

Water Pasteurization

The basic idea behind pasteurization is that heat kills all the bacteria, viruses, parasites, and other “bugs” that cause disease when taken in through the mouth. The temperatures and times required to do this have been well studied over the years, and vary slightly between milk, water, and other things that are pasteurized (or cooked). The temperatures are well below the boiling point, water does NOT need to be boiled as many people believe.

The required temperatures are around 65°C for a few minutes or 60°C for 30 minutes even for the most heat-resistant pathogen (Hepatitis A). This means simple solar devices like the Solar Household Energy Bank are capable of providing clean drinking water. Other devices can also be used (add links to other sites regarding pasteurization).

A method of pasteurizing water using the Solar Household Energy Bank is shown below. Water vessels of various sizes up to 2 liters are painted black and put inside the Solar Household Energy Bank, angled as much as possible without spilling so that there is less tendency to be hotter on the top and cooler (and insufficiently pasteurized) on the bottom.



This photo shows two water bottles being pasteurized at the same time that wood is being dried and wash water if being heated. The bottles are a brown beer bottle and a plastic 2-liter bottle, painted

black. The bottles are tilted to minimize the temperature differences between top and bottom. In the final application you would want a lot more water bottles, of course.

Glass or plastic vessels can be used, noting that plastic will shrink over time. Colored beer bottles are ideal, and vessels painted black are ideal, but leaving their natural color is usually OK. Typically, all sizes of vessels achieve about the same peak temperature, but the smaller vessels heat up faster.

If one wants to be extra safe, a WAPI, Water Pasteurization Indicator, can be used. This is shown in the photo below. WAPIs come in a variety of forms, but usually involve a sealed tube with a wax inside that melts at just above 65°. The wax starts out at the top of the tube and if it is found later at the bottom of the tube, then the pasteurization temperature was reached. The tube is reusable, and depending on the type of WAPI there are different means for making sure that the sensing element, the wax, is near the bottom of the vessel where the water is coolest.

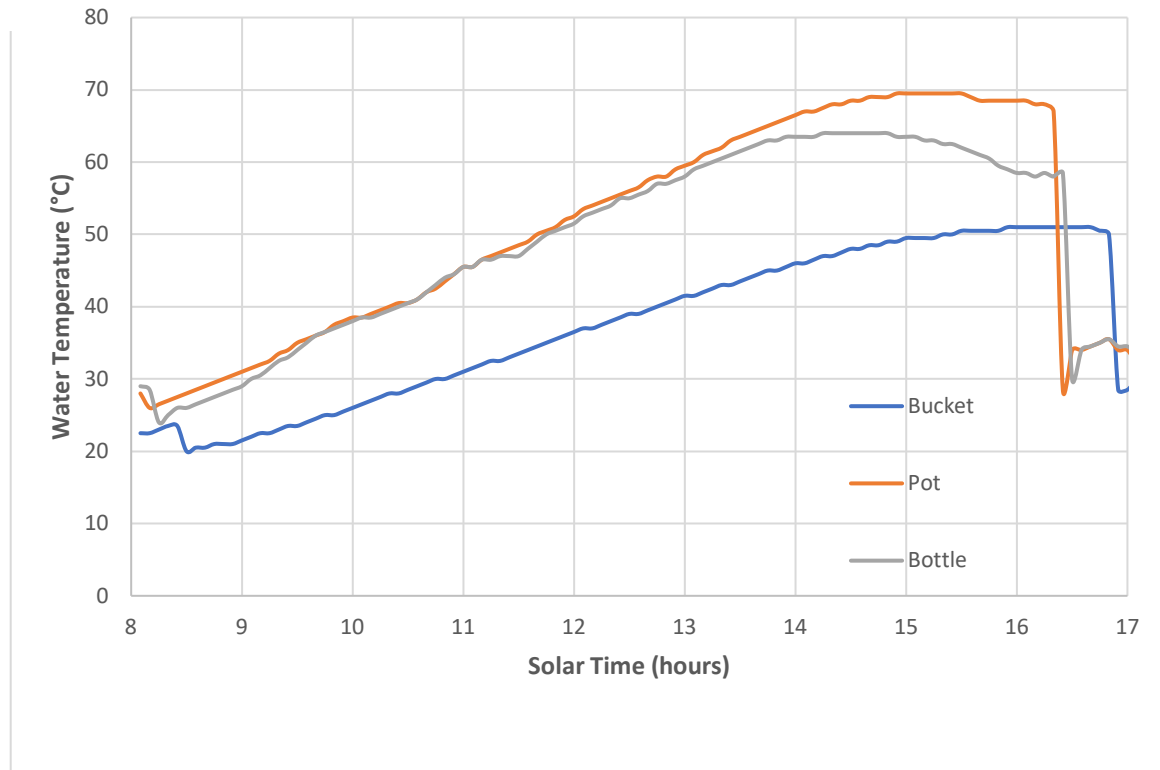


This shows a glass tube WAPI being removed from a water bottle at the end of the day. Since the green wax is still in the high end of the tube, pasteurization cannot be confirmed on this day.

In this photo the sealed tube is made of glass, and the WAPI is on a bendable wire. The wire is stuck in the largest bottle such that the glass tube is near the bottom, and bent such that the wax starts out in the high end of the WAPI. If the wax ends the day in the high end of the tube, as in the photo above, then

pasteurization may have occurred, but cannot be confirmed. For more information on WAPIs, go to https://solarcooking.fandom.com/wiki/Water_Pasteurization_Indicator.

The chart below shows temperatures attained with several types of water containers, including a 2-liter bottle. The sensing element was in the low end of the bottle, where the temperature will be coolest. On this day the temperature was over 60°C for over 30 minutes so the water was pasteurized, even though the wax melting temperature (typically about 67°) was not achieved, and the WAPI would give a false negative.



Temperatures achieved with several types of water containers in the Solar Household Energy Bank. The bottle is a 2-liter bottle, painted black, with the sensing element near the bottom of the bottle where the water is coolest.

Currently, around 1.0 to 1.1 billion people boil their drinking water for safety. If this is done over wood burning stoves of typical efficiencies, water boiling adds another 0.5% or so to the roughly 30 billion tons of CO₂ released by burning fossil fuels. Solar energy could cut this to zero. Using a WAPI and a wood stove could cut the energy and wood use by about 50%, heating the water to only 65° instead of 100°.