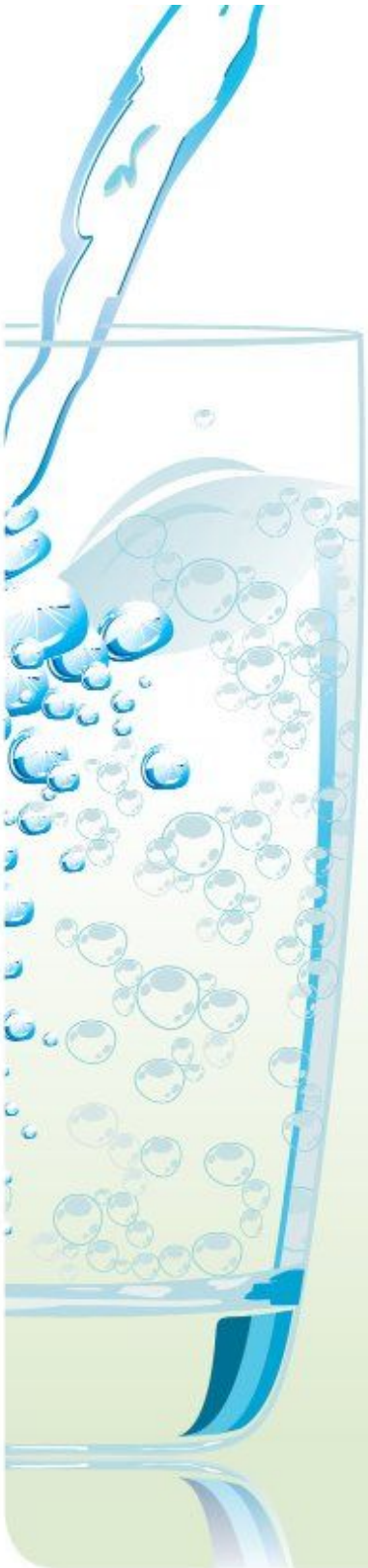
Create Your Own WATER FILTRATION SYSTEM On The Go!

(So You Can Drink Your Own Pee If Need Be!)

Donald Langley



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Introduction

Apart from food and shelter, **water is one of the most essential necessities in life**. During a survival or emergency situation such as a natural disaster, clean and potable water is a primary requirement. More often than not, private and public water systems have pumps that are electricity-powered. However, if the electricity is cut in an emergency situation, there would be no other power source for these types of water systems. Thus, in a critical situation, one may find a dire need for a source of clean and potable water.

During survival or emergency situations, an individual may find various sources of water. However, these water sources may be full of debris, mud, animal matter, rotten plant, and other dirt and bacteria. Thus, water from available sources in emergency situations could not be drinkable. In this light, an individual would need a quick way to eliminate the dirt and bacteria from the water in order to make it drinkable and usable.

One of the safest water sources is a camping water filter, which can be purchased commercially. Camp water filters are designed for the purpose of removing many types of chemicals and bacteria from water especially for hikers who drink water from ponds and streams that they come across during their hikes.

On the other hand, during survival or emergency situations, one may not simply have access to commercial water filters. Fortunately, there are several ways that an individual may carry out for building homemade or emergency water filtration systems even when stuck in a disaster or survival situation.

How to Assess Water Purity

In a survival situation, once you are able to find water, the first thing that comes to mind is its pureness. You may be doubtful on whether you can drink or use it.

These days, the issue of water purity has become more complicated than it was 20 years ago. For instance, in 1993, water from natural resources such as rivers, lakes, and streams are still drinkable even if unfiltered. However, in recent years, the spread of a non-native cyst or organism known as Giardia has increased the risk of obtaining water and drinking it straight from these natural sources.

Giardia can debilitate a person once it is acquired. It targets the digestive tract primarily. It has been determined that Giardia spreads through beaver droppings although recent studies claim that other animals can spread this organism as well.

In addition, chemical as well as industrial pollutants are more prevalent today than they were in the past years. In spite of the dangers of these pollutants, they have still become widespread, affecting various bodies of water. Some of the most common water pollutants include modern-day pollutants such as heavy metals and chemicals, bacterial agents, and suspended and silt materials.

It is important for you to segregate your containers that you use for storing water. For instance, you should make use of a different container for impure water from the one in which you store purified water.

In order to assess the purity of water, you should make sure to follow some general rules applicable for different situations. Some of the guidelines for assessing water purity include the following:

- Always look for clear water
- Avoid discolored water
- Avoid water from swamps and marshes
- Avoid water with algae growth
- Water from the ground such as in springs is purer in general as compared to water running over the ground
- Running water is much better as compared to still water

You should also bear in mind that pollutants can be human-made. Regardless if there is no possibility of human-made or manufactured pollutants in a specific area, human activities can also affect water purity. One of the most prominent human activities that affect water purity is mining. Mining releases various elements that are harmful. These include cyanide, heavy metals, arsenic, and mercury among others.

If you are in an area prone to human-made pollutants, the guidelines to follow are as follows:

- Do not drink water near mining sites, cities and towns, industries, human habitation, and factories
- Do not drink water near roads as engines of automobiles release toxic pollutants that do not go up into the air.
- Do not drink water that has already passed through agricultural areas since they may contain pesticides, fertilizers, and other elements.

Proper Storage Affects Water Purity

It may seem simple to store water as long as you have a container with a lid or a water drum with cover. On the other hand, water storage should be done properly in order to maintain the purity and quality of water. Different materials of water containers are available in the market. However, it is best to know which one is appropriate to use for different water storage purposes.

For instance, if you are storing water supplies, the most suitable containers are those made of glass, fiberglass, plastic, and enamel-lined metal containers. Experts claim that the best water containers are those made of durable plastic such as soft drink bottles and mineral water bottles. It is also best to make use of larger containers or food-grade plastic buckets. On the other hand, if you purchase plastic containers, make sure that they are solely for food and water use. This is because some plastic containers contain chemicals that can affect the purity of water.

If you are buying water containers for personal use, it is advisable to purchase one that is no bigger than 2 gallons. This is because if there is leak in the container, you are likely to lose more of your water supply as compared to smaller containers. You can also make use of 2-liter soft drink bottles that are made of plastic.

If you have larger supply of water to store, the most preferable size is five- or ten-gallon drums that are intended for food or water usage.

In addition, there are different types of water bottles with built-in filtration units. These water bottles are great for situations that only necessitate small quantities of water. These water bottles are mostly used by first-time campers.

Prior to filling your container with filtered, purified, or treated water, make sure that you wash it thoroughly along with the lid or cover. You can wash the container with hot water and detergent. You can also sanitize the container by using a cup of bleach to a gallon of water.

When choosing water containers, you not only consider the container itself. You should also take note of its lid. Make sure the lid does not contain any paper material. However, if the lid has a paper component, you can insert polyester plastic or polyethylene.

To ensure the purity of water, make sure you do not store it in empty milk cartons or juice jugs. This is because the milk containers leave milk proteins that result to growth of bacteria. In addition, you should take note if the container is designed for food and water storage. Otherwise, do not use it.

Finally, make sure that you do not store water in a container that held poisonous or toxic substances. This is because even tiny amounts of these substances could

remain in the pores of the container.

Learning about Water Contaminants

Water is often the most immediate necessity in a disaster or emergency situation. Conversely, an individual may survive without water for three days depending on his/her activity level. However, if an individual stays in a situation without proper hydration and lack of food, there could be a slim chance of survival.

Depending on the area, finding potable and usable water can be a critical problem. An individual should not simply wait to become thirsty prior to looking for water. During a disaster or emergency situation, one should quickly find ways to look for drinkable water unless he/she is willing to drink from contaminated sources. In addition, drinking water from contaminated sources could worsen an emergency situation by further dehydration and getting sick.

There are various types of contaminants that can affect the quality of water. It would be advantageous for most people to know the type of contaminants that may be present in water especially during a disaster or an emergency situation. Some of these contaminants and their sizes in microns include:

Giardia lamblia	8-12 microns
Bacteria	0.2-4 microns
Cryptosporidium parvum	4-6 microns
Viruses	0.004-0.1 microns

During a disaster or an emergency, an individual may find a solid container, which can carry water. These include water bottle, plastic or metal pot, canteen, or milk jug. On the other hand, there are other alternatives that can be used including a plastic sheet, which is folded similar to a condom and has no lubricant or spermicide.

Water Filtration and Purification Methods for Different Situations

- Filtering by Using Commercially Available Water Filters – There are many good and efficient water filters available in the market today that can eliminate various types of bacteria and pathogens from water including giardia. Commercially-bought water filters are perfect to use for normal situations rather than in non-primitive survival circumstances. However, commercial water filtration and purification systems are usually expensive although they can to their job efficiently.

- Filtering During Survival Situations – During a survival situation, you can use three ways to make water drinkable.

4. Building a Water Filter – If the situation is primitive, you can make use of a birch bark, shaping it like a cone for your water filter. You need to fill the cone with

layers of charcoal, sand, grasses, and/or other suitable materials. Sand and grasses can help in trapping small particles in contaminated or soiled water. Charcoal can help in eliminating chemical impurities although it still could not remove bacteria based on several tests and studies. You need to pass the water through the cone at least three times based on the make and size of the filter. In general, if the filter is big, more layers should fill it. As in a typical cone, the birch bark should have a small hole in its bottom. It needs to be tied with a vine or anything that would prevent it from scattering the contents inside. It is best to place an appropriate number of stones in the bottom of the cone to hold the materials inside. Once you put water through the filter, you need to have another container, which you will use to collect the filtered water.

5. Using the Earth for Water Filtration – The very concept of this is the water well, which people have been using even years ago to obtain water. Wells are usually 4 to 4 feet above a source of water such as a river or lake. A hole is dug up to be filled with water from the natural source. Although most water from natural sources is believed to be pure, there is no way to tell for sure.

6. Distilling by Using a Solar Still – One of the best methods to filter water is building a solar still. All you need is sunshine and suitable materials. The impure water is poured into the solar still, which looks like a pit. The water is allowed to evaporate through the sun's help. It is advisable to use any absorbent material to saturate the impure water. This material will be placed in the solar still while the water evaporates. Water is then collected from the underside of the still cover and would drip to a collecting container.

 Boiling – This is the safest and most common method of purifying water from microbes and bacteria. On the other hand, it has not yet been determined as to how long it needs to take to eliminate harmful microbes when boiling water. Conversely, studies claim that water should be boiled at least 5 minutes although just to be sure, the ideal length of time is 20 minutes.
When boiling water, you need a source of heat and a fire-proof container. Water is poured into the container prior to placing the container on the fire. In other circumstances, you can also make use of rock-boiling wherein stones are placed in fire. You need to wait for the stones to heat up. Remove the stones from the fire and place them in the container filled with water. Since the stones are still hot, they would transfer heat to the water. You need to make use of as many stones or rocks as possible and keep adding them to the water container. This way, the water would boil and stays heated until you reach the required time of 5 to 20 minutes.

Basics of Water Filtration and Purification Process

A. Filtration

Filtration is a process that can make water more attractive to drink even after a proper purification process. It is a fact that most people could not drink water with dirt, leaves,

and algae among others; thus, filtration is very much recommended.

The simplest form of filtration is using a cloth in which water can run through. The cloth should have a very tight weave in order to filter finer particles. On the other hand, if a cloth with a tighter weave is unavailable, any cloth will do as long as it is folded in multiple layers to help filter smaller particles.

B. Purification

In a survival situation, it can be more helpful if people have knowledge in simple water purification techniques such as boiling and chemical treatment.

Boiling

Boiling is considered as the simplest technique when it comes to eliminating viruses and bacteria from water. It is said that boiling can destroy organisms in water by pushing it to a heat range of 212 °F or 100 °C. This heat range can eliminate most types of organisms apart from bacteria.

In a survival situation in which an individual can obtain fire and has a water container, he/she can fill the container that can be placed over the fire. Once the container is already on fire, bring the water to a boil and afterwards, allow it to cool. Boiling can eliminate almost all types of harmful bacteria present in water because most bacteria cannot survive in hot temperatures. In addition, boiling is better than any other method of purification since no chemicals are added to the water. On the other hand, an individual should have a source of heat that can produce fire so that the water can be brought to a boiling point.

Chemical Treatment

Some of the most common chemicals used for treating water include iodine, sodium chlorite/chlorine dioxide, potassium permanganate, and chlor-floc. However, water chemical treatment may not eliminate some parasites due to several factors such as expiration date of the chemicals and the temperature and clarity of water.

- Iodine crystals - When treating water with iodine crystals, bacteria can be eliminated through affecting the ion balance in the bacteria's cell and replacing the elements that the bacteria use for survival with iodide ions. On the other hand, iodine can be harmful and poisonous to people especially young children as well as pregnant women. Thus, there should only be a certain amount when purifying water with iodine. Most health experts would suggest avoiding the use of iodine for water purification for longer time periods.

During a survival situation, one may fill a container with water. Shake the container and let it stand for an hour to allow the iodine be saturated in the water. Add the indicated amount of capfuls of iodine to the container and shake it to achieve appropriate mixture. Leave the container for 20 to 30 minutes. Finally, the water is already drinkable.

The advantage of using iodine crystals is that it can treat 10,000 gallons of water. However, it cannot be used for extended periods.

- Sodium Chlorite/Chlorine Dioxide – These tablets make use of chlorination to purify water. Sodium chlorite produces chlorine dioxide that enables it to treat water. More often than not, chlorination is a technique used to disinfect water in municipalities across the globe. This is because chlorine is able to destroy the cell walls of bacteria or viruses; thus, eliminating the organism. The possibility of causing damage to one's health is low when drinking chlorinated water. An individual's digestive system can neutralize chlorine quickly, making it safe for the gastrointestinal tract to stand chlorine concentrations.

It is advisable to add a sodium chlorite/chlorine dioxide tablet to a quart of a water container, leaving the mixture for at least 4 hours. It may help to shake the container to help dissolve the tablet quickly as well as improve the distribution of the chemicals in the water.

One may find the mixture with slight chlorine or bleach taste. The advantage of using these tablets is the simplicity of the process. An individual would only have to add them and wait for the specific time when it can already be drinkable. However, the disadvantage is waiting for more than a couple hours before the mixture can finally be used.

- Potassium Permanganate – This chemical can be purchased commercially often in hardware stores. It is being sold as a softener for water and is available in powder and pill forms. There are various uses of this chemical compound. Apart from being able to purify water, it can also be a component for fire-starting.

In order to treat a quart of water, one can use 3 to 4 crystals, which is equivalent to 1 gram per liter.

Types of Homemade or Survival Water Filtration Systems

1. Micro-filters

Micro-filters make use of a ceramic filter to remove any form of contaminant from water. Pathogens are removed effectively by letting the water pass through the microporous membrane with pores that are smaller than common contaminants.

2. Transpiration Bags

One of the most common kinds of transpiration bag is the vegetation bag, which is used to collect water. As plants take in carbon dioxide, converting it to organic compounds through sunlight, water and carbon dioxide result as its by-product. Thus, when water evaporates from plants, transpiration occurs.

Plants absorb water through their roots and nutrients and minerals are provided for the entire plant. Both water and oxygen are released during this process. Simply said, transpiration involves the process wherein water from the ground is distributed in other parts of the plant to provide nutrients. Water and oxygen are also released to the atmosphere during this process. In a disaster or an emergency situation, the vapor released to the atmosphere can be used to collect water.

Some of the advantages of using transpiration bags include:

- Water from plants is a clean and pure source of water
- Minimal effort is required; thus, less energy is spent
- Bags are able to collect water even when an individual has other things to do

When stuck in a survival situation, an individual can place transpiration bags, say, along a tree line. Even in just a few minutes, one may already see the condensation in the bag. When water condenses, it can already drip to the lowest area of the bag. After a few hours under the sun, the bag would have already collected a fair amount of water at the bottom of the bag. It would only take minimal energy to gather water from the bag.

An individual may also collect dew and rain water using transpiration bags. Bags under direct sunlight can collect more water as compared to bags that are hanged or lined in a shaded area. On the other hand, when using transpiration bags, an individual should make sure that the plant used is not poisonous or toxic.

3. Solar Still

In a survival situation, it can be very difficult to procure potable or usable water. In addition, it can be tough for someone to survive without proper nutrition and hydration under taxing circumstances. Various activities in different temperatures can also lessen one's chances of survival. In waterless situations, the human body can only take a few days to survive without water. Dehydration may already show symptoms after 3 to 4 days. Cramps, fatigue, and headache are its most common symptoms. Furthermore, when these symptoms arise, it would be all the more difficult for an individual to find potable or usable water.

During a survival situation in coastal or desert regions, the solar still is one of the most common methods used to procure water. A solar still or distiller is used as equipment for liquids purification. To produce vapor, an individual should have a source of heat. The vapor condenses and turns into liquid again as it cools. A survivalist may be able to use this process in order to eliminate contaminants from water. Similarly, this process can also be used during a survival situation specifically in desert or coastal regions.

Countries that have rare or no readily available potable water usually make use of solar stills. These stills are available in different types. In survival situations, the pit solar still is often used. Solar stills may also come in cone-shaped or box types. Regardless of the shapes and ways of obtaining liquid, the different types of solar stills make use of a single principle. For instance, a survivalist can make use of a clear plastic sheet to

create a solar pit. The radiation from the sun is used to distill water. It is important to take note that the soil also contains a specific moisture level. Vegetation can help in increasing the output of water from the pit. In the desert, a cactus may be used by crushing and adding it to the still's bottom. Water from a contaminated source of water can also be poured into the still.

The shape of the pit solar still can be square-shaped or V-shaped. For instance, a small bowl can be placed at the middle of a box-shaped pit solar still covering the pit with the clear plastic sheet. Sand can be used in order to anchor the plastic sheet. A small rock or stone can be placed in the center of the bowl. As water evaporates and condenses, water will eventually drip from the plastic sheet and into a water container. In order to increase the amount of water that would evaporate an individual may add any fluid that is clean or unclean and vegetation. To draw out water from the solar still, surgical tubing can be used even without removing the plastic sheet.

4. Charcoal Filters

It is believed that charcoal contains elemental carbon, which is found in its graphite composition. Long ago, people have already used carbon to purify water. In fact, charcoal has been used as far back as ancient times specifically in India and Egypt.

Carbon in its graphite form has shown has shown a high surface area per volume. This is to say that one gram of activated carbon can have a surface area of just a little smaller than a 5000-meter football field. A gram of industrially produce carbon equals a surface area of 400 to 1,500 meters.

Carbon filters are usually used in large scale water treatment facilities in various municipalities. Even commercially-bought water treatment systems used in homes make use of carbon filters usually to improve taste and color.

Carbon filters are deemed efficient in eliminating mercury, chlorine, iodine, and other inorganic compounds. Carbon filters can also remove other organic contaminants including volatile organic compounds (VOCs), hydrogen sulphide (H2S) and formaldehyde (HCOH). On the other hand, activated carbon could not blend well with certain chemicals such as alcohols, ammonia, glycols, metals, strong bases and acids, and inorganic substances like lead, arsenic, fluoride, sodium, iron, and nitrates. Thus, carbon would only blend with non-polar materials. In addition, polar materials would still remain in water even if carbon is employed. Many types of pesticides are considered non-polar and organic. As such, they are likely absorbed on the carbon surface.

Based on the EPA National Drinking Water Standards, water contaminants that are likely reduced to standards that are acceptable through activated carbon include chromium, mercury, organic arsenic, inorganic mercury, endrin, methoxychlor, benzene, lindane, 1.1-dichloroethylene, 1.2-dichloroethane, 1.1.1-trichloroethane, 2.4-D, 2.4.5-TP, toxaphene, p-dichlorobenzene, and trihalomethanes.

Building Homemade or Survival Water Filtration Systems

Homemade Charcoal Water Filters

When creating a simple charcoal water filtration system, the materials to be used include:

- A large container
- Lots of charcoal
- Little gravel
- Sand
- A piece of tubing
- Hammer or anything similar to it
- Sharp, metal object like barbeque skewer or screwdriver
- A piece of string long enough to circle the container
- A piece of absorbent fabric (optional)

Given that you are in a survival or emergency situation, it may be difficult to secure these materials. Thus, prior to discussing the steps for creating a simple charcoal filter, several alternatives and ways to secure the materials needed can be used.

For instance, the container can be anything, which is able to hold water and has not been filled up with poisonous or toxic chemicals. The container may be a barrel, 2-liter bottle with cut-off top, plastic storage tub, or a 5-gallon bucket among others.

More often than not, sand can be found near a body of water. You may also find sandbags used to control flood waters. In a survival situation, you may find sand from playground sandboxes in the event that the situation is in a city or non-coastal areas.

You can make use of a small PVC pipe for the tubing. If a garden hose is available, you may cut off a small part of it. If these two options are not possible, you can take a piece from a side of large plastic bottle and form into a tube or pipe.

For the charcoal, you can burn hardwood until it produces coals. Once there are coals, bury the fire with dry soil in order to cool. Dig out the homemade charcoal, which will appear as a crumbly stuff from the dry earth. If charcoal briquettes are available, they should be broken up prior to using them for a water filter.

The fabric can be an old bed sheet or t-shirt.

To build the homemade charcoal filters, follow these steps:

1. Create a hole in one side of your container by using the hammer and sharp metal object. The hole should only less than half an inch from the bottom of the container. If your container is made of plastic, you can try melting a hole through heating the metal object. Push it into the container while it is hot to make the hole. For plastic containers, it is advisable to heat the metal object for making the hole since plastic is brittle and might split if hammer is used upon it.

2. Insert your tubing material making sure that it fits in the hole as tightly as possible. Push the tubing until it reaches the inside of your container.
3. You can now put gravel into your container. The amount of gravel you put in the container should be able to reach the area just above the tube. A thick layer of tightly packed charcoal should be placed into the container. This would fill about ½ to 2/3 of the container way up. Then, add a layer of sand into the container, reaching an inch of the top of the container.
4. The piece of fabric is placed loosely over the filter's top. The edges of the fabric should be draped down the sides of the container. The string is used to tie around the container and over the fabric. It is important not to tie the fabric too tightly so it would sag slightly.
5. You can now use your homemade charcoal filter by simply pouring water slowly over the fabric's surface. The water would drip into the layer of the filter where there is sand. The amount of water to make the filter saturated depends on the size of your container. Once your filter is full, you can now see clean water dripping slowly out of the tube, which is found at the bottom of the filter.

If the situation permits, water from this charcoal filter is recommended for boiling to eliminate any persistent bacteria or viruses given that the charcoal, sand, and gravel would not remove all pathogens. On the other hand, if you have used contaminated water, you would still feel that you have accomplished procuring clean water as soon as it drips from an improvised water filter system.

Meanwhile, if you need to make use of your homemade charcoal water filter, make sure to change the sand and charcoal regularly. Preferably, these materials should be changed once a week.

Survival Charcoal Bucket Filter

The materials and tools used for creating a charcoal bucket filter include the following:

1. Commercial activated carbon, filter carbon
2. ½-inch ball valve
3. 6 to 10 pieces 1/2-inch inner-diameter rubber washers
4. 2 pieces 5-gallon plastic bucket with lid
5. 3 to 4 feet Teflon tape
6. 2 pieces 1/2 –inch PVC elbow fitting, threaded and slip
7. 2 pieces ½ inch female threaded PVC insert connector
8. 1 piece ½ inch male threaded PVC insert connector
9. ½ inch PVC end-cap slip
10. 2 pieces ½ inch PVC bushing, threaded
11. 6 pieces ½ inch inner-diameter vinyl/Tygon tubing
12. ½ inch PVC adapter; male, threaded; female, slip
13. 1 gallon 15-pound pea gravel
14. 2 gallons 30-pound sand
15. 1 gallon 15-pound coarse gravel
16. ½ inch PVC drainpipe, 9 inches long
17. Nickel

18. 15 by 15 inch window screen
19. Drill (sheet metal drill bit, spade drill bit)
20. Box cutter, pocket knife, pliers, scissors
21. Measuring cup 1 liter or larger
22. Sandpaper (medium to coarse)

A charcoal bucket filter can be used in a household of no more than 5 people who want to procure potable water from rainwater but are hesitant to do so due to possible contamination from various factors.

Although it may be quite doubtful to generate water from a slow sand filter in a short span of time, fine sand can serve as an efficient filter through blocking microorganisms that could not fit pore spaces between grains of sand. The design for this charcoal bucket filter is not comparable to full-scale sand filter designs but it is likewise efficient in water filtration.

As part of the specifications of this charcoal bucket filter, it would make use of a multi-layered design in the form of charcoal, which is positioned between two layers of gravel and fine sand. Unlike homemade charcoal water filters, the charcoal used in this design is purchased commercially as filter carbon or activated charcoal. Filter carbon is available in a aquarium supplies shops.

In this design, the quantity of filter carbon to be used is measured in estimates. The design would make use of 1 gram of activated charcoal, which is essential in purifying 1 liter of rainwater. A gram of activated charcoal is enough to purify 10 liters of rainwater. However, the design specifications would make use of a 1 gram to 1 liter ratio since the water will be used for drinking. The charcoal's density is about 500 grams per liter.

This design for a charcoal bucket filter also makes use of a single valve that is installed between the rainwater bucket and the filter bucket. This valve will be the responsible for controlling the flow of water in the system.

For this charcoal bucket filter, drilling 1 to 3 holes in a disk-shaped object such as a nickel is necessary to create a flow restrictor. The disk-shaped objects should fit exactly into the 1-inch ball valve housing.

To support the layers of filtration as well as to keep sand from flowing up into the pipe, rock and pea gravel are used. The sequence of the filtration media should be in the following manner:

Coarse gravel → pea gravel → sand → charcoal → sand → pea gravel → coarse gravel

The layers of sand or gravel should be 2 to 3 inches deep each. In addition, the filtration media should be able to fill up the entire bucket. The sand to be used should be fine-grained. More so, the sand should be washed thoroughly. For instance, if play sand is to be used, it should be pre-washed although it may still need additional

washing in order to eliminate silt. Apart from the sand, the charcoal, coarse gravel, and pea gravel should also be washed prior to using them in the filter.

To wash the charcoal, you can make use of a piece of window screen which is 3ft by 3ft in size in order to wash 1 gallon of charcoal at a time. The bundle of charcoal should be tied with twine. Dunk the bundle several times in clean water. Once the water blackens, discard it and dunk the bundle in clean water again until most of the fine particles are eliminated.

For the filter pipe assembly, you would have to drill several holes into a 9-inch long section of PVC pipe. The filter pipe aids in dispersing the water flow into the bucket. It also helps in even distribution of the materials in the filter media.

Holes are also drilled near the bucket's bas and the lid of the filter bucket. Plumbing joints are used for the holes, using rubber washers that prevent leaks and provide a tight fit in the holes.

PVC connections are all taped with Teflon, which provides good sealing as well as prevents leaks. On the other hand, PVC slip fittings can be made hand-tight to avoid the need for PVC glue.

In order to fabricate a rainwater input bucket, cut an 8 inch circle from the bucket lid. Then secure a 15 by 15 inch of window screen on the bucket's mouth using the lid's rim. This assembly eliminates debris in the rainwater source and prevents clogging in the water filter system.

It is important that the lid of the filter bucket fits exactly in order to prevent leaks when the filtration process begins. In the even that leak is not prevented, Teflon tape can be secured in the gap to seal the rim of the bucket's mouth. However, if the leak persists, soft silicon sealants can be used to seal the lid to the bucket's rim.

Simple Water Filtration and Purification System

A pure water source is a primary concern most especially in an emergency or survival situation. Although you can collect rainwater using a clean container, you may not be sure if there are no contaminants that come from roofing. Any other way of procuring water from natural sources is recommended to be purified through purification tablets, boiling, or iodine. On the other hand, you can make a simple water filtration and purification system through the following steps:

- Using a piece of cloth and cord, you can start creating your container for the system. You can use a forearm of your old shirt or the bottom of a pant leg that you no longer use. Any cloth can be used just as long as it is open-ended. You can also peel a piece of bark from a tree, shaping it into a cone to hold the filter's contents. Vines can be used to secure the piece of bark together.
- In order to allow you to place contents on the filter, tie the bottom of the container as tightly as possible. Make sure that water can seep through the

bottom down to the collection container.

- A looped cord is tied to the container's top. Hang the container to a tree limb at around chest height.
- Place a layer of stones or small rocks in the container's bottom in order to hold the rest of the contents.
- Layers of sand, charcoal, and grass alternating each other should be put into the container. At least two layers of each material should be put into the container. You may have to leave sufficient space at the top of the container for a certain amount of water.
- You are now ready to pour water into the top of the water filtration system. The water, regardless if it is stagnant, muddy water or rainwater should begin to pass through the filter slowly once you pour it into the system. It should be able to drip from the bottom of the filter into the collection container. You might need to do this several times and finishing the process may likewise take a few hours to filter and purify water.
- Once you have secured your desired amount of water in your collection container, boil it over fire to eliminate any persistent parasites or pathogens.

Simple Sand Water Filter

It is important to know how to create your own water filter especially if you are in a survival or emergency situation. There are various ways to make water filtration systems. One of the most common ways to create water filtration systems is using sand. In fact, the nature's way to purify is sand. As such, it is preferable to know how to create a simple sand water filter. The steps are as follows:

1. You would need a container. It is best to make use of a large container such as an empty can or plastic bucket. Once you have secured a container, punch at least 5 holes it its bottom. If you are making use of a plastic bucket or bottle, cut the end of the bottle evenly. On the other hand, if you cannot find a container, you may make use of any material that you find that is similar to a container.
2. You should make sure that the sand is sealed or stopped from getting out of your container. Some of the best filter materials that you can place at the container's bottom include a grass mesh, cotton material, or pebbles.
3. After putting sand at the bottom of the container, you should now add a layer of gravel. Gravel is used to make the filter material stronger as well as prevent the sand from mixing into the water.
4. To top the container, add another layer of sand.
5. Pour the water you have collected from rainwater or roofs into the filter. You should have another container for water collection. The water that would come out of the filter should be clear. If you still see that the water is cloudy, you may have to go through the filtration process again.
6. After you have collected water from your simple sand water filter, you are now ready to purify it even more by boiling it over heat.
7. If you choose to improve your water filter, you can add a charcoal layer between the layers of sand and gravel. You can obtain charcoal from your fire by crushing it into fine gravel-sized particles.

Improvised Charcoal Filter

In a survival situation, water is inevitably an important necessity. During this type of situation, it is safe to assume that any water coming from the ground is not safe to drink. As such, you need to filter and purify it prior to using or drinking the water. The best way to ensure that all pathogens are eliminates is to boil the water.

On the other hand, you can also make use of an improvised charcoal filter to remove particles such as sediments and other harmful contaminants to ensure drinking clean water as well as improve its taste. Charcoal has been used in most household and in country water filters.

To create an improvised charcoal filter, you need to secure a 2-liter plastic bottle although a sheet of tree bark can also be used. You can also make use of a clay pot that has a hole in the bottom. Other survivalists have come up with various alternatives such as a glass bottle with removed bottom and a length of cane or bamboo.

Steps for Improvised Charcoal Filter:

1. Acquire charcoal which has already cooled completely. You can obtain charcoal from a camp fire and come up with a coal bed. You need to cover coal bed with ash or dirt and leave it for at least 2 days. Once you uncover the charcoal, make sure to let it cool completely prior to removing it from the coal bed. Crush the charcoal in small parts preferably the size of aquarium gravel.
2. Secure a container with open ends. It is advisable to look for a container that is tall rather than wide.
3. Fill the opening of the container that has a smaller size with a piece of fabric. If both the openings are of the same size, just choose between them. Filling the smaller opening of the container can prevent the charcoal from coming out of the container or running through the water.
4. Make sure that you pack the crushed charcoal tightly into the container. You should be able to make a fine matrix so that the water can drip very slowly, blocking sediments or other contaminants. Once you see that the water runs through the container instead of dripping, you need to pack the charcoal tighter. In addition, you also have to fill your container with crushed charcoal halfway.
5. Put the filter on top of another container used for collecting water from the improvised filter. If you are in a survival situation, it is most likely a pot or anything that can catch water. Once this is done, you are now ready to filter the untreated water either from rainfall or other available sources.
6. Slowly pout the water into the improvised filter. Be careful not to make the sand unstable. Fill the remainder of your container with water allow it to saturate slowly. The water should drip and not run through the bottom of the filter.
7. When all the poured water has dripped through the filter, you may pour it back as many times as necessary to make the water clear.
8. If you have already achieved your desired clarity of water, you can start boiling it to ensure it is free of bacteria or any viruses. As mentioned earlier, boiling is the

safest way to eliminate pathogens.
9. For improving the taste of the water, you can add a small piece of charcoal while boiling the water.

Solar Still Pit

The materials include a container, knife or any sharp-edged object, tree bark, cordage (vine), small stones, grass, sand, and charcoal. The steps in building a solar still pit are quite simple:

1. Use the knife or sharp-edged object to cut the tree bark horizontally. The bark should be at least 14 inches. Below the first cut, make another horizontal cut that matches the start and end points. Cut vertical marks in order to connect the horizontal marks. The bark should come up in one piece.
2. Roll the bark inward similarly if you are trying to roll up a newspaper. The bottom of the bark should be rolled tightly. Leave an opening as small as a penny. You should now form a cone-shaped tree bark.
3. Tie the cone using the vine to hold it together.
4. Add several stones in the cone's bottom to hold the filter materials.
5. Fill the cone with layers of grass, sand, and charcoal alternating each other.
6. Pour water into the top part of the cone. Let the water drip to the bottom of the cone.
7. Collect water from the filter using another container. Repeat until desired clarity is obtained.

Chemicals that are Safe to Use for Water Filtration and Purification

In normal circumstances, water filtration is usually done by using high-quality water filters. Hand-pump filters are often used in homes. These commercially-manufactured filters are efficient in separating clear, clean water from its source water, which may be tainted with microorganisms. On the other hand, these filters cannot eliminate toxic-dissolved substances or chemicals. As such, you need to take note of the source from which you acquire water.

The advantages of high-quality water filters include portability, easy to operate, and long-lasting. However, if you do not have enough strength, these filters may be slow and difficult to operate. In addition, they are quite expensive; thus, you would need a larger amount of initial investment as compared to building homemade filters.

Although you can build your own water filtration system, most campers and trekkers carry with them portable water filters, which are available in most camping shops. The price of portable water filters ranges from $35 to $250. There are also cheaper models of portable water filters but they are slower to operate and heavier in weight.

When used alone, commercially-manufactured filters are efficient in removing almost all particulates except some types of viruses. However, to obtain best results, it is

advisable to pre-purify the source water before using it with the filter. Combining mechanical and chemical filtering often results in water that is free from sediment and biological contaminants. For instance, iodine crystal solution or saturated iodine is efficient in eliminating microbes apart from being more potent as compared to chlorine. Saturated iodine is stable, inexpensive, and portable. However, it should not be consumed by people with thyroid problems, pregnant women, or anyone for over 14 days.

The safest chemicals that can be used to filter and purify water include the following:

1. Polar Pure – This chemical is made of crystals that are bottled permanently. Prior to using it, Polar Pure should first be dissolved in water partially. This is done by filling the bottle with clear water, which is not necessarily pure. Shake the bottle and leave for an hour. Although the crystals would not dissolve completely, there will be enough iodine in the solution. Since Polar Pure can be bought in a bottle, you should not drink straight from the bottle. Polar Pure is an additive to purify water and not water itself.
You can use it by pouring the source water into a container and adding the solution as indicated in its bottle. You should take note that iodine is dependent on temperature. A thermometer on the bottle's side indicates the capfuls of solution required to a quart of water. If the source water is cloudy, it is best to double the dosage. After covering your container, shake well and wait for at least 20 minutes. You may not like the taste and odor of the iodine; however, you can mix the resulting water with your preferred powdered drinks once purification has been completed.
2. Iodine Tincture – This is the liquid, which is normally available and sold in pharmacies. Iodine tincture is placed in small opaque or brown bottles and used for treating cuts or bruises. According to experts, iodine tincture can be an efficient killer of microorganisms although some health advisers strongly oppose to its use. This is because it contains isopropyl alcohol. On the other hand, when using iodine tincture, make sure it is the product intended for purifying water and not for some other purposes.
3. Household Clorox Bleach – In general, bleach is a very efficient disinfectant, which is most likely available in your home. Apart from being inexpensive, with just a gallon, it can treat 4,000 gallons of water. It is safe to drink as long as it is consumed in small quantities. Bleach can degrade to salt over time. However, its strength also weakens over time; as such, it should be replaced for no longer than 6 months. When using bleach for water filtration and purification, choose the product that is unscented and having no additives. The chlorine bleach should only have sodium hypochlorite in its solution, which is no more than 6%. Thus, make sure you check the label first. You can add bleach to the clear source water depending on your desired quantity of resulting water. For a quart of water, add 2 drops; for a gallon of water, add 8 drops; and for 5 gallons of water, add a teaspoon. For cloudy source water, double the dosage. You may notice a slight odor of the bleach. You can mask the taste and odor by mixing the resulting water with powdered drinks.
4. Germicidal Tablets – Also known as hyperiodide tablets, they are available in many wilderness supply shops or camping stores. It is an inexpensive alternative

to high-priced water purifying tablets. Germicidal tablets are usually available in 50-table bottles that are able to treat 25 quarts of source water. Some products come with iodine taste neutralizer. Two tablets are added into a quart of source water. Once you have shaken your container, wait for 30 minutes. If it comes with neutralizing tablets, add 2 tablets to a quart of water after it has been purified. Shake well and wait for 3 minutes prior to drinking it. It is still has odor and taste of iodine, you can mix it with powdered drinks.

5. Non-scented Chlorine Bleach – This type of bleach can make water potable by adding 16 drops or 1/8 teaspoon to a gallon of water. Shake well and leave for about 30 minutes. If the water has slight chlorine smell, it means the water can already be used. If a faint smell of chlorine is not obvious, then you have to repeat the entire process. On the other hand, if the water is cloudy or excessively cold, you should double the dosage. Once you open the bottle of bleach, its full potency will only last up to six months. Although bleach is inexpensive, it has a limited shelf life; thus, its potency degrades.

You also have an option to make your own bleach mixture. You can make use of calcium hypochlorite, which is also commonly known as pool shock. According to the Environmental Protection Agency, you can make bleach mixture by adding or dissolving one teaspoon of calcium hypochlorite for every two gallons of water. In other amounts, you can add 7 grams of high-test granular calcium hypochlorite to 7.5 liters of water. The mixture will result to a stock chlorine solution, approximately 500 milligrams per liter. This is because the calcium hypochlorite contains chlorine that is equal to 70% of its own weight. In order to disinfect water, you can add the solution in the ratio 1 is to 100 (chlorine to water). Approximately, this is equivalent to adding 16 ounces of chlorine to every 12.5 gallons of water. To eliminate chlorine odor, you may pour the disinfected water back and forth from one container to another.

6. Water Purification Tablets – There is a wide range of water purification tablets available in almost all camping stores and wilderness supply shops. Although these tablets are capable of purifying water, you can only purify small amounts at a time. If you choose it as your only purification method, it may take a few tablets and more than two days to have enough supply of water.

Tips on Knowing if Water is Drinkable and Usable

There are several ways to know if the water you are about to drink is potable and usable. First, you need to know your water. This means that you need to test the source water prior to determining what types of microorganisms, microbes, or contaminants it contains. This way, you would know what type of filter is best to use for the water.

Second, master the art of boiling. It has been said time and again that boiling is the safest and most efficient way to treat water. In fact, even the Federal Emergency Management Agency attests to this. You simply need a kettle or pot in which you can bring the water to a boil. Once the kettle heats up, you would notice bubbles and steam coming out of the vessel. Let it stand for a minute. Also, you need to consider that some of the water will evaporate and would lessen your supply if it boils for long

periods. Let the water cool to your preferred temperature. You may notice that boiled water tastes better if it is re-oxygenated. This is done by pouring the water back and forth between 2 uncontaminated containers. You can also treat water with bleach to eliminate persistent bacteria or critters. There are unscented varieties of bleach that contains 6% sodium hypochlorite. Purchase only small bottles of bleach since once a bottle is opened, its potency decreases. More often than not, the potency of bleach is only up to six months. You may treat water with bleach by adding 16 drops to 1 gallon of water. Stir and leave for 30 minutes. It is advisable to use ceramic filters because they are said to provide protection from bacteria. In addition, ceramic filters do not require too much energy. In fact, it only makes use of gravity. As water is poured in the top of a ceramic filter, the bacteria can no longer go back to the top.

Distilling water can also get rid of microorganisms, which may still survive even after boiling, bleaching, or employing other filtration and purification methods. Distilling water can eliminate salts, metals, and other pollutants that can be harmful to one's health. In general, the process also involves boiling the water to remove anything that is left behind. Once boiling is done, the vapor is collected and the water is allowed to condense back into liquid water. You can also build your own distilling system. This may be done by suspending a cup, attaching it to a large lid from a pot. Put the layer of water in the pot's bottom and boil for about 20 minutes. Once the pot cools down, the water which drips to the cup has already been purified. If you do not have a heat source, you can also purchase an ultraviolet light for use in your home or when you are out in the wilderness. An ultraviolet purifying unit is available in most camping stores. It is basically a bottle that has a small light source, which is inserted into the water. The radiation eliminates most microbes from the water in just 30 to 80 seconds. Although ultraviolet purifying units cannot eliminate impurities like metals, dirt, or chemicals, you can combine this method with another one to obtain clean water.

Conclusion

Water is considered as the most important substance ever existed given that all plants, animals, and human beings need it in order to survive. Apart from drinking it as part of the body's sustenance, water is used for other purposes such as washing our bodies, cooking, washing clothes, keeping houses and communities clean, recreation such as swimming pools, and keeping plants and animals alive. Water is very important for the growth of farm stock and crops as well. In addition, water is used to manufacture many products that human beings use.

Three quarters of the Earth is believed to be water. There are various sources of water include brooks, rivers, springs, waterfalls, oceans, and seas. Man-made water sources include water dams, artesian wells and deep wells. Thus, water is everywhere; however, not for long. This is because of global warming as well as the improper use of most water sources. For instance, most people misuse water and waste it by allowing it to continuously flow in faucets even when not in use.

It is very important that the water that we drink as well as use for our daily activities is clean. Clean water means being free from chemicals and germs. More so, clean water should be clear instead of cloudy. Potable water is the term used to describe water that is safe to drink. Based on history, there may have been hundreds, if not, thousands of people who may have died due to contaminated or polluted water.

Clean water is very important when it comes to survival. Although storing water in large quantities may be one of the primary steps included in a contingency plan, you still need to have knowledge on how to make water potable and usable. In today's modern world, only a few people have the initiative to store water before, during, and after a disaster or survival situation.

In almost all circumstances, it is always best to be prepared and knowledgeable. Given that it can be difficult to find pure water due to the advent of different technologies that make use of harmful chemicals and substances, affecting natural water sources, it is advisable to know how to make water potable and usable.
Prior to going through a survival or emergency situation, it is recommended to prepare everything you need for water supply. For instance, it would be nice to have a basic ceramic filter in handy. Although it is a simple way to eliminate bacteria, it can be very efficient.

It is also good to stock up on bleach. As mentioned in previous sections, bleach is efficient in filling many types of microorganisms that are harmful to your health.

Boiling water, as repeatedly discussed in most sections, is the safest and most efficient method to purify water. As such, you need to have knowledge on how to boil water the proper way. In addition, you also prepare the things that you might need for boiling water in case of emergency or survival situations. Naturally, you need a pot of water to boil for at least a minute. Let the water cool until the temperature is ready for drinking.

Most third world countries are already using five-gallon buckets for their water filtration systems. Making use of five-gallon buckets is the cheapest and simplest filtration system yet can be very efficient specifically when combined with local materials such as bio-sand filter. Based on studies, this filter has proven to eliminate 90-99.9% of harmful contaminants and disease-spreading agents. More often than not, this type of filter can eliminate a large amount of heavy metals from water. In other countries, the most common filtration systems that are being used include solar disinfection and chlorination. These systems are considered less effective yet cost more than other filtration systems.

Given that you cannot tell when you might encounter an emergency or survival situation, it is best to be equipped with knowledge on how to build your own water filtration system. For instance, you can build a five-gallon bucket bio-sand filtration system by using pieces of PVC pipes and buckets.

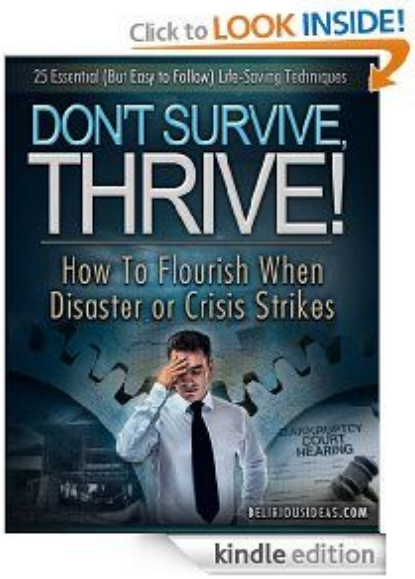
On the other hand, if you want to come prepared for any given circumstance that may necessitate for water, it is recommended to build a long-lasting filtration system similar to a Berkey-style filter. You would also need 5-gallon buckets for this but would save you as much as $100 instead of buying a full filtration unit.
To get you motivated, you should always bear in mind that your life and the lives of your loved ones are at stake if you drink and use contaminated water. It is best never to take chances. Know your water source and the type of contaminants that may be present in it. Learn the proper ways to build even a simple water filtration system that you could use in any given situation, normal circumstances or emergency situations. Keeping in mind that contaminants and pathogens in water can be very fatal to your health. As such, you need to know the best filtration methods that may be available under any circumstance.

I hope you enjoyed the book as much as I enjoyed writing it. And, more importantly, I hope you've learnt some important water survival skills. Remember, *'failing to plan means planning to fail!'*

Donald Langley

P.S. Do check out titles from my colleagues below:

#1 **My original book on preparing for disasters:**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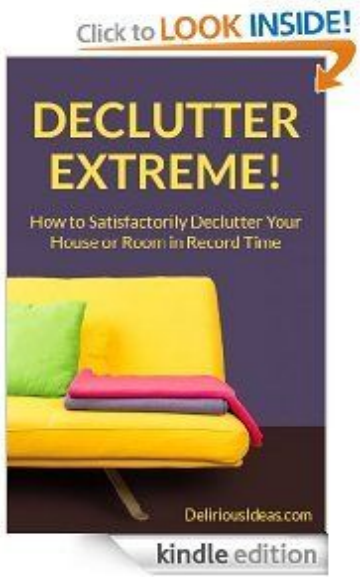
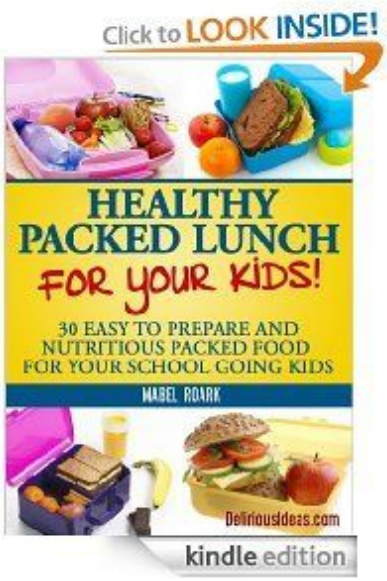


#3 NEW- [Healthy Packed Lunch for your kids!]



 # 4 - Herbs That Heal! – [Extremely useful if you're in the wild with nothing to eat!]