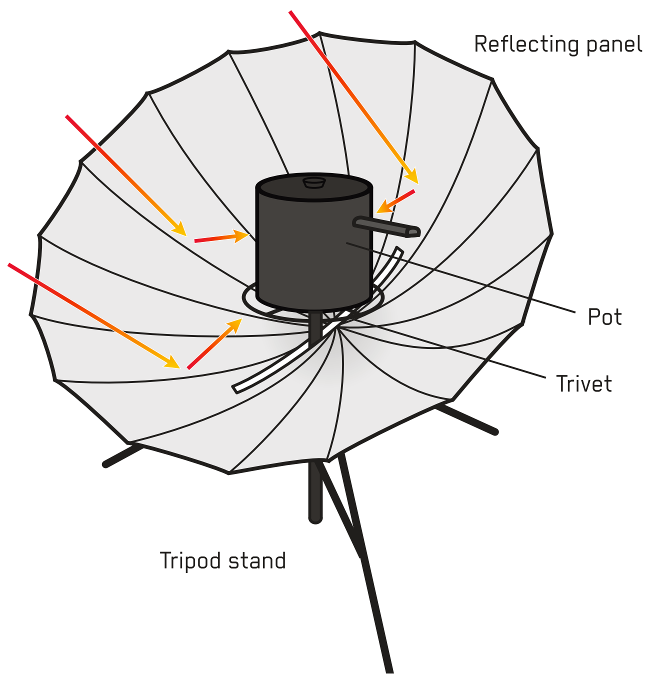
Pasteurisation

Response Phase	Application Level	Management Level	Objectives / Key Features
Acute Response ** Stabilisation ** Recovery	** Household * Neighbourhood City	** Household Shared Public	Point-of-use treatment, water disinfection
Local Availability ** Medium	**Technical Complexity** ** Medium	**Maturity Level** ** Medium	



Water Pasteurisation uses heat to inactivate pathogenic microorganisms. Most protozoa, bacteria and viruses are inactivated at temperatures between 60–70° C and an exposure time of at least 1 min, though some bacterial spores and protozoan cysts require longer exposure. In practice, water pasteurisation means maintaining water at 70° C for 15 minutes.

Water Pasteurisation can be referred to as solar cooking, which is one of the main methods of household-scale Pasteurisation. Solar cooking uses the energy of direct sunlight, which is concentrated onto a cooking pan using a mirrored surface with high regular reflectivity. In direct solar Pasteurisation, dark containers with water are placed under the sun until the temperature reaches 65–70° C. Other forms of heat can also be used for Pasteurisation at the household level, such as waste heat from cooking meals or an open fire, where water is passed through a metal tube installed around the cooking stove or flows through a short tube placed in an open fire.

Design Considerations: Unlike boiling, where the recommendation is to bring water to a rolling boil, there is no natural visual indicator for the required temperature for water Pasteurisation, and it can be difficult to maintain the correct temperature over the required period. To ensure the time of Pasteurisation and temperatures are correct, there are some products are available on the market. For example, thermostatic valves only dispense water when the Pasteurisation temperature has been reached, or indicators made of a transparent plastic tube partly filled with wax that melts at 70° C, indicating that Pasteurisation has been reached.

Materials: For solar cookers, the cooking pan is made from materials that conduct and retain heat well and are often black or dark in colour. A lid reduces heat loss. Glass lids may further increase the efficiency by a greenhouse effect, but in general, any metal pot covered with a lid can be used. Devices using the excess heat from conventional stoves through a very basic heat exchanger can be produced locally. Pasteurisation indicators are recommended to assure that the temperature has been reached.

Applicability: Household devices are usually very low cost and can be manufactured locally. Solar cookers can also be used for cooking meals, making them more attractive. Usually, the distribution of Pasteurisation devices is more suited to the recovery phase, as the know-how and materials may not be readily available during the acute response, and training might be needed for manufacturing and/or use of the devices. In general, for the proper use of household devices, only basic initial training is needed. However, with no indicator of time and temperature, there is a risk that Pasteurisation is not done properly. Generally, turbid waters can be pasteurised as well, although the turbidity will remain and it might be necessary to increase the Pasteurisation time to assure sufficient inactivation of microorganisms. When turbidity is removed for aesthetic reasons, this should be done before Pasteurisation to avoid recontamination of the water. For solar Pasteurisation, due to comparably low outputs and a high vulnerability to cloudy weather, good planning is important, and sufficient storage capacity is required.

Operation and Maintenance: Suitable containers for solar Pasteurisation incorporate some type of window for solar irradiation, which must be cleaned regularly and replaced when no longer transparent. For solar cooking, the solar collector surface must be cleaned every day. Cleaning can be done using a broom, brush or cloth, but scratching of the surface should be avoided. Pasteurisation does not provide residual protection, and treated water should be consumed shortly after Pasteurisation and stored in the safe water storage containers.

Health and Safety: For living cells of pathogenic bacteria, viruses and protozoa log removal values > 99.9999 % can be achieved at 60–70 °C during exposure times of less than 1 min. However, bacterial spores and protozoan cysts representing early stages in the life cycle of some microorganisms can be more resistant to thermal inactivation. To significantly reduce spores, a sufficient temperature and time must be ensured, usually corresponding to a temperature of 70 °C for at least 15 min. Burn injuries from hot surfaces are the major threat to human health while handling solar cookers or other Pasteurisation techniques, though direct eye contact with reflecting light from solar cookers should also be avoided. Children should not use solar cookers or other Pasteurisation equipment on their own, and the operating equipment should be placed out of reach of children when possible. If fire or fuel are used for Pasteurisation, long-term exposure to smoke may cause associated respiratory diseases. For this, the indoor cooking space should be made well ventilated.

Costs: The cost of a high-quality solar cooker is around 200 USD, although locally produced solar cookers at < 50 USD are available in some places. The costs of wax-based Pasteurisation indicators for direct solar Pasteurisation vary between 0.9–2 USD.

Social and Environmental Considerations: A warm unpleasant taste might be poorly accepted by consumers if the water is not left to cool. During Pasteurisation, water does not change appearance, which also might reduce acceptance of this method in areas with turbid water. If fire and fuel are used, Pasteurisation may be environmentally unsustainable and contribute to greenhouse gas emissions, as well as other local problems related to deforestation, that will affect health and safety. Especially in densely populated areas, using firewood for water treatment is not appropriate due to the overexploitation of the wood resources and the subsequent environmental damage.

Strengths and Weaknesses:

(+) Has almost no treatment cost, only requires suitable containers
(+) Is possible using any energy source

(−) Has rather small treatment capacity
(−) Results in unpleasant, warm water after treatment
(−) Remains vulnerable to unstable weather (if solar powered); clouds, rain and polar regions limit efficiency
(−) Contains no residual disinfectant (safe distribution and storage must be assured otherwise)

→ **References and further reading material for this technology can be found on page 222**