Making water safe for drinking and cooking

PACE Action Sheet 23

Water can carry tiny creatures called germs, viruses and parasites. These are disease organisms can make you and your family sick. Although it is better to protect and use a source of safe water (eg. a protected spring or well-kept well), many people collect the water they use to drink from a contaminated source such as a river or water hole. In this case, it needs to be treated before use. This Action Sheet is about ways to treat water to make it safe for drinking and cooking.

Are there other situations when water need to be treated?
River water always needs to be treated. Water from pipes, tanks and wells needs to be treated if:

- There is any possibility that has been contaminated
- People refuse to drink it because of the colour or taste
- It has been transported and stored in the home

The methods shown in this Action Sheet do not make water safe from toxic chemicals. Water with toxic chemicals is never safe for drinking, bathing or washing clothes. It may lead to cancer, skin rashes, miscarriages, or other health problems.

How to choose which water treatment method to use?
The methods you choose to treat water will depend on how much water you need, what it is contaminated with, how you will store it, and what resources are available. No matter how it is treated it is best to either let the water settle and pour it into another container, or filter the water, before disinfecting it.

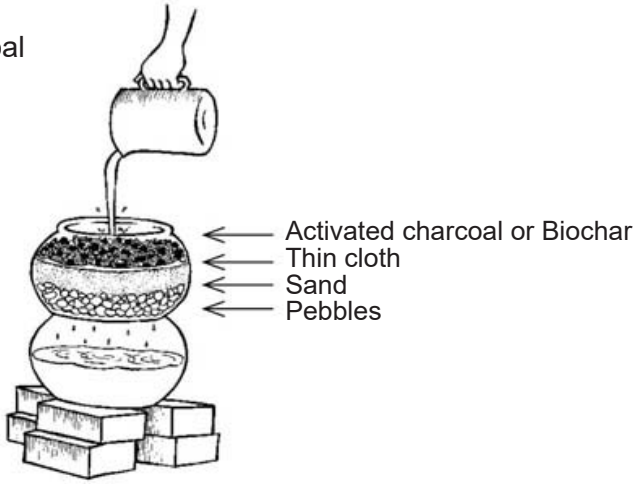
How do you make water safe from germs?
To make water safe from germs – the tiny living things that carry diseases – follow these steps

Let the water settle for a few hours and pour it into a clean container

OR filter it, using

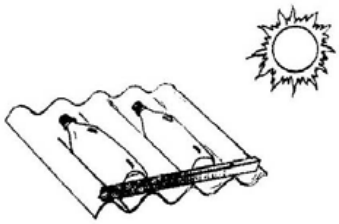
A cloth filter,

or an activated charcoal or biochar filter



Then disinfect the water using 1 of these methods:
(These basic methods for treating water need little or no equipment).

Boiling or



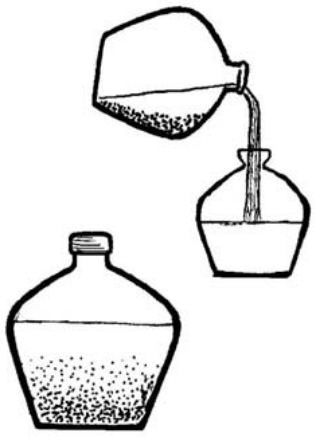
Solar disinfection or

Adding chlorine or

Adding lime or lemon juice

How does settling water get rid of germs?
When water settles, mud, other solids, and germs and worms that cause illnesses fall to the bottom. Storing water for 5 to 6 days will reduce the number of germs in the water. But some germs, like giardia, will not be killed by any length of storage. For this reason it is best to use another method after letting the water settle, such as filtering, chlorinating, or solar disinfection. The following methods are ways to settle water that take more time but make it safe from most germs.

Three pot method
The three pot method settles water so germs and solid matter fall to the bottom. This method is safer than settling water in one pot, but it does not make the water completely free of germs. The three pot method should be followed by disinfection (see page 5 of this action sheet).



Morning, Day 1: Fill pot 1 with water. Cover the top and let it settle for 2 days.

Morning, Day 2: Fill pot 2 with water. Cover it and leave for 2 days. The dirt in pot 1 will begin to settle

Morning, Day 3: Pour the clear water from pot 1 into empty pot 3, making sure not to disturb the sediment at the bottom of pot 1. The water in pot 3 is now ready for drinking. The dirty water left in the bottom of pot 1 can be poured out. Wash pot 1 and refill it with water. Cover it and let it settle for 2 days.

Morning, Day 4: Pour the clear water from pot 2 into pot 3 for drinking. Wash pot 2 and refill it with water.

Morning, Day 5: Pour the clear water from pot 1 into pot 3 for drinking. Wash pot 1 and refill it with water.

Every few days wash the clear water pot (pot 3) with boiling water. If you use a clean flexible pipe to siphon water from one pot to the next the sediment will be less disturbed than if you pour the water

Using plants to clear and settle water
In many places people use plants to make water safer to drink. One plant used often is Moringa.

Purifying water with Moringa seeds

- Allow the Moringa seed pods to dry naturally on the tree before harvesting
- Remove the seed husks, leaving a whitish kernel
- Crush the seed kernels to a powder with a stone or mortar
- Mix the powder with a small quantity of clean water in a small cup
- Pour the mixture through a tea strainer or sieve into a cup. It's best to cover the strainer with a piece of clean cloth
- Add the resulting milky fluid to the water you wish to treat in a clean vessel such as a pan or gourd
- Stir quickly for 30 seconds, then slowly and regularly for five to ten minutes. The faster it is stirred, the less time is needed.
- Cover the water and do not disturb it for at least an hour.
- The clear water may be siphoned or poured off the top of the container, or a vessel with a tap can be designed.
- The particles of dirt in the water will sink to the bottom. Most of the tiny creatures that make you sick will stick to these particles and sink to the bottom as well. However, not all of the dangerous disease organisms will be removed, so if you are able to, it is still safer to use a disinfection treatment as well.

How much seed powder do you need?
Depending on how clear the water is, you will need between 50 and 150 milligrams (1/100 of a gram) of ground Moringa seed to treat one litre of water. A good, full seed will typically purify 5 litres of water that is not turbid (muddy); two seeds will purify between 2.5 and 5 litres of water that is slightly to moderately turbid; and three seeds will purify 2.5 litres of very turbid water.

You will need to experiment with the amount of seeds and stirring time to find what works in your area. Health-workers should be consulted about quantities and materials, and about how to combine this method with other ways to make drinking water safe.

Seed cake left over after extracting oil can still be used for water purification, if ground to a fine powder.

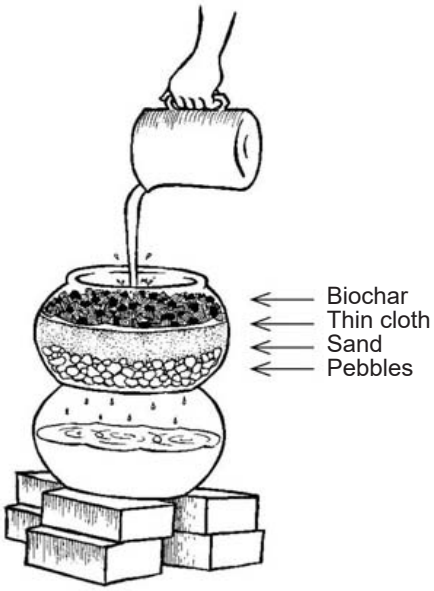
Can this be method be used on a larger scale?
Scientists have worked with water treatment works in Africa (Eritrea and Malawi) to show that powder from the seeds can replace expensive chemicals in water treatment works. If more water treatment works found out about this method, farmers might be able to sell Moringa seeds to water treatment works.

Action Sheet 52 tells you more about the many uses of the Moringa tree, and how to plant it.
You mentioned charcoal and cloth filters above. Can you give more details?

There are many ways to filter water to make it safer from germs. Some very effective filters, like slow sand and ceramic filters (See Action Sheet 24), require special equipment to make, but can filter large amounts of water. Other filters, like charcoal and cloth filters described below, require no special equipment and are easy to use to filter smaller amounts of water before disinfecting.

Biochar filter

This filter is easy to make and works well for removing most germs from small amounts of water. Because the germs that are filtered out will grow on the biochar, it is important to remove and clean the charcoal often if the filter is used daily, or anytime the filter has been unused for a few days.



1. Punch holes in the bottom of a container with a sharp instrument.
2. Grind biochar to a fine powder and rinse with clean water. Activated charcoal can be substituted for biochar, ordinary charcoal will not work as well. NEVER USE CHARCOAL BRIQUETTES!THEY ARE POISON!
3. Place layers of stones, gravel, and sand in the container. Put in a thin cloth and a layer of charcoal on top.
4. Pour water into the filter and collect drinking water from the bottom vessel.

Cloth filters

In Bangladesh and India a filter made of sari cloth, a finely woven cloth, is used to reduce the amount of cholera germs in drinking water. Because the cholera germ often attaches to a tiny animal that lives in water, filtering out these animals also filters out most cholera germs. This method also filters out guinea worms.

You can make a cloth filter out of handkerchiefs, linen, or other fabric. Old cloth is more effective than new cloth because worn fibers make the pores smaller and better for filtering.

1. Let water settle in a container so that solids sink to the bottom.
2. Fold the cloth 4 times and stretch or tie it over the mouth of a water jar.
3. Pour water slowly into the jar through the cloth.

Always use the same side of the cloth, or germs may get into the water. After using the cloth, wash it and leave it in the sun to dry. This kills any germs that may be left in the cloth. In the rainy season, disinfect the cloth with bleach.

Once the water is clear, why do you need to disinfect it?

The methods of settling or filtering water described above make it clean and pleasant to drink, but some germs can still survive.

Disinfecting water kills germs. If done correctly, disinfection makes water completely safe to drink. The most effective methods are boiling, solar disinfection, or using chlorine.

Boiling water

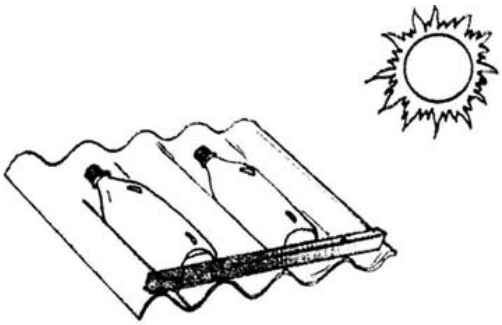
Boiling water for 1 minute makes it safe from germs. Bring water to a rapid, rolling boil. Once it starts boiling, let it boil for 1 full minute before taking the pot off to cool. Water needs to boil for 3 minutes to kill germs in high mountain areas because water boils at a lower temperature high in the mountains.

Boiling changes the taste of the water and boiled water takes a long time to cool, so it cannot be used right away. After boiled water cools pour it into a bottle and shake it strongly. This will add air to the water and improve the taste.

Solar disinfection (SODIS)

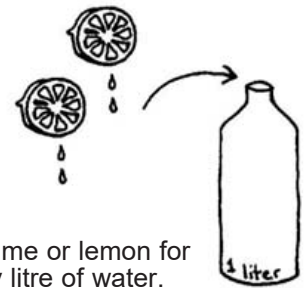
Solar disinfection is a very effective way to treat water with only sunlight and a bottle. Filtering or settling the water first will make it clearer so it will disinfect more quickly. Solar disinfection works best in countries close to the equator, because the sun is strongest there. The farther north or south you are, the more time is needed for disinfection to work. (For more information about SODIS, see the Contacts List at the end of this sheet.)

1. Clean a clear plastic or glass bottle or plastic bag.
2. Fill the bottle 3/4 full, and shake it for 20 seconds. This will add air bubbles to the water. Then fill the bottle or bag to the top. The air bubbles will help to disinfect the water faster.
3. Place the bottle in an open place where there is no shade and where people and animals will not disturb it, like the roof of a house. Leave the bottle in the sun for at least 6 hours in full sun, or 2 days if it is cloudy.
4. Drink directly from the bottle. This will prevent the possibility of contamination from hands or other vessels.



Lime or lemon juice

Adding the juice of a lime or lemon to 1 litre of drinking water will kill most cholera and other germs as well. This does not make water completely safe, but may be better than no treatment in areas where cholera is a threat. Adding lime or lemon juice to water before using solar disinfection or the 3 pot method will improve the effectiveness.



Use 1 lime or lemon for every litre of water.

Chlorine
Chlorine is cheap and easy to use to kill most germs in drinking water. The difficulty with chlorine is that if too little is used it will not kill germs or make the water safe. If too much is used, the water will taste bad and people may not want to drink it.

How much chlorine to add to the water?
The amount of chlorine needed to disinfect water depends on how contaminated the water is (how many and what kinds of germs it contains). The more germs you have, the more chlorine you need to get rid of them. It is important to add enough chlorine so that some is left in the water after the germs are killed. The chlorine that is left is called free chlorine. This will kill any new germs that get in the water. If the water has free chlorine in it, it will smell and taste just slightly of chlorine. This tells you it is safe to drink. If it has too much, the smell and taste will be strong and unpleasant.

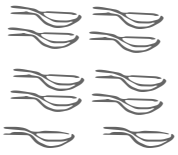
To use the right amount of chlorine you need to know how strong your chlorine solution is. Chlorine comes in different forms - gas, bleaching powder, high-test hypochlorite (HTH), and household liquid bleach. Because household bleach is the most common form of chlorine, this book shows how to disinfect water with household bleach.

Household bleach may have different amounts of chlorine. Most common are 3.5% and 5%. The easiest way to measure the amount of bleach needed is to first make a mother solution (about 1 % chlorine) and then add this solution to the water you want to disinfect. First prepare the mother solution:

1. Add 1 cup of bleach to a clean, empty beer bottle.
2. Fill the bottle with clean water.
3. Shake the bottle for 30 seconds.
4. Let it sit for 30 minutes.

Your mother solution is ready.

If there is a lot of solid matter in the water the chlorine will be less effective in killing germs. To ensure that chlorine is most effective either filter the water through a cloth or other type of filter (see page 4 of this Action Sheet) or let the water settle so solid matter sinks to the bottom. Pour the clear water off into a clean container and then add chlorine.

Water		**Bleach**		
For 1 litre of water		use	3 drops of bleach	
For 4 litres of water		use	12 drops of bleach	
for 20 litres of water		use	1 teaspoon of bleach	
for a 200 litre barrel of water		use	10 teaspoons of bleach	

Add these amounts of the mother solution to clear water and wait at least 30 minutes before drinking the water. If the water is cloudy, you need twice as much of the bleach solution.

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For more information

On - Solar Water Disinfection /www.sodis.ch/index_EN.html can be obtained from EAWEG and SANDEC (Swiss Federal Institute for Environmental Science and Technology and EAWEG Department of Water and Sanitation in Developing Countries.

WaterAid www.wateraid.org.uk

World Health Organization (WHO) - Water, Sanitation and Health: www.who.int/water_sanitation_health/en

Centre for Affordable Water and Sanitation Technology www.cawst.org www.cawst.org Many free high quality, downloadable posters, brochures and other resources and information.

Sanitation and Cleanliness for a Healthy Environment, created by the Hesperian Foundation for the UNDP, in cooperation with the Community Water Initiative partners, part of a larger book by the Hesperian Foundation, A Community Guide to Environmental Health.

Water for Life: Community Water Security, created by the Hesperian Foundation for the UNDP, in cooperation with the Community Water Initiative partners, part of a larger book by the Hesperian Foundation

Hygiene Promotion: A practical manual for relief and development by Suzanne Ferron, Joy Morgan and Marion O'Reilly, ITDG Publishing (available from www.developmentbookshop.com) 2000.

A Community Guide to Environmental Health; Food, Water and Family Health A Manual for Community Educators, 1994, World Health Organisation

Where There Is No Doctor: A Village Healthcare Handbook, by David Werner, Carol Thuman and Jane Maxwell, Hesperian Foundation, Updated.

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