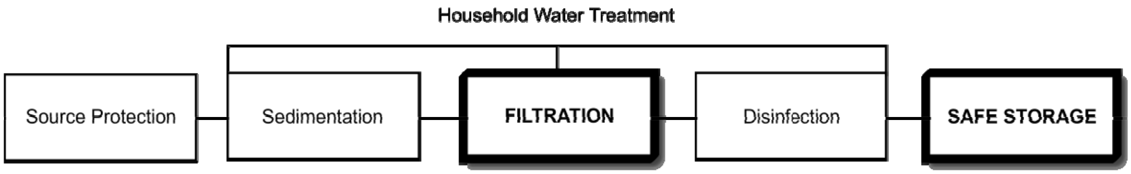
Household Water Treatment and Safe Storage Factsheet: Ceramic Pot Filter

Treatment Type



Potential Treatment Capacity

Very Effective For:	Somewhat Effective For:	Not Effective For:
• Bacteria • Protozoa • Helminths • Turbidity • Taste, odour, colour	• Viruses • Iron	• Dissolved chemicals

What is a Ceramic Pot Filter?

Locally produced ceramics have been used to filter water for hundreds of years. Water is poured into a porous ceramic filter pot, and is collected in another container after it passes through the ceramic pot.

Ceramic pot filters usually have a diameter of about 30 cm by 25 cm deep, with an 8 litre capacity. Two variations of ceramic filters, flat-bottom and round-bottom, are currently manufactured.

The ceramic pot typically sits or hangs in the top of a larger plastic or ceramic container (20-30 litres), which is fitted with a tap at the bottom. A lid is placed on top of the filter to prevent contamination. The system both treats the water and provides safe storage until it is used.

Ceramic pots are usually made from local clay mixed with a combustible material like sawdust, rice husks or coffee husks. The clay and combustible material are sieved through a fine mesh, and then mixed together with water until it forms a homogeneous mixture. The mixture is pressed into shape using a mold. When the pot 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 pot. Colloidal silver is an antibacterial which helps in pathogen removal, as well as preventing growth of bacteria within the filter itself.

Some ceramic pot filters also include activated charcoal in the clay mixture to improve odour, taste, and colour.

How Does It Remove Contamination?

Pathogens and suspended material are removed from water through physical processes such as mechanical trapping and adsorption. Colloidal silver breaks down the pathogens' cell walls causing them to die.

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 ceramic pot. The water slowly passes through the pores 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 base of the container when they need water.

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

The filter pot should be regularly cleaned using a cloth or soft brush to remove any accumulated material. It is recommended that the filter pot be replaced every 1-2 years. This is in part to protect against fine invisible cracks which may have developed over time. Any cracks will reduce the effectiveness since water can short-circuit without being filtered through the ceramic pores.

Cross Section of Ceramic Pot Filter (Credit: Filter Pure Inc)

Round Bottom Ceramic Pot Filter (Credit: Filter Pure Inc)

Flat Bottom Ceramic Pot Filter (Credit: Potters for Peace)

Household Water Treatment and Safe Storage Factsheet: Ceramic Pot Filter Key Data

Inlet Water Quality

- Turbidity < 50 NTU (Nephelometric Turbidity Units)

Treatment Efficiency

	Bacteria	Viruses	Protozoa	Helminths	Turbidity	Iron
Laboratory	>98%[1]-100%[4]	19%[1]->99%[6,7]	>100%[8]	>100%[8]	83%[1]–99%[5]	Not available
Field	88%[2] to >95.1%[3]	Not available	>100%[8]	>100%[8]	<5 NTU[2]	>90%[5]

1 Lantagne (2001)
2 Smith (2004)
3 Brown and Sobsey (2006)
4 Vinka (2007)
5 Low (2002)
6 Van Halem (2006)
7 Some additives to the clay may increase virus removal
8 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
1-3 litres/hour	8 litres	20-30 litres

- Flow rate is highest when the pot is full
- Flow rate declines with use and accumulation of contaminants within the filter pores

Robustness

- Lower container can be used as 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 filter
- Poor transportation of filters 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 filters and taps
- Requires construction quality control process to ensure effectiveness
- 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 5 years, generally 1-2 years
- Filter needs to be replaced if there are visible cracks

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Manufacturing Requirements

Worldwide Producers:
- Free press and kiln designs are available from Potters for Peace

Local Production:
- Local production of the filters is common and preferable
- Requires quality control process to ensure filter effectiveness
- The lower container, lid and tap can usually be purchased locally

Materials:
- Clay
- Combustible material (e.g. sawdust, rice husks, coffee husks)
- Colloidal silver (optional)
- Lid
- 20-30 litre ceramic or plastic container with tap

Fabrication Facilities:
- A ceramic factory requires at least 100 square metres of covered area
- 15 to 20 ton hydraulic press (can be fabricated locally)
- Filter molds (can be fabricated locally)
- Mixer for clay and combustible material (can be fabricated locally)
- Hammer mill (can be fabricated locally)
- Kiln with an internal area of at least 1 cubic metre (can be fabricated locally)
- Racks
- Work benches
- Miscellaneous tools (e.g. traditional pottery 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 to boil the filter every three months to ensure effectiveness
- Some manufacturers recommend that soap and chlorine should not be used to clean the filter
- Lower container, tap and lid should be cleaned on a regular basis

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Direct Cost

Capital Cost	Operating Cost	Replacement Cost
US$12-25	US$0	~US$4[1]

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

[1] Filter pots generally need to be replaced every 1-2 years

References

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Lantagne, D. (2001). Investigation of the Potters for Peace Colloidal Silver Impregnated Ceramic Filter Report 2: Field Investigations. Alethia Environmental for USAID, USA.

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Napotnik, J., Mayer, A., Lantagne, D. and K. Jellison. Efficacy of Silver-Treated Ceramic Filters for Household Water Treatment. Department of Civil and Environmental Engineering, Lehigh University, USA. Available at: www.filterpurefilters.org/files/pdf/silver.pdf

Smith, L. (2004). Ceramic Water Filter Use in Takeo, Cambodia – Operational Issues and Health Promotion Recommendations. Submitted in partial fulfilment as a requirement for a Master of Science in Control of Infectious Diseases, London School of Hygiene and Tropical Medicine, London, England.

Van Halem, D. (2006). Ceramic silver impregnated pot filters for household drinking water treatment in developing countries. Masters of Science in Civil Engineering Thesis, Department of Water Resources, Delft University of Technology, Netherlands.

Vinka, A. et al. (2007). Sustainable Colloidal-Silver-Impregnated Ceramic Filter for Point-of-Use Water Treatment. Environmental Science & Technology, Vol. 42, No. 3, 927–933

Further Information

Centers for Disease Control and Prevention:
http://www.cdc.gov/safewater/publications_pages/options-ceramic.pdf

Filter Pure, Inc: www.filterpurefilters.org

Potters for Peace: www.pottersforpeace.org

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Last Update: October 2009

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