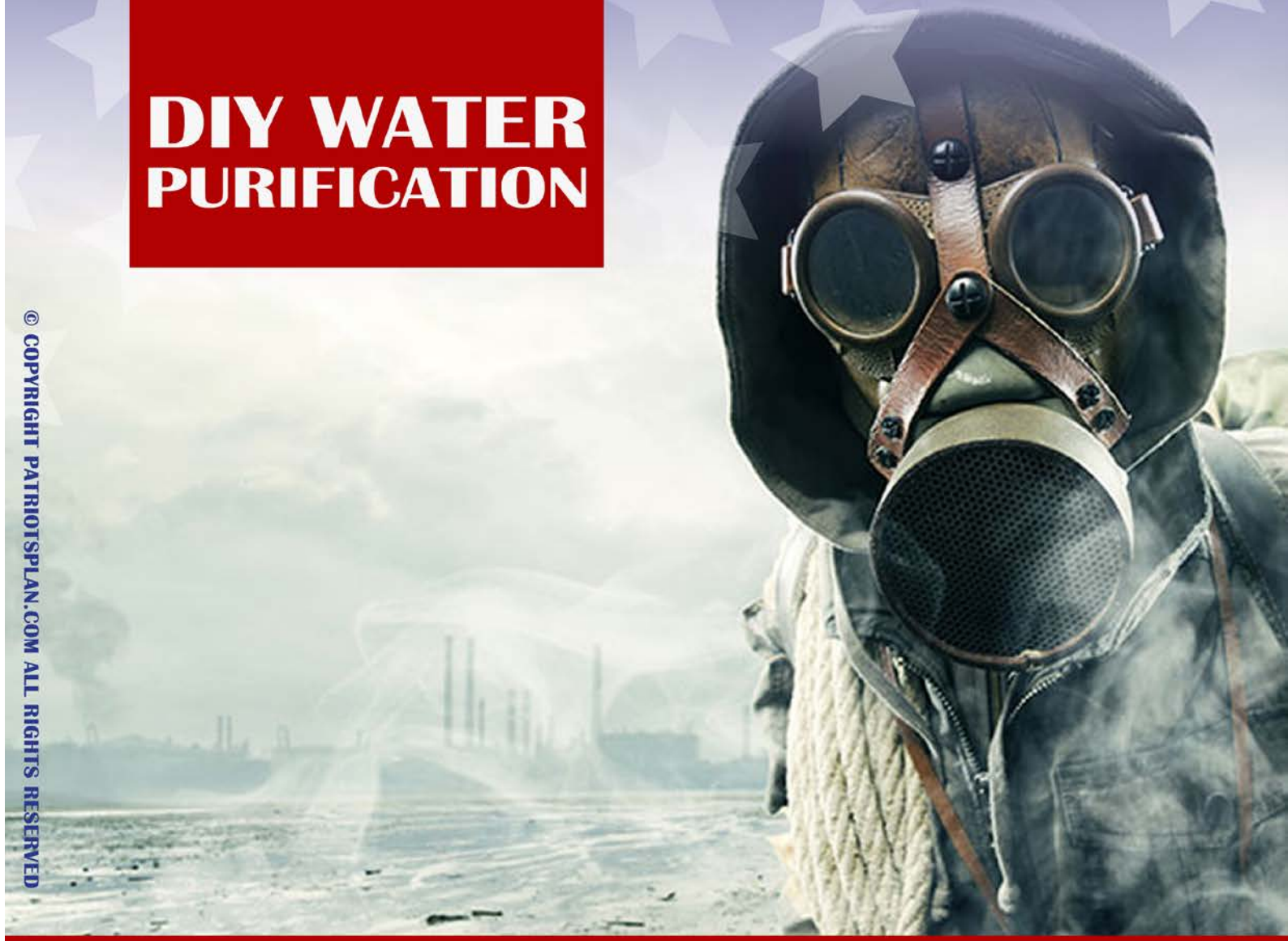
PATRIOTS PLAN

DIY WATER PURIFICATION



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Water is essentially one of the most important elements supporting life on Earth.

There's no doubt that water is extremely important to our survival. It has helped form the Earth as we know it, and it covers over 70% of the Earth. Even where there is land, much of it is covered in ice, which is obviously just solid water. The importance of water is clear to us in many ways, and we can't overlook it.

Water helps by transporting nutrients, dissolving essential elements and replenishing organic matter in soil, similar to its function in our body. It also has the function of cleaning up waste material and thereby ensuring active functioning of various systemic processes.

With the rising population it's not surprising that we have taken ground water for granted in the last few decades. We have severely underestimated our own capacity of exploiting this seemingly abundant resource that has now given in to our indiscriminate use.

However, fresh water is an extremely finite resource. More than 31 nations are facing an acute scarcity of clean and hygienic water.

It is also a known fact that by 2025, more than two-thirds of the world's population would suffer from serious trouble due to a scarcity of fresh water.

And despite all of our knowledge and efforts, we are falling prey to the water crisis and are only making it worse day by day. Our increased industrial activity has been polluting our water supplies and the dwindling of this resource is becoming a continual problem for our futures.

Think of a situation where you do not get enough clean drinking water because your primary source has dried up. And another situation when you somehow manage to get a supply of water, but the water is polluted and infested with contaminants. Scary isn't it?

When you face a water crisis it's likely that you will imagine a sincere government and an efficient red cross to come to your rescue. But, what if they don't? It is known that they have repeatedly proven to be incompetent in solving several crises that the world has faced till date. Once more wouldn't harm their reputation much! Also, we are not trying to say that these setups won't help or are dishonest. But many times it could be just as possible that they are helpless too!

Several disastrous situations in the past were unavoidable despite knowledge and preparedness of more than one government. Hurricane Katrina that killed thousand is just a single popular example.

But after the winds died down, much larger problems had arisen. People were left waiting at their homes without clean water or food. They waited, hopeful that someone would rescue them. Others however, could not be saved.

Lots of help was available, but due to the magnitude and scale of the devastation, it wasn't nearly enough for everyone. Also, to restore life to a regular and normal pace, it takes more than a couple of months. In the meantime, where would you find clean drinking water? You might still survive on small amount of food, but without water, you wouldn't have any hope of survival!

Is the water is safe to drink?

There are several safeguards certified by the health department and public water safety officials in order to ensure hygienic drinking water. But, during a natural disaster, you cannot expect the safety protection to work on regular terms.

In fact, supplies could either be cut off or become contaminated during a crisis. Then, water becomes the number one priority.

In such a situation, it would be best to depend on oneself than the government or any agency to bring you safe drinking water. Also, remember these are the typical times when diseases like typhoid, dysentery and hepatitis get more prevalent. In such a situation, only a fool would take a chance with his family's well being and health.

During an emergency caused by a natural disaster, you can never be too sure of the quality of water. You just won't find clean and safe drinking water at these times. Any available water needs to be purified before drinking. And this has to be done without exception.

Purification of water essentially means removing potentially dangerous agents from the water. In general, there are three types of pathogens that carry diseases through impure, infected water. They are protozoa, bacteria and viruses.

Protozoa are often found on insect bodies or in cysts on the external font of animals. Ameoba, Giardia and Cryptosporidium are the most common protozoans. They range in size from 1 micron to 100 microns with an average size of 16 microns.

These can easily be neutralized in water by means of boiling. Some commercially available filters have been found to be extremely effective in killing these germs because of their size. Some protozoa however have been found to be resistant to both chlorine and iodine treatments. In fact, an estimated 90% of United States' water has been found to be infested with protozoa.

Bacteria on the other hand, can exist both in water and in air. Its average size ranges between 0.2 microns to 1.5 microns. However, there are bacteria that have known to be as large as 10 microns. The best way to rid drinking water of bacteria is boiling. They are even removed very effectively by treating water with chemicals or through filters.

Also, not all kinds of bacteria are life-threatening. The most common diseases

that are caused due to bacteria and are carried by water are dysentery/diarrhea, typhoid, vibrio cholera, campylobacter, polio myelitis salmonella and E. coli.

Viruses are the third kinds of micro organisms that cause water borne diseases in human beings. Most common viruses are hepatitis, yellow fever, rotavirus and Norwalk. The size of viruses is much less than that of bacteria and the average ranges from 0.004 microns to 0.1 microns.

They can be easily eliminated by boiling or chemical exposure. However, filters are usually found to be inefficient. This is because of their extremely small size. But despite that, some viruses can be filtered out as they stick to other larger particles.

Depending on the pathogen ingested, its mode of attack, the organ or system of our body it attacks etc. the incubation period just before falling extremely sick could vary from a couple of hours to weeks. This also depends vastly on the concentration of the pathogens ingested.

Regularly observed symptoms common to most pathogen attacks are fatigue, fever, muscle cramps, dysentery/ diarrhea, dehydration and nausea. If proper and timely medical care is not provided to the patient, it could even result in death.

Living in a remote area where access to a qualified doctor is more difficult than otherwise, could mean that you need to take some extra care against such pathogen borne diseases.

Prevention is better than a cure and you could prevent these situations by staying warm, rehydrating yourself with lots of water, safe fluids and taking adequate rest and nutritious food. Diarrhea could easily be controlled and reduced considerably by use of anti-diarrheal drugs available at any pharmacy over the counter. Pain-relievers bought over the counter could also be used to lessen the pain and other discomforts involved. In any case, it is suggested that the patient be rushed to a local medical practitioner as soon as possible!

Below are some ways in which you could purify water

Clean water is needed for the following purposes:

- For drinking
- For making beverages
- For cooking
- For brushing water
- For washing hands, face and feet
- For washing clothes, utensils and other commodities

In case you find cloudy or muddy water that is highly turbid, it is suggested that you allow it to stand in a large pot for twelve hours so as to allow the mud particles to settle down at the bottom. Then gradually, tilt the pot slowly so that all the clear water is taken out without mixing it up with the sedimentation at the bottom.

Whatever technique you use to purify water, you can use the same first step to remove large sediments. Pour the water through a standard paper coffee filter or layers of cloth.

The same filter could be used multiple times for several days. When the water is too muddy and too much dirt sediments, the filter could either be washed and cleaned or replaced as necessary.

In the next stage, you could follow one of the following techniques to make your drinking water safe.

1. Boiling

Protozoa, bacteria and viruses can be killed effectively by boiling. However, boiling is inefficient against any harmful chemicals or radioactive particles present in the water. Boiling is by far, the best way to kill all the pathogens present in water. Not even the best filter can claim to do the same.

Let us now have a better understanding of the process of boiling.

It is a known fact that all pathogens die at 185°F, some even sooner.

Therefore, even before water boils, most of the pathogens are killed by heat.

By allowing water to boil and letting it hard boil for a minute, ensures that all the pathogens are killed. If you are on the top of a mountain, with low barometric pressures, you might need to hard boil water for a couple of minutes. However, you must remember that boiling water for a longer time doesn't make any difference as most pathogens are already killed by then. It only results in a loss of water as steam. It also makes water taste flatter due to excess heating.

After boiling you would need to allow it to cool down for a while before it could be used for drinking.

However, the taste of boiled water could be improved by the following few methods.

- Stirring the water in order to add oxygen back.
- Pouring the water several times from one sterile container into another
- Addition of a pinch of table salt
- Addition of 50 mg of Vitamin C to a quart of water

- Addition of Kool-Aid (10% Vitamin C) or Tang (100% Vitamin C) to the water.

2. Usage of Liquid Chlorine Bleach (Sodium Hypochlorite)- Strength - 5.25% or 6%

This method effectively kills Bacteria and Viruses. However, it is not effective against all kinds of Protozoa. Also, it does not neutralize harmful chemicals or radioactive particles.

For water that is relatively clear you could use 2 drops of bleach for every quart of water or 8 drops for every gallon (or around 1 teaspoon for every 10 gallons of water).

For water that is cloudy it is suggested that you use 4 drops of bleach for every quart of water or 16 drops for every gallon (or 2 teaspoons for every 10 gallons of water).

You must make sure that the water is never too cool. The temperature must be maintained at about 70°F at least. Direct exposure to sunlight could be an easy method to increase the temperature of water. This is because the effect of chlorine on pathogens decreases considerably at lower temperatures.

Addition of a few drops of chlorine or liquid to the water for an hour allowing the bleach to kill all micro organisms. If a faint smell of chlorine can be detected at the end of one hour, then the water is safe.

If the faint smell of chlorine cannot be felt, it is suggested that you add a little bleach to the water again and wait for an hour. If despite adding bleach a couple of times, the water doesn't faintly smell, then it is better discarded as it contains too many pathogens.

It is recommended to use as little bleach as possible and add more as necessary within the prescribed limits.

3. Addition of Dry 68% Calcium Hypochlorite Granules

This is also called the shock treatment chemical. It is used in swimming pools and kills Bacteria and Viruses. It is not effective against all Protozoa though and does not neutralize chemicals and radioactive particles.

You must take care and see that the water is never too cool. The temperature must be maintained at least about 70°F. Direct exposure to sunlight could be an easy method to increase the temperature of water. This is because the effect of chlorine on pathogens decreases considerably at lower temperatures.

Add about a pinch of 68% Calcium Hypochlorite granules to one gallon of water and allow it to settle for an hour. If a faint smell of chlorine can be detected, the water is safe for drinking purposes. Otherwise, you might need to repeat the process starting from a small amount of the chemical, slowly adding it in pinch amounts.

Dry granules have a longer shelf life compared to the liquid bleach and are therefore more preferable compared to the latter for use during emergencies.

Liquid Bleach can be made by dissolving one ounce of 68% Calcium Hypochlorite granules in one pint of water. This will give you a 5.25% liquid bleach solution.

4. 2% Liquid solution of Tincture of Iodine

This is effective for killing Bacteria and Viruses but doesn't work on protozoa and does not neutralize chemicals or radioactive particles.

- For relatively clear Water 4 drops of iodine for every quart of water or 16 drops for every gallon may be used.

- For muddy or cloudy water 8 drops of iodine for every quart of water or 32 drops for every gallon may be used.

You must take care to see that water is never too cool. The temperature must be maintained at least about 70°F. Direct exposure to sunlight could be an easy method to increase the temperature of water. This is because the effect of iodine on pathogens decreases considerably at lower temperatures.

Care also needs to be taken to ensure that the expiration date mentioned on the bottle is not compromised. In general, iodine cannot be used for long-term plans of treatment of water.

It is important to note and remember that iodine water treatments could be extremely harmful for pregnant women, nursing mothers or people facing hypo or hyper thyroidism. Besides that, long-term use of iodine could result in liver damage.

Despite being an efficient way to purify water, using iodine is definitely not a very preferred method. The methods mentioned prior to this are easily better.

5. Commercial Water Purification Tablets

Most of the commercially available water purification tablets use either chlorine or iodine as a primary active ingredient. But the disadvantage with either chlorine or iodine is that they have a relatively short shelf life after which they begin to lose their full effectiveness on pathogens. Water purification tablets that have passed their expiration date should be replaced as soon as possible.

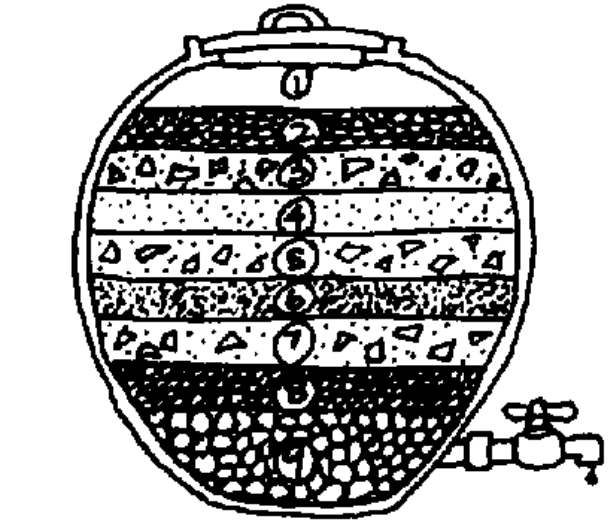
Care must be taken to check that you do NOT re-contaminate your pure water by a touching it with a pot, or spoon, or anything else that has been in contact with the impure water.

6. Water filters

By far, the best method for killing the germs present in water is to use a water filter that is commercially tested and proven. The only problem associated with this could be that, this is an expensive method. However, if you could build your own water filter, nothing like it!

The clay pot biological filter:

You could use a clay pot biological filter to make drinkable water from water that is extremely polluted and contaminated. The design is easy to build and is inexpensive. It is also environmentally healthy and sustainable with local resources. Clay pots and sand, which attract biological resources that colonize the pots, are used in this model.



Construction

A large clay pot also known as a Nadi is used. This is around 32 to 34 inches tall. On one side of the nadi a hole is carefully drilled using a suitable tool. The height of the hole must be around 20 inches from the bottom.

A stiff pipe on 30 inches length and 1 inch diameter carefully chosen without any splits is fitted through the hole with one end in the nadi and the other just touching the bottom. This is first fixed in place and then, the hole that is around the pipe is covered completely using cement to prevent any leaks.

Below the nadi is a storage pot and even this must be chosen carefully. If you plan to have a nadi with a tap, carefully see that the tap is high enough to put a jug under it for collecting water.

This clean water nadi is to be placed on bricks or a small stool so as to give it the necessary height. Also, the protruding pipe of the nadi must be just above the storage nadi.

Wash some stones the size of potatoes with clean water and place them in one layer inside the nadi. They should form the bottom most layer. The gaps between them should form convenient channels for the water flow.

Small stones are filled in the gaps between the large stones so as to form a layer stopping the next layer of gravel from sliding down into the water and clogging up the pipe.

A layer of dhal sized gravel is formed as a layer is spread on this uniformly so as to reach a leveled surface over the small stones. Over this, a layer of seed sized gravel, carefully washed is placed.

These layers used for drainage must not be more than 4 inches in total height. Otherwise, they will block space from the main material to be filled in the pots which is well washed sand. 5 inches of this washed sand is filled up

to a height just below the height of the pipe reaching in the inner side of the nadi.

The Matka or clay pot is chosen for collecting water. In the matka, a small hole is made using a 3 or 4 inch nail that is bent at right angles forming a handle. This might be a little difficult to do but after a couple of trials, you might be able to do this with a help of a hammer. It is advised to use a nail instead of a screw driver as nails would ensure smaller holes.

Ideally, the hole must be made on the bottom side of the matka at about 4 inches on one side. Care must be taken that this hole doesn't get blocked too often by the sedimentation in the matka.

Then, tie the matka above the nadi, in place, the hole of the matka and pipe from the pipe in line.

In a way that the hole in the matka is seen clearly, a stone is kept between it and the nadi. This helps you to know when the holes of the matka are blocked.

The matka is to be fixed firmly using a string so as to protect it from the microbes that are good for human ingestion.

Tie a cloth over the mouth of the clean water collection and storage pot so that the cloth extends over the pipe protruding out. Care should be taken to see that the cloth does not extend on to the flowing water and this could result in re-contamination.

Alternatively, you could cover the matka with a thin cloth or paper film, to keep the debris off.

Usage of the nadi:

Add dirty water carefully to the nadi once every day and continue doing so for a couple of weeks. As long as the sand is left undisturbed, the filter would work efficiently.

Water will begin improving during this filtration period. By using sand and stones that are carefully washed, fresh and clean water could even be obtained in the very first day.

The clean water collection and storage pot must be emptied as often as every three days in this time, as this time crucially improves the quality of water in the pot.

Care must be taken to see that you never use the clean water collection pot to collect dirty water. Care must also be taken to check for leaks in a new nadi before using it for filtration. Leaks if any must be sealed with cement.

New nadis must never be filled fully with water as they could develop cracks. The best way is to first fill only until half the total height and slowly add water checking for leaks in between.

If you notice that the water is not flowing down quickly, you could remove two inches of sand from the nadi. This sand has to be washed in clean water and should be put back into the pot again.

Care must be taken to ensure that the level of sand in the nadi is at least 5 inches below the level of the pipe.

When the filter is full used up to its maximum extent, it is suggested that another filter is used in its place for a couple of weeks while the sand in the filter can be changed and the system reset.

<u>These few pointers must be kept in mind while using a nadi for filtration:</u>

The layers must be carefully placed so as to ensure that the water passes through all of them definitely and gradually.

Only then will the water get totally rid of harmful microbes and the goodness of the beneficial microbes. Carefully see that there is not shortcut for water without passing through the layers.

The depth of sand must be just about 12 inches. This ensures that water is purified to the best advantage with the beneficial biology.

The diameter of the filter on the inner side must be about 10 to 14 inches. This setup could conveniently be used for 15 liters of water to pass, in the first 30 minutes.

Carefully check that the hose doesn’t have any joins or splits. This helps prevent re- mixing of the purified water with contaminated water.

The outlet of the hose must be around 5 inches about the top of the sand.

Also, please note that the beneficial microbes are aquatic and can survive only in the presence of water. Therefore, sand must always be immersed under the water level.

The surface of the sand must not be disturbed by the turbulence of the water flowing in or it could tamper with the beneficial biology.

A hole in the main container is to be made with a low pressure seal. This is easy to achieve and also makes the leaks less significant. A poor seal at this point does not contaminate the filtered water.

A small hole must be made in the top pot using a 3 inch nail. This helps in controlling the speed and force if the water flowing in. This also helps in keeping the top layer of sand undisturbed.

Carefully check that the lowest point of the top pot is at least 10 or 12 inches over the level of the pipe exiting the filter. This helps in controlling the water pressure that drives the filter.

Care should be taken in choosing a right place to fix the top pot so as to ensure that the sand is not disturbed.

Clean water must be stored safely in a closed container and must be protected against re-contamination.

A light weight cloth may be used to cover the top nadi in order to prevent any leaves from blocking the small hole.

A reasonable gap should be maintained between the top nadi and the filter to allow free air and oxygen flow. Water flowing in might also considerably block the small hole, and this must be prevented.

I hope this guide has given you some insight into how you can easily purify water so that it's safe to consume in times of crisis.

Remember, the easiest option is to store clean drinking water for times of crisis. You should store your "crisis water" in a dark cool place for longevity. But, if you run out of bottled water the above purification options will help you stay healthy until you have a new supply.

Water Storage

When you have plenty of water, save some for the future- It is by far the easiest way to keep some water for yourself for difficult situations.

Sinks, bathtub and large containers are often good storage vessels. You might not have large five gallon containers at hand, like some people do, but fill whatever you have and store.

All you've got to remember is to use food-grade containers for storing water. If not, this water must not be used for drinking and should rather be used for sanitation.

Make way while the sun shines, and save water when you have plenty. You wouldn't want to find yourself without water during a potential crisis!

Also, be prepared in advance, as in the last minute, everyone will want stock for themselves and you might miss out.

Where do you store your drinking water?

Necessarily, you must store your water away from heat and light, ideally a cool and dark corner of your store room.

A lot of water could be wasted from leaking containers and this must be intelligently avoided.

Water storage and purification is all about being ready for a potential crisis. It's simple and something you shouldn't turn a blind eye to.

Appreciating what we have

We take advantage of our access to clean drinking water. Many of us go to the tap and get a glass of clean fresh water several times a day and never give a second thought to how important it is. We have become so accustomed to having it, we rarely think about what our lives would be like, if we had to struggle to find water.

Next time your drinking that nice clean glass of water, just think what you would do if you couldn't get it.