

June 2012

MAKE A SOLAR FUNNEL COOKER



BACKGROUND

The Solar Funnel Cooker is safe, low cost, easy to make, yet effective in capturing the sun's energy for cooking and pasteurizing water.

How it Works

The reflector is shaped like a giant funnel, and lined with aluminium foil. This funnel is rather like a parabolic cooker, except that the sunlight is concentrated along a line (not a point) at the bottom of the funnel. You can put your hand up the bottom of the funnel and feel the sun's heat, but it will not burn you.

You then need to paint a jar black on the outside, to collect heat, and place this at the bottom of the funnel. Or one can use a black pot, with a lid. The black vessel gets hot quickly. But not quite hot enough to cook with. One needs some way to build up the heat without letting the air cool it. So, by putting a cheap plastic bag around the jar, you have a solar funnel cooker! The plastic bag, available in grocery stores, replaces the cumbersome and expensive box and glass lid of the solar box ovens. Dark-coloured bags will not do.

Why We Need Solar Cookers

The Funnel Cooker can:

- cook food without the need for electricity or wood or other fuels.
- pasteurize water for safe drinking, preventing many diseases.
- save trees and other resources.
- avoid air pollution and breathing smoke while cooking.
- use the sun's free energy - a renewable energy source.
- cook food with little or no stirring, without burning.
- kill insects in grains.
- dehydrate fruits, etc.

This 'How To' has been adapted from 'The Solar Funnel Cooker: How to make and use the BYU solar cooker/cooler' by Prof. Steven E Jones, at Brigham Young University with Colter Paulson, Jason Chesley, Jacob Fugal, Derek Hullinger, Jamie Winterton, Jeannette Lawler and Seth, David, Nathan and Danelle Jones. Source: <http://solarcooking.org/plans/funnel.htm>, accessed on 18 June 2012.

What you will need to build a Solar Funnel Cooker:

1. A piece of flat cardboard, about 60cm wide by 120cm long. (The length should be just twice the width. The bigger, the better.)
2. Ordinary aluminium foil.
3. A glue such as white glue, and water to mix with it 50-50. Also, a brush to apply the glue to the cardboard (a cloth or paper towel will do). Or, some may wish to use a cheap "spray adhesive" available in spray cans. You can also use wheat paste.
4. Three wire brass fasteners (or brads) - or small nuts and bolts, or string to hold the funnel together.
5. For a cooking vessel, a canning jar is recommended. (A 1½ to 2 litre canning jar works fine for larger quantities of food, although the cooking is somewhat slower.)
6. The cooking jar (or vessel) should be spray-painted black on the outside. A cheap flat-black spray paint works well. Scrape off a vertical stripe so that you have a clear glass "window" to look into the vessel, to check the food or water for boiling.
7. A block of wood is used as an insulator under the jar. Use a piece of 5cm x 10cm board which is cut into a square nominally 10cm x 10cm by about 5cm thick (in other words, 10cm square x 5cm thick). One square piece of wood makes a good insulator.
8. A plastic bag is used to go around the cooking-jar and block of wood, to provide a greenhouse effect.

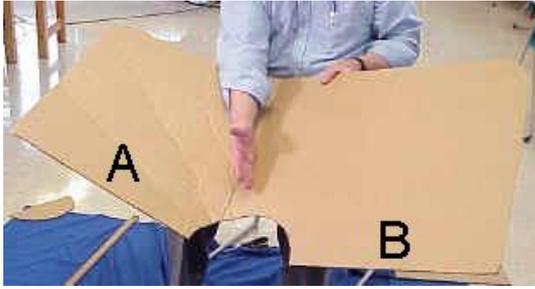
Construction Steps

1. Cut a half-circle out of the cardboard

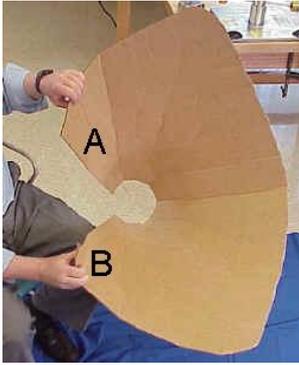


Cut a half circle out of the cardboard, along the bottom. When the funnel is formed, this becomes a full-circle and should be wide enough to go around your cooking pot. So for a 18cm diameter cooking pot, the radius of the half-circle is 18cm. For a litre canning jar, cut a 13cm radius half-circle out of the cardboard.

2. Form the funnel



To form the funnel, you will bring side A towards side B, as shown in the figure. The aluminium foil must go on the INSIDE of the funnel. Do this slowly, helping the cardboard to the shape of a funnel by using one hand to form creases that radiate out from the half-circle.



Work your way around the funnel, bending it in stages to form the funnel shape, until the two sides overlap and the half-circle forms a complete circle. The aluminium foil will go on the INSIDE of the funnel.

Open the funnel and lay it flat, "inside up", in preparation for the next step.

3. Glue foil to cardboard



Apply glue or adhesive to the top (inner) surface of the cardboard, then quickly apply the aluminium foil on top of the glue, to affix the foil to the cardboard. Make sure the shiniest side of the foil is on top, since this becomes your reflective surface in the funnel. Put just enough glue for one width of foil, so that the glue stays

moist while the foil is applied. Also overlap strips of foil by about 2cm. Try to smooth out the aluminium foil as much as you reasonably can, but small wrinkles won't make much difference. (If even cardboard is not available, one can simply dig a funnel-shaped hole in the ground and line it with a reflector, to make a fixed solar cooker for use at mid-day.)

4. Join side A to side B to keep the funnel together.

The easiest way to do this is to punch three holes in the cardboard that line up on side A and side B (see figure). Then put a metal brad through each hole and fasten by pulling apart the metal pins. Or you can use a nut-and-bolt to secure the two sides (A and B) together.



Be creative here with what you have available. For example, by putting two holes about a thumb-width apart, you can put a string, twine, small rope, wire or twist-tie in one hole and out the other, and tie together.

When A and B are connected together, you will have a "funnel with two wings". The wings could be cut off, but these help to gather more sunlight, so you can leave them on.

5. Tape or glue a piece of aluminium foil across the hole at the bottom of the funnel, with shiny side in.

This completes the assembly of your solar funnel cooker.



For stability, place the funnel inside a cardboard or other box to provide support. For long-term applications, one may wish to dig a hole in the ground to hold the funnel against strong winds.

Final Steps

At this stage, you are ready to put food items or water into the cooking vessel or jar, and put the lid on securely. (See instructions on food cooking times, to follow.)

Place a wooden block in the INSIDE bottom of the cooking bag. Use a piece of board which is cut into a square nominally 10cm x 10cm by 5cm thick. Then place the cooking vessel containing the food or water on top of the wooden block, inside the bag.

Next, gather the top of the bag in your fingers and *blow air into the bag, to inflate it*. This will form a small "greenhouse" around the cooking vessel, to trap much of the heat inside.

Close off the bag with a tight twist tie or wire. Important - the bag should not touch the sides or lid of the cooking



vessel. The bag may be called a "convection shield," slowing convection-cooling due to air currents.

Place the entire bag and its contents inside the funnel near the bottom as shown in the photographs.

Place the Solar Funnel Cooker so that it faces the sun

Remember: Sunlight can hurt the eyes: Please wear sunglasses when using a Solar Funnel Cooker! The Solar Funnel Cooker is designed so that the hot region is deep down inside the funnel, out of harm's way.



Put the Solar Funnel Cooker in the sun pointing towards the sun, so that it captures as much sunlight as possible. The design of the funnel allows it to collect solar energy for about an hour without needing to be re-positioned. For longer cooking times, readjust the position of the funnel to follow the sun's path.

It helps to put the Solar Funnel Cooker in front of a north-facing wall or window to reflect additional sunlight into the funnel. A reflective wall is most important in locations farther from the equator and in winter.

After Cooking

Remember that the cooking vessel will be very hot: Use cooking gloves when handling! If you are heating water in a canning jar, you may notice that the water is boiling when the lid is first removed - it gets very hot!

Open the plastic cooking bag by removing the twist-tie. Using gloves or a thick cloth, lift the vessel out of the bag and place it on the ground or table. Carefully open the vessel and check the food, to make sure it has finished cooking. Let the hot food cool before eating.

Helpful Hints

1. Avoid leaving fingerprints and smudges on the inside surface of the cooker. Keep the inner surface clean and shiny by wiping occasionally with a wet towel. This will keep the Solar Funnel Cooker working at its best.
2. If your funnel gets out-of-round, it can be put back into a circular shape by attaching a rope or string between opposite sides which need to be brought closer together.
3. For long-term applications, a hole in the ground will hold the Solar Funnel Cooker securely against winds. Bring the funnel inside or cover it during rain storms.
4. The lids can be used over and over. Running new lids through very hot water before the first use seems to help. The lids can be used over and over if they are not bent too badly when opened (pry off lid carefully).
5. The jar can be suspended near the bottom of the funnel using fishing line or string (etc.), instead of placing the jar on a block of wood. A plastic bag is placed around the jar with air puffed inside, as usual, to trap the heat. The suspension method allows sunlight to strike all surfaces of the jar, all around, so that it heats faster and more evenly. This suspension method is crucial for use in winter months.
6. Adjust the funnel to put as much sunlight onto the cooking jar as possible. Look at the jar to see where the sunlight is hitting, and to be sure the bottom is not in the shadows. For long cooking times (over about an hour), re-adjust the position of the funnel to follow the sun's path. During winter months, when the sun is low on the horizon, it is helpful to lay the funnel on its side, facing the sun.

Safety

- Any time you have heat you need to take some precautions.
- The cooking vessel (jar) is going to get hot, otherwise the food inside won't cook. Let the jar cool a bit before opening. Handle only with gloves or tongs.
- Always wear dark glasses to protect from the sun's rays.
- Keep the plastic bag away from children and away from nose and mouth to avoid any possibility of suffocation.

Cooking with the Solar Funnel Cooker

Whatever you cook in a moderate-temperature oven, the same foods will cook in the Solar Funnel Cooker - without burning!

The charts below give approximate summer cooking times.

- The solar cooker works best when the UV index is 7 or higher. (Sun high overhead, few clouds.)
- Cooking times are approximate. Increase cooking times for partly-cloudy days, sun not overhead (e.g., wintertime) or for more than about 3 cups of food in the cooking jar.
- Stirring is not necessary for most foods. Food generally will not burn in the solar cooker.

Vegetables (potatoes, carrots, squash, asparagus etc)

Preparation: No need to add water if fresh. Cut into slices to ensure uniform cooking. Cooking time: About 1½ hours.

Pasta and dehydrated soups

Preparation: First heat water to near boiling (50 to 70 minutes). Then add the pasta or soup mix. Stir or shake, and cook 15 additional minutes. Cooking time: 65 to 85 minutes.

Beans

Preparation: Let tough or dry beans soak overnight. Place in cooking jar with water. Cooking time: 2 to 3 hours.

Meats (chicken, beef and fish).

Preparation: No need to add water. Longer cooking makes the meat more tender. Cooking time: Chicken: 1½ hours cut up or 2½ hours whole; Beef: 1½ hours cut up or 2½ to 3 hours for larger cuts; Fish: 1 to 1½ hours.

Baking Preparation: Times vary on amount of dough.

Cooking times: Breads: 1 to 1½ hours; biscuits: 1 to 1½ hours.



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