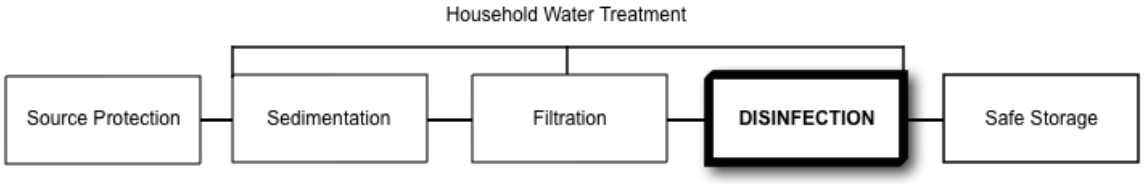
Centre for Affordable Water and Sanitation Technology

Household Water Treatment and Safe Storage Factsheet: Solar Pasteurization

The Treatment Process



Potential Treatment Capacity

Very Effective For:	Somewhat Effective For:	Not Effective For:
• Bacteria • Viruses • Protozoa • Helminths		• Turbidity • Chemicals • Taste/odour/colour

What is Solar Pasteurization?

Pasteurization is the process of disinfecting water by heat or radiation, short of boiling. Typical water pasteurization achieves the same effect as boiling, but at a lower temperature (usually 65-75°C), over a longer period of time.

A simple method of pasteurizing water is to put blackened containers of water in a solar cooker. The cooker may be an insulated box made of wood, cardboard, plastic, or woven straw, with reflective panels to concentrate sunlight onto the water container. It may also be an arrangement of reflective panels, or a reflective “satellite dish”, on which the water pot sits.

A thermometer or indicator is needed to tell when sufficient temperature is reached for pasteurization. Common devices for monitoring the water temperature use either beeswax, which melts at 62°C, or soya bean fat, which melts at 69°C. A simple device known as the Water Pasteurization Indicator (WAPI) has been developed at the University of California.

How Does It Remove Contamination?

As the water heats due to radiation from the sun, the increased temperature will kill or inactivate pathogens at 65°C.

Operation

Water is put into a black container, which is placed in a solar cooker that reflects sunlight onto the container. The box cooker should be frequently repositioned to ensure it is catching all available sunlight (and never in shade) until the indicator device shows the water has reached the required temperature. Water may take 1 to 4 hours or more to heat to temperature.

Box Cooker and Water Pasteurization Indicator (WAPI) (Credit: Solar Cooker International)

Household Water Treatment and Safe Storage
Fact Sheet: Solar Pasteurization Key Data

Inlet Water Criteria

- No specific limits

Treatment Efficiency

	Bacteria	Viruses	Protozoa	Helminths	Turbidity	Chemicals
Laboratory	> 100% [1,2]	> 100%[3]	> 100%[4]	> 100%[4]	0%	0%
Field	Not available	Not available	Not available	Not available	0%	0%

[1] 100% *E. coli* in 1.5 hours at 60°C (Ciochetti & Metcalf 1984, Safapour & Metcalf 1998)
[2] 100% *E. coli, Salmonella, S. dysenteriae,* and *V. cholerae* at 70°C (Iijima et al., 2001)
[3] 100% in 1.5 hours at 70°C (Safapour & Metcalf 1998)
[4] Not tested, but other research suggests that many helminths and protozoa will be killed at a temperature of 70°C if maintained for 45 seconds

Operating Criteria

Flow Rate	Batch Volume	Daily Water Supply
Not applicable	Depends on container size	Depends on container size

Robustness

- Does not work during continuous rainfall or in very cloudy days
- Users require a thermometer or pasteurization indicator device
- Users need to keep track of containers to know which ones have been treated and ensure that they always have treated water
- Users may need to wait for water to cool prior to use
- Cookers are made from lightweight and easily breakable materials
- Recontamination is possible after the water has cooled; safe storage is essential
- The system requires no additional inputs after installation

Estimated Lifespan

- 5+ years

Manufacturing Requirements

Worldwide Producers:
- There are many worldwide producers
- Simple designs are available at no cost on the internet

Local Production:
- This device may be built with parts available throughout most countries.

Materials:
- Cardboard
- Straw
- Aluminium foil
- Glass or plastic sheet
- Silver/metallic reflective spray paint
- Dark paint or mud
- Glass or plastic water containers to be painted; or dark/black metal pots
- Water Pasteurization Indicators (WAPI) or thermometers

Household Water Treatment and Safe Storage
Fact Sheet: Solar Pasteurization Key Data

Fabrication Facilities:
- Workshop space to manufacture solar cookers

Labour:
- Anyone can be trained to construct a solar cooker

Hazards:
- No specific manufacturing hazards

Maintenance

- Cleaned on a regular basis

Direct Cost

Capital Cost	Operating Cost	Replacement Cost
US$20-25	US$0/year	US$0

Note: Program, transportation and education costs are not included. Costs will vary depending on location

Other

- Solar pasteurization boxes can also be used as solar cookers for cooking meals
- Boiling is sometime preferred because it provides a visual measure of when the water has reached sufficient temperature without requiring a thermometer

References

Andreatta, D. (1994). A Summary of Water Pasteurization Techniques. S.E.A. Inc http://solarcooking.org/pasteurization/solarwat.htm

Ciochetti, D. A., and R. H. Metcalf (1984). Pasteurization of Naturally Contaminated Water with Solar Energy. California State University, USA.

Iijima Y., Karama M., Oundo, J. O., and T. Honda (2001). Prevention of Bacterial Diarrhea by Pasteurization of Drinking Water in Kenya. Microbiological Immunology, 45(6), 413-416.

Safapour, N. and R. H. Metcalf (1999). Enhancement of Solar Water Pasteurization with Reflectors. Applied and Environmental Microbiology, Feb. 1999, p. 859–861.

Further Information

Solar Cookers International: http://solarcookers.org

Safe Water Systems: www.safewatersystems.com

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