solar drying and put these in perspective.

At the outset, we should probably differentiate between "solar" and "sun" drying. Although both use the sun as a source of energy, the term "sun drying" often describes the process of spreading things out in the open sun to dry; whereas "solar drying" usually involves a cabinet or drying chamber of some description. Many of you will be familiar with sun-dried tomatoes and raisins which are examples of successful (and safe) commercial applications of sun drying.

On-line "web" sources are full of information on how to build a solar dryer. Designs range from incredibly simple to highly elaborate devices. Whatever the design, each has the same basic elements. First, you need an enclosed cabinet, normally with a glass panel on the front. The sun's rays will travel through the glass and be trapped inside, thereby raising the temperature - just like a car on a hot summer day. By lining the cabinet with metal, a drying oven effect can be obtained. Open mesh or wire racks can be positioned inside the cabinet to support the material being dried. A flow of air is necessary to carry away moisture from the surface of the material and remove it from the cabinet so that more water can be evaporated. An even more favourable drying environment can be created by heating the air before it enters the drying cabinet. A heat collector made from sheet metal and painted black works extremely well for this purpose.

A number of years ago, I began working with solar drying as a means of preserving garden crops at the family farm level in developing countries. In areas of Equatorial Guinea, which lacked electricity and running water, there was no easy way for people to preserve food from their gardens for use in the off-season. They experienced much the same situation as we do when all our tomatoes etc. ripen at the same time and we have an over-abundance. However, once their growing season was over, these impoverished people had to rely on imported produce to meet their needs. Since

Equatorial Guinea lies just a few degrees north of the equator, one would expect that it would be ideally suited for solar drying. Unfortunately, the rainy season begins just when the crops are being harvested, and overcast skies with afternoon rain showers are a serious obstacle to solar drying.

The solar dryer which I built looks like a cousin of R2D2 of “Star Wars” fame as it stands in our yard. Over the years, I’ve introduced a few bells and whistles to boost its performance a little. Many solar dryers rely on the natural flow of warm air up through the drying cabinet to remove the moisture. I use a couple of solar-powered fans to draw the moisture-rich air out of the dryer and subsequently replace it with warm dry air that has travelled through the heat collector. These are the round circles that look like eyes in the photograph. An additional small solar-powered fan inside the cabinet ensures adequate air circulation for drying. There is also an electronic balance assembly to follow the drying progress for research purposes, but most solar dryers ignore this feature. It is also possible to have a number of racks in the dryer instead of the single rack shown here.

Tomatoes seem to be what most people want to dry - yet they are the most challenging. Tomatoes are absolutely remarkable in their ability to hold water. Many varieties (even Roma) contain up to 94% water! If you start with 22 pounds (10 kg) of tomatoes, 20.5 pounds (9.3 kg) of water would have to be removed to obtain a suitably dried product. For your efforts, you would end up with about 1.5 pounds (700 grams) of dried tomato wedges. Drying could take several days under ideal conditions of sun and humidity - and above all, no rain. Getting these ideal conditions is the big challenge in many locations.

Unlike the summer we’ve had so far, our part of Ontario usually has an abundance of sunlight which can be harnessed for “solar drying”. This may be tempting to those who want to try their hand at solar drying in their own backyard.

This brings me to my words of caution for anyone about to start their own solar drying.

- Be extremely careful to dry the material fully. If the dried product is not leathery in texture, it probably still contains sufficient moisture to promote the growth of spoilage microorganisms.

- It may take a few days to dry something like tomatoes. Do not leave things in the dryer during non-drying hours. Remove them and place them in your refrigerator overnight to prevent spoilage. The long drying time is a major concern to me.

- Be sure to protect the material being dried from insects. Flies love to linger on the surfaces of food as it is drying. Mesh screening across the air inlets and outlets of the dryer could help here.

- Read as much as you can on solar drying before attempting it at home.

Like you, I am very concerned about food safety and want to avoid any unnecessary risks. Based on the reliability of electric home dehydrators which were discussed last month, I'm tending to favour them for use in our part of the world. Meanwhile, each summer I continue looking for ways to enhance the performance of small-scale solar drying units. Whatever your personal preference, enjoy your drying experiences and be safe.

For further information on this topic, you may wish to check out:

"Solar Drying in Developing Countries: Possibilities and Pitfalls" by Donald G. Mercer. Chapter 4 in "Using Food Science and Technology to Improve Nutrition and Promote National Development: Selected Case Studies". G.L. Robertson and J.R. Lupien, editors. Published on-line by the International Union of Food Science and Technology (2008). This can be accessed at: www.iufost.org/publications/books/IUFoSTFoodScienceandTechnologyHandbook.cfm

A small prototype solar dryer being used for research purposes.
The large flat black surface is the heat collector.