WATER FOR LIFE

By

BLUE WORLD TEAM

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INDONESIA

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I. INTRODUCTION

I.1. BACKGROUND

Indonesia archipelago is geographically located at the confluence of four tectonic plates, namely the Asia Continent Plate, the Australia Continent Plate, the Indian Ocean Plate and the Pacific Ocean Plate.

In the Southearn and Eastern part of Indonesia there is volcanic belt (volcanic *arc*) extending from the island of Sumatra-Java-Nusa Tenggara and Sulawesi. This condition causes Indonesia to have a high potential for disasters.

A 9.1M earthquake occurred in Indian Ocean on 26 December 2004 and caused tsunami disaster that devastated many areas in Asian and African countries. Aceh Province, the closest areas from the epicenter, received huge impacts. Death toll reached 220,000 people.

The last, 7.4 M earthquake in Palu and Donggala at Sulawesi, cause tsunami and 2.000 people death because of it.

The problem when disaster is the electricity is death and can supply to the water treatment instalation. That's why the people can't be supplied fresh water and They consume unhealthy water from the river or well that not be purified,

This project is to make filtered of water that make fresh water can be consumed by the people in disaster area or who living in isolated place.

I.2. PURPOSE

- To make simple water filter using material that easy to find.
- To make portable water filter that can be used in disaster area.

I.3. AIM

- People can make this filter by Their own using material that easily to find.
- The output of this filter can cooked directly.

II. BASIC THEORY

II.1. WATER FILTER

People use water filter systems for a variety of different reasons, and there are dozens of benefits of filtering your own water. For example, people will use water filters to remove chlorine and bacterial contaminants to provide better tasting and better smelling drinking water. They'll also use them to remove lead from drinking water immediately before they drink it, eliminating the chance of a harmful substance entering their bodies.

Another benefit of water filter systems is that they provide you with clean water without racking up a huge bill from plastic water bottles (environmentally-speaking, this is a much better option too).

Overall, drinking clean, filtered water can help to protect your body from diseases and lead to greater overall health. Filtered water can reduce the risk of gastrointestinal disease by more than 33 percent, help children's' developing immune systems grow strong, act as the last line of defense against 2,100 known toxins from drinking water, and greatly reduce the risk of rectal cancer, colon cancer and bladder cancer by removing chlorine and chlorine byproducts.

And water filtration doesn't only benefit drinking water. In fact, filtered water should be used for cooking, drinking, brushing teeth, bathing, and more. Using filtered water means there's a healthy mineral deposit and a healthy pH in the water you ingest!

II.2. TYPES OF WATER FILTERS

There are several types of water filters that are typically used, each with different mechanics and functions, but all serving the same purpose: cleaning your water supply to provide healthy, safe water. Let's focus on a few common types.

A. ACTIVATED CARBON

The activated carbon filter is one of the most common household water filters. This type of filter uses activated carbon granules that attract and trap chemical impurities through an absorption process.

Activated carbon granules are based on charcoal and are very porous forms of the carbon that is created by burning wood with a reduced supply of oxygen. Charcoal, somewhat like a cross between lead and a sponge, has an internal surface area that's riddled with nooks and crannies that can help to boost that absorption process.

The Environmental Working Group does offer one important caveat to remember when using carbon filters:

Keep in mind that carbon filters vary greatly in effectiveness. Some just remove chlorine, and improve taste and odor. Others remove contaminants including asbestos, lead, mercury and volatile organic compounds, or VOCs. However, activated carbon doesn't remove common inorganic pollutants such as arsenic, fluoride, hexavalent chromium, nitrate and perchlorate.

Additionally, this type of filter isn't ideal for dealing with hardness like limescale heavy metals, nitrates, fluorine, microbes, and sodium.

B. REVERSE OSMOSIS

Reverse osmosis is the forcing of contaminated water through a membrane at pressure so that the water is able to pass through, but the contaminants in the water are left behind.

Unfiltered water is pumped in through a plastic membrane, clean water flows through the membrane at pressure, and that semipermeable filter or membrane will catch all the contaminants in said water.

C. ION EXCHANGE

Ion Exchange filters are some of the best filters for softening water. They can take hard water and make it more digestible by removing limescale. In layman's terms, these filters are designed to split apart atoms of contaminating substances to make ions, then, then traps those ions and releases less good ions.

These types of filters use zeolite beads that contain sodium ions. These beads, which act as filters, trap the incoming contaminants and replace them with sodium ions. Without that magnesium and calcium, your water is going to taste softer much more pleasant.

D. DISTILLATION

This is one of the simplest ways to purify water. While this is less of a type of filter and more of a way to filter water on your own without the use of a fancy device, distillation is still one of the best ways to filter or purify water.

Distillation involves boiling the water, but then taking things a step further to ensure purity. First, you boil water to make steam, much as you would boil it to kill the bacteria. Then you capture the steam and cool it back into water in a separate container. Because water boils at a much lower temperature than other contaminants (like toxic heavy metals), these will stay back as the steam separates and boils off, leaving you with clean water.

II.3. CARBON ACTIVE

Activated carbon filters are small pieces of carbon, in granular or block form, that have been treated to be extremely porous. Just one gram of activated carbon has a surface area of 500-3000m2 (600 to 3600 sq yards). 4 grams is the equivalent of a football field. It's the massive surface area that allows active carbon filters to be very effective in adsorbing (essentially removing) contaminants and other substances.

In addition to the surface area active carbon filters have different capabilities in terms of the size of contaminants they remove. Activated carbon filters range from around 50 microns to 0.5 microns.The smaller the more effective but smaller pores also may reduce water flow.

When the water flows through active carbon filters the chemicals stick to the carbon resulting in purer water output. The effectiveness depends on the flow and temperature of the water. Therefore most smaller active carbon filters should be used with low pressure and cold water.

Activated carbon is usually made of coconut shells, wood or coal and sold as granular activated carbon or carbon blocks.

What does active carbon filters remove and reduce?
Active carbon is very effective in removing at least 81 chemicals, effective in another 30 and moderately effective for 22. In reality it's a lot more but these are chemicals that have been thoroughly tested.

There are also contaminants that active carbon doesn't remove which we will cover below. For a complete lists see links below in sources.

According to EPA (the Environmental Protection Agency in the United States) Activated Carbon is the only filter recommended to remove all 32 identified organic contaminants including THMs (by-products from chlorine). The same is true for all 14 listed pesticides and 12 herbicides.

II.4. ZEOLIT

Zeolite is one of the multipurpose minerals of non-metallic minerals because of its unique properties which are as absorbers, ion exchangers, molecular filters and as catalysts. Zeolite stones are formed from the reaction between riolytic tuff rocks and pore water or meteoric water (rainwater).

Tuff rock itself is formed from the deposition of fine-sized volcanic material (ash-dust). Zeolite is a group of alumina silicates consisting of cations, alkalis and alkaline soils, which have pores that can be filled by other water or mineral molecules.

The content of water trapped in the cavities or pores in zeolite ranges from 10-50%, if this mineral is hydrated the cations that are in the cavity or pore will be covered by water molecules, these water molecules are easily released.

The general nature of zeolite is that it has a rather soft crystalline arrangement, specific gravity 2-2.4, greenish, bluish, brown, and white.

Natural Zeolite can be used to filter and purify swimming pools, town water supplies, sewerage effluent, biological wetlands, industrial and mining waste-water and aquaculture ponds. Water filtration, apart from the removal of solids and colloids, increasingly demands the efficient removal contaminants including heavy metals and other toxic substances, bacteria and other parasites.

Conventional sand filter systems do not remove all contaminants and therefore alternative or additional systems are required so that the water quality meets compliance regulations.

The filtering abilities of Zeolites offer a versatile and environmentally friendly option to capture most contaminants found in water systems. Natural Zeolites can perform these functions due to their high ion exchange capacity, adsorption-desorption energies and ability for modification.

Zeolites have an open, regular crystalline framework that generates an electric field that interacts, attracts and binds various cations and, after modification, anions. Zeolites have a particularly high selectivity for ammonium (NH_4^+) and can reduce the ammonium content in waste-water by up to 97%. NH_4^+ has serious environmental consequences because of its toxicity to aquatic life, contribution to algal eutrophication, reduction in dissolved oxygen and detrimental effects on disinfection of water.

Modifications such as charge change from (-) to (+) provides Zeolite with the flexibility to absorb anions as well as cations and also some non-polar organics such as benzene, toluene and xylene. Zeolites can be charged with ‘antibiotic’ cations of Ag, Cu, Zn to provide antimicrobial properties.

Zeolite filterbeds can remove contaminants to purify air (Ammonia NH_3, H_2S, CO_2, CO, SO_2). The hard, durable nature of Zeolites enables them to perform a range of filter functions to produce improved water quality more efficiently than both the conventional slow or rapid sand filter systems. robust, insoluble Zeolites have improved attrition qualities and are adaptable to re-use through regeneration and recycling.

IV.5. SILICA SAND

Silica is a chemical compound of silicon dioxide, also known as silica (from Latin -ilex), is silicon oxide with the chemical formula SiO_2 and has been known since ancient times to its hardness. Silica is most often found in nature as sand or quartz, and in diatom cell walls. Silica is the most abundant mineral in the earth's crust.

Silica is produced in several forms including fused quartz, crystals, irritated silica (or pyrogenic silica, trademarks Aerosil or Cab-O-Sil), colloidal silica, silica gel and aerogels. In addition, silica nanosprings are produced with a steam-liquid-solid method in temperatures as low as room temperature.

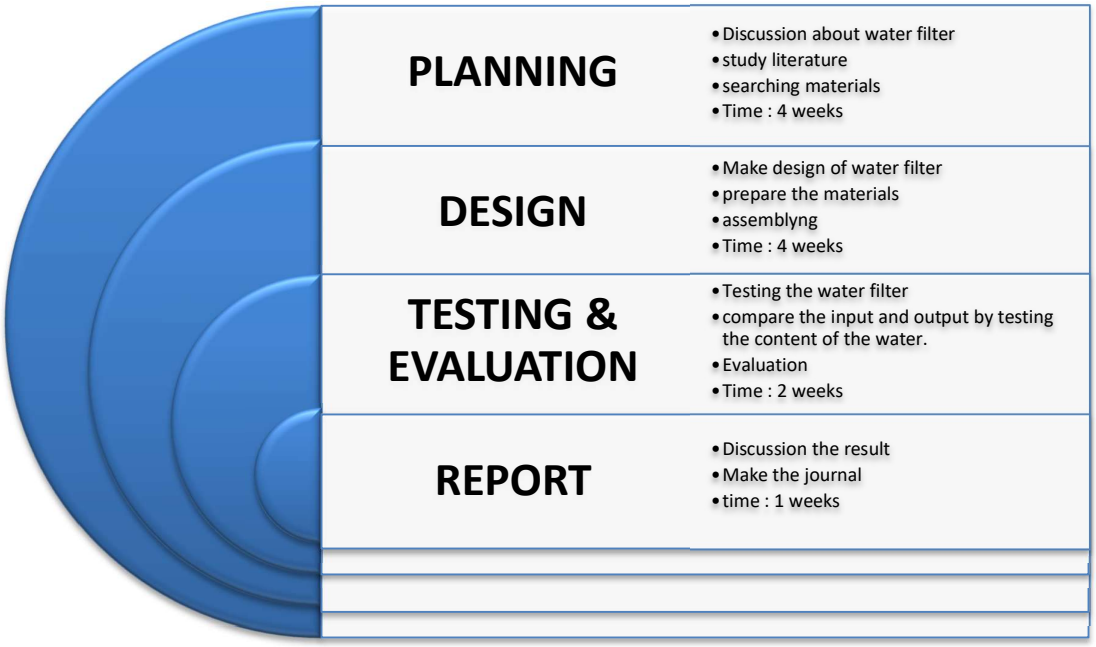
Silica is used primarily in the production of glass for windows, drinking glasses, beverage bottles, and many other uses. The majority of optical fiber for telecommunications is also made of silica. These are the main raw materials for whiteware ceramics such as pottery, ceramics, porcelain, and the Portland cement industry.

Silica additives are also commonly used in food production, where it is used primarily as a moisture absorber in powdered food and other products in the form of Silica gel,

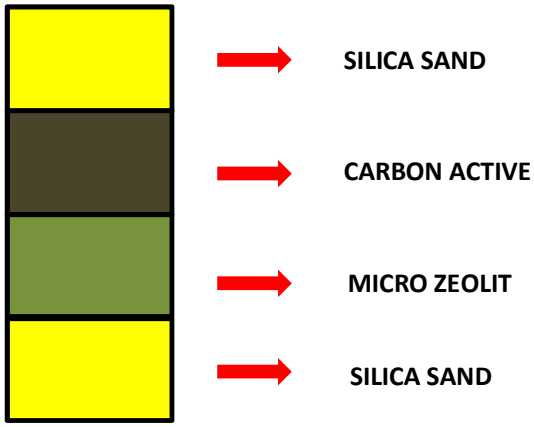
Silica is also an excellent filtration tool in the waste and water treatment process, used as a filtering medium by combining several other materials such as activated carbon.

III. METHOD

III.1. METHOD



III.2. FILTER DESIGN



Design of this water filter contain of :

- Silica Sand
- Carbon Active
- Micro Zeolit (200 mesh)

IV. DISCUSSION

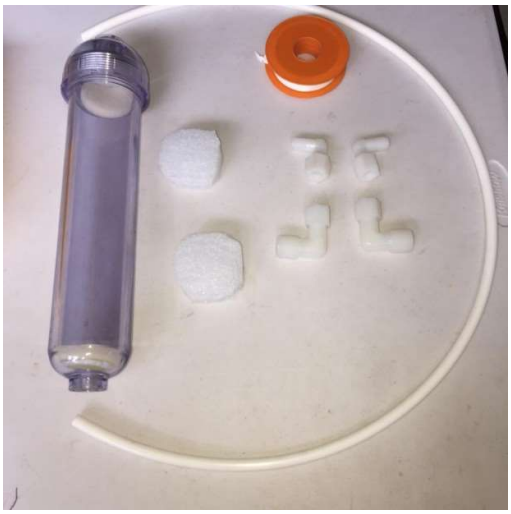
IV.1. PREPARE WATER FILTER

TOOLS & MATERIAL

- 3 pcs Container for filter material
- 1 filter tube
- Filter Cotton
- 2 pcs bottle 500 ml
- Measuring cup

The filter material will filled in the container :

The water filter tube and some accessories :



After the tools and material prepared, the water filter is ready to assembly.

IV.2. ASSEMBLY THE WATER FILTER

The tube will be filled with 3 kinds of filter material : silica sand, carbon active and micro zeolit. To fill the tube with sequence :

- First Silica Sand about 5 cm high
- Second Micro Zeolit about 5 cm high
- Third Carbon Active about 5 cm high
- The last, silica sand again about 5 cm high

Finally :

After the tube was filled with the filter material, the water filter ia ready to try with water from river in Semarang City. This river water is drinking water raw material of local drinking water company by the local goverment in Semarang City.

IV.3. RESULT

Fill the river water to the water filter until it drains to the emty bollte that we prepare before it.

The result of water filter is :

The Result Table of Water Test :

Description	River Water	Filtered Water
Colour	Light Brown	Clear
Smell	Stink	None
TDS	129 ppm	340 ppm
PH	7.8	7.8
Fe	2	0
Ca	30	30

Noted :

- *TDS : Total Dissolved Solid*
  TDS is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogencarbonate, chloride, sulfate, and nitrate anions
  TDS level as follows: excellent, less than 300 mg/litre; good, between 300 and 600 mg/litre; fair, between 600 and 900 mg/litre; poor, between 900 and 1200 mg/litre; and unacceptable, greater than 1200 mg/litre (1). Water with extremely low concentrations of TDS may also be unacceptable because of its flat, insipid taste.(source : WHO)

The test is only simple test that measure some of mineral that contains in the river water before and after filtered. To get more spesific test, it msut go to the bigger laboratory in university or Public Health Service.
As the test result, this filter can remove Fe (iron). Small amounts of iron compounds in the human body function as forming red blood cells, where the body needs 7-35 mg / day which is partly derived from water. But Fe (iron) which exceeds the dosage needed by the body can cause health problems. In large doses of Fe (iron) substances can damage the intestinal wall, irritation of the eyes and skin.

V. CONCLUSSION

V.1. CONCLUSSION

- The water filter can be made from simple material that easy to find, such as : silica sand, carbon active and micro zeolit.
- The water filter is a portable device that easily to bulid and it can help for the disaster victims to get fresh water supply.
- The water filter can removed Fe (iron) compounds that can make our body healthier.

V.2. SUGGESSTION

- This project will be continoued using several material, such as : coconut fiber, palm fiber, sand and others material tha easlily to find.
- The reslut of the filltered water can be tested in bigger laboratory that have more complete equipment

We hope that this project can help people in the world to produce fresh water that can directly cook, especially people in the isolation place and disaster victims. So that They can still consume healthy water.

VI. REFERENCE

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