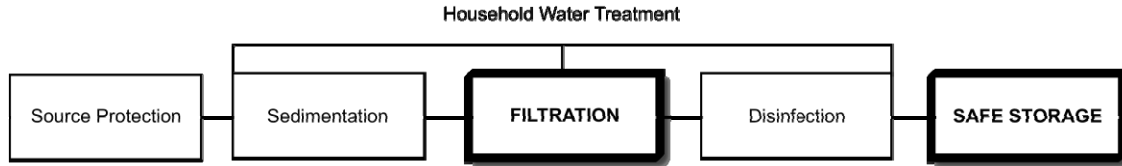


# Household Water Treatment and Safe Storage Fact Sheet: Ceramic Candle Filter

## The Treatment Process



## Potential Treatment Capacity

Very Effective For:	Somewhat Effective For:	Not Effective For:
<ul style="list-style-type: none"> <li>• Bacteria</li> <li>• Protozoa</li> <li>• Helminths</li> <li>• Turbidity</li> <li>• Taste, odour, colour</li> </ul>	<ul style="list-style-type: none"> <li>• Viruses</li> </ul>	<ul style="list-style-type: none"> <li>• Dissolved chemicals</li> </ul>

## What is a Ceramic Candle Filter?

Locally produced ceramics have been used to filter water for hundreds of years. Ceramic candles are hollow cylindrical forms fastened into the bottom of a container. Water seeps through the ceramic candle and falls into a lower container, which is fitted with a tap at the bottom. Units often use more than one candle because the flow rate through one candle can be slow. A lid is placed on top of the filter to prevent contamination. This system both treats the water and provides safe storage until it is used.

Ceramic candles are usually made from local clay mixed with a combustible material like sawdust, rice husks or coffee husks. When the candle is fired in a kiln, the combustible material burns out, leaving a network of fine pores through which the water can flow through.

Colloidal silver is sometimes added to the clay mixture before firing or applied to the fired ceramic candle. Colloidal silver is an antibacterial which helps in pathogen removal, as well as preventing growth of bacteria within the candle itself.

## How Does It Remove Contamination?

Pathogens and suspended material are removed from water through physical processes such as mechanical trapping and adsorption.



**Ceramic Candle Filter (Credit: USAID, Nepal)**

Quality control on the size of the combustible materials used in the clay mix ensures that the filter pore size is small enough to prevent contaminants from passing through the filter. Colloidal silver aids treatment by breaking down pathogens' cell membranes, causing them to die.

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## Operation

Contaminated water is poured into the top container where the candles are attached. The water slowly passes through the pores in the candles and is collected in the lower container. The treated water is stored in the container until needed, protecting it from recontamination. The user simply opens the tap at the bottom of the container to get water.

For turbidity levels greater than 50 NTU, the water should first be strained through a cloth or sedimented before using the ceramic candle filter.

The candles should be regularly cleaned using a cloth or soft brush to remove any accumulated material. It is recommended that the candles be replaced every 6 months to 3 years, depending on the manufacturer's instructions and quality of the candles. This is in part to protect against fine cracks which may have developed and are not be visible. Any cracks will reduce the effectiveness since water can short-circuit through the crack without being filtered through the ceramic pores.



Filter with one ceramic candle



Different types of ceramic candles

# Household Water Treatment and Safe Storage Fact Sheet: Ceramic Candle Filter Key Data

## Inlet Water Quality

- Turbidity < 50 NTU (Nephelometric Turbidity Units)

## Treatment Efficiency

	Bacteria	Viruses	Protozoa	Helminths	Turbidity
<b>Laboratory</b>	>99% <sup>1,3,4,5</sup>	>90% <sup>4,5</sup>	>100% <sup>5, 6</sup>	>100% <sup>6</sup>	88-97% <sup>3</sup>
<b>Field</b>	>99.95% <sup>2,3</sup>	Not available	>100% <sup>6</sup>	>100% <sup>6</sup>	97-99% <sup>3</sup>

1 Mattelet (2006)

2 Clasen & Boisson (2006)

3 Franz (2004)

4 Chaudhuri et al. (1994)

5 Horman et al. (2004)

6 Not researched, however helminths and protozoa are too large to pass between the 0.6-3 µm pores. Therefore, up to 100% removal efficiency can be assumed.

- Efficiencies provided in the above table require colloidal silver
- Pore size and construction quality are critical to ensure flow rate and effective treatment
- Taste, odour and colour of filtered water is generally improved
- The system provides safe storage to prevent recontamination

## Operating Criteria

Flow Rate	Batch Volume	Daily Water Supply
0.1-1 litres/hour	Depends on size of upper container	About 10 litres

- Flow rate is highest when the upper container is full
- Flow rate declines with use and accumulation of contaminants within the filter pores
- Flow rate can be improved by using more than one candle in the filter

## Robustness

- Lower container is a safe storage container
- There are no moving or mechanical parts to break
- Small cracks can occur which are not visible to the naked eye, but which allow pathogens to pass through the candle
- Seal between the candle and container is critical; water may pass through untreated if there is a gap; some locally manufactured candles have a poor seal resulting in lower treatment efficiencies
- Poor transportation of candles can lead to cracking and/or breakage
- Plastic taps in the lower container can break, metal taps last longer but increase cost
- Requires supply chain and market availability for replacement candles and taps
- Recontamination is possible during cleaning; care should be taken to use clean water, not to touch the ceramic with dirty hands, and not to place the filter on a dirty surface

## Estimated Lifespan

- Up to 3 years, generally 6 months to 1 year
- Candle needs to be replaced if there are visible cracks
- Filters must be repaired, resealed or replaced if the seal between the candle and the container is damaged (e.g., if short-circuiting or dripping is observed)

## Manufacturing Requirements

### Worldwide Producers:

- Produced by different manufacturers around the world

# Household Water Treatment and Safe Storage

## Fact Sheet: Ceramic Candle Filter

### Key Data

- Highest quality candles are generally produced by European and North American manufacturers

#### Local Production:

- Candles are generally imported, except in a few countries where candles are produced locally
- Filter units can be assembled locally using locally available plastic containers and taps

#### Materials:

- Ceramic candle
- Plastic container with lid
- Tap
- Sealant

#### Fabrication Facilities:

- A small factory with a kiln is required for local production
- A small workshop is required for local filter assembly
- Miscellaneous tools

#### Labour:

- Professional potter with experience in collecting clay, making ceramic articles, semi-industrial or mass production
- Assistants, preferably potters as well
- Skill and quality control in manufacturing is essential to ensure optimum pore size, flow rate and effectiveness

#### Hazards:

- Working with presses and kilns is potentially hazardous and adequate safety precautions should be used

#### Maintenance

- Filters are cleaned by lightly scrubbing the surface when the flow rate is reduced
- Some manufacturers recommend that soap and chlorine should not be used to clean the candle
- Lower container, tap and lid should be cleaned on a regular basis

#### Direct Cost

Capital Cost	Operating Cost	Replacement Cost
US\$15-30	US\$0	~US\$4.5/year <sup>1</sup>

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

<sup>1</sup> Ceramic candles need to be replaced every 6-12 months

#### Other

- Safest design uses clear plastic containers so that candle seal leaks are visible

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