The Sun Bowl

A Solar Thermal, Water Pasteurization Tool.

constantine@h2ohow.com

A Word of Caution

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During one of my (unsuccessful) attempts to desalinate seawater using solar energy, I managed to invent an effective and simple tool to pasteurize contaminated water. I call it the Sun Bowl and it consists of a 20 quart stainless steel mixing bowl and a 320 oz (10 quart) clear plastic punch bowl. Under ideal conditions, the Sun Bowl has the capacity to pasteurize up to 12-quarts of contaminated water per day. Hence, one Sun Bowl can meet the water treatment needs of the average household almost anywhere in the world. The basic Sun Bowl and its' components are shown in Figures 1 and 2. The Sun Bowl is a solar thermal, water pasteurization tool. To use the tool, you place the steel bowl in the sunlight, place your water pot in the center of the bowl and cover the pot with the clear plastic punch bowl.

Figure 1. Sun Bowl - a solar thermal, water pasteurization tool.

Figure 2. Sun Bowl components - large 'shiny' stainless steel mixing bowl, large clear plastic punch bowl, and black metal water container (c.f., tea pot, stock pot).

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). Always use a liquid thermometer to measure water temperature and avoid heating beyond 160° F (71° C). Once temperature reaches 160° F, you only need 15 seconds to kill all harmful waterborne germs. This does NOT include chemically contaminated water, seawater or brackish water. Also, the Sun Bowl 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 Sun Bowl works because the large mixing bowl acts like a deep parabolic reflector that collects and focuses sunlight in the center of the bowl where you place your water pot. 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 bowl helps to retain heat by promoting a greenhouse effect and preventing heat loss due to wind and air temperature. Because of the round shape of the bowl, no additional turning is required to catch the available sunlight as the sun moves across the sky during the day. Some sunlight is always being focused on the water pot no matter what the angle or position of the sun in the sky.

I have tested the Sun Bowl with a black 2-quart teapot; 4-quart and 6-quart black enamel stock pots. Given sunny skies and air temperatures of at least 75° F (24° C), I found I could reach pasteurization temperatures using a 2-quart teapot in three hours, a 4-quart stock pot in four hours, and a 6-quart stock pot in six hours. Whatever water container you use, it needs to be black or very dark metal and have a dimension no greater than 10 inches wide x 6 inches tall. I also found that I could heat the water faster in a pot by replacing the metal lid with a clear glass plate as shown in Figure 3. Allow about 1/4 inch air space between the top on the water and the bottom of the plate. Using a glass lid allows more available sunlight to strike the black metal surface area of the pot - both inside and outside - which excites more metal molecules to produce heat. You can reduce heating time by at least 1/2 hour with a glass lid.

Figure 3. Replace metal lids with clear glass plates to speed up heating.

In addition to heating water, the Sun Bowl can be used for heating and cooking food. This is a tool that can perform double duty. I have also used the large steel bowl to light tissue paper on fire! The main drawback is that a Sun Bowl will cost your about you about $30 which does not include the cost of your pot(s). However, the Sun Bowl is a robust tool and with proper maintenance, it should last for many years. For proper maintenance keep the bowls clean and dry. Keep the punch bowl covered and out of the sun when not in use. Periodically, use a polishing cloth with metal polish to maintain the shine of the mixing bowl and prevent discoloration.

Finally, I have amplified the basic Sun Bowl with an additional back reflector as showed in Figure 4. This option further reduces heating time by up to one hour. The back reflector is made from self-adhesive HVAC duct insulation and 12 inch heavy-duty aluminum foil. Details for making a flexible back reflector are described for my PanCooker. Light amplification may be used to reduce time during emergencies or when the sun and air temperature don't want to cooperate. However, under ideal conditions, where the sky is mostly sunny and the air temperature is at least 75° F (24° C), a back reflector may not be needed.

Figure 4. Sun Bowl with an additional back reflector made from 12 inch self-adhesive HVAC duct insulation and 12 inch heavy duty aluminum foil (optional).

In Conclusion

The Sun Bowl is the 'lazy man's' solar cooker that can pasteurize 6 quarts of water in about six hours. With the exception of the optional back reflector, everything is off-the-shelf and can be assembled in a matter of seconds. As seen in Figure 5, storage is a snap with everything fitting easily into the large stainless steel bowl. Folks, it just doesn't get any easier than this.

Figure 5. Sun Bowl storage - everything fits easily into the large bowl.

References

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