The PanCooker™

A Solar Thermal, Water Pasteurization and Food Cooking Tool.

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During one of my (unsuccessful) attempts to desalinate seawater using solar energy, I managed to invent a highly effective and simple solar thermal cooker that can be used for both hazardous water pasteurization and food cooking. I call it the PanCooker and it consists of a 12 x 24 inch flexible back reflector, 18 x 24 inch shiny surface mat, and 12-quart clear plastic ice bucket as shown in Figures 1 and 2. Up to a 4-quart black enamel cooking pot can be used to treat water or cook a meal. A 2-quart black tea pot may also be used for water treatment.

Figure 1. PanCooker - a solar thermal cooking and water pasteurization tool.

Figure 2. PanCooker components - from left to right: 12-quart clear plastic ice bucket, 12 x 24 inch flexible back reflector, 18 x 24 inch shiny surface mat, 4-quart black enamel cooking pot, and 2-quart black teapot. Optional 2-liter filled water bottle to brace the back reflector (from wind).

To use the PanCooker, first lay the surface mat on the ground, lengthwise, facing the sun. Next, use your hands to shape the back reflector into an open letter 'C' and center it on the back edge of the mat facing the sun. Then, place your pot on the center of the mat, and cover the pot with the ice bucket. Adjust the covered pot so the base of the ice bucket touches the back reflector as shown in Figure 1. Monitor the position of the sun in the sky and move the PanCooker as needed to always face the sun. The PanCooker is capable of intense light amplification. A set of sunglasses is highly recommended when using or being near the PanCooker. The size of the PanCooker is only limited by the size of the ice bucket. As a result, the size of the water/cooking pot is limited to nothing larger that 7.5 x 7.5 inches (4-quarts). When I find a larger inexpensive alternative, I'll let you know.

Since 1890, pasteurization has been used to kill harmful waterborne bacteria and virus. To be pasteurized, water must be heated to at least 150° F (65° C) for one hour (1). The PanCooker is fully capable of reaching 150° F in two hours but you need up to one more hour to safely complete the pasteurization process. Always use a thermometer (liquid or meat) to measure water temperature and avoid heating beyond 160° F (71° C). Once water temperature reaches 160° F, you only need 15 seconds to kill all harmful waterborne germs.

Given sunny skies and air temperatures of at least 75° F (24° C), I found I could pasteurize a 2-quart teapot in two hours and a 4-quart cooking pot in three hours. On very hot days (90°+ F, 32+° C) the heating time is reduced by up to one hour. Under ideal conditions, the PanCooker has the capacity to pasteurize up to 12-quarts of hazardous water per day. Hence, one PanCooker can meet the water treatment needs of the average household almost anywhere in the world. Please note, the PanCooker does NOT treat chemically

contaminated water, seawater or brackish water. Also, the PanCookerl is NOT a filter or purification system. The water used should be reasonably clear and free of obvious particles or have already passed some other pre-filter system (2).

The PanCooker works because the back reflector is curved to reflect and focus sunlight onto the center of the surface mat where we place our water pot. The shiny surface mat further reflects light onto the pot and onto the back reflector. The black color of the pot acts like a light magnet absorbing all available light striking its' surface. The pots' metal molecules are excited by the photons that make up the light resulting in heat that is transferred to the water (or food) in the pot. Finally, the clear plastic ice bucket helps to retain heat by promoting a greenhouse effect and preventing heat loss due to wind and air temperature.

Steps for Making a PanCooker™

Materials (brands in parenthesis)

With the exception of the 12-quart ice bucket which I found at Party City, all tools and materials may be purchased in the USA at most large hardware stores and supermarkets. I found everything at Loews hardware and Walmart. Everything you need is shown in Figure 3. The ice bucket is the most expensive component of the PanCooker and costs $12. However, the total material cost is under $17 per unit.

12-quart jumbo ice bucket (Party City)

12 inch roll of self-adhesive HVAC duct insulation (Frost King at Loews)

12 inch roll of heavy duty aluminum foil (Reynolds at Walmart)

18 inch roll of heavy duty aluminum foil (Reynolds at Walmart)

18 inch roll of self-adhesive clear plastic contact paper (Con-tact at Walmart)

Aluminum foil tape (Shurtape at Loews)

Clear packing tape (3M at Loews)

Tools

Scissors (for cutting)

Yard stick (for measuring)

Liquid or meat thermometer (for measuring water temperature)

Figure 3. Tools and materials used to make a PanCooker. From left to right: yard stick, scissors, meat thermometer, 12-quart jumbo ice bucket, self-adhesive HVAC duct insulation, 12 inch and 18 inch rolls of heavy duty aluminum foil, 18 inch roll of self-adhesive clear plastic contact paper, aluminum foil tape and clear packing tape.

Step 1: Make the Surface Mat

The shiny surface mat is a sheet of 'aluminum canvas'. Aluminum canvas is a name I coined to describe the product of applying a sheet of self-adhesive contact paper or overlapping strips of 2-inch duct tape to the 'dull' side of a sheet of aluminum foil. After some experience, I found it easier to apply duct tape instead of contact paper. I like to use aluminum canvas whenever I need a surface that's shiny plus water and tear resistant. You make the aluminum canvas surface mat by first cutting an 18 x 24 inch strip of aluminum foil. Next, if you are using contact paper, press an equal sized sheet of clear self-adhesive contact paper onto the 'dull' side of the aluminum foil. Press the two layers together and smooth out with your hands. Remove any air bubbles by pricking them with your scissor (or other sharp point) and flattening with your fingers. Use clear packing tape to cover any rough edges and bare spots. Cut away any excess material with your scissors.

The result is a tough, tear resistant sheet of aluminum foil that is protected from wear and water. You will be placing the contact paper (or taped) side of the surface mat face down on the ground and the shiny side up. Depending on your situation, you may want to add another sheet of clear contact paper onto the shiny side of the foil for extra wear and water protection. However, this may compromise the shine (slightly), so see how things work with only a single layer of contact paper.

Step 2: Make the Back Reflector

Second, make the back reflector by cutting a 12 x 24 inch strip of self-adhesive HVAC duct insulation and laying it adhesive side up. Next, press the 'dull' side of the 12-inch roll of heavy duty aluminum foil onto the adhesive side of the insulation to form the reflector. Use aluminum foil tape to cover any rough edges and bare spots. The result is a tough, lightweight and flexible parabolic solar reflector. Depending on your situation, you may want to use aluminum canvas instead of unprotected foil. This time, make the aluminum canvas by pressing the contact paper onto the 'shiny' side of the aluminum foil.

In Conclusion

There are many of excellent solar cookers you can make or buy on the market today. For example, if I did not invent the PanCooker I would recommend the CooKit for water pasteurization. However, for simplicity of design and low cost, the do-it-yourself PanCooker is hard to beat. It's a powerful tool that can cook anything you can fit into a 4-quart pot. Any able bodied adult can make a PanCooker in less than 15 minutes. Moreover, as shown in Figure 4, the compact design allows everything to fit inside the ice bucket including the cooking pot. Where I live, summer time is hurricane season. Having lived through hurricane Katrina in 2005, I know my family will be better prepared to survive with our PanCooker. Amen.

Figure 4. PanCooker storage - everything fits inside the ice bucket including thewater/cooking pot.

References

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