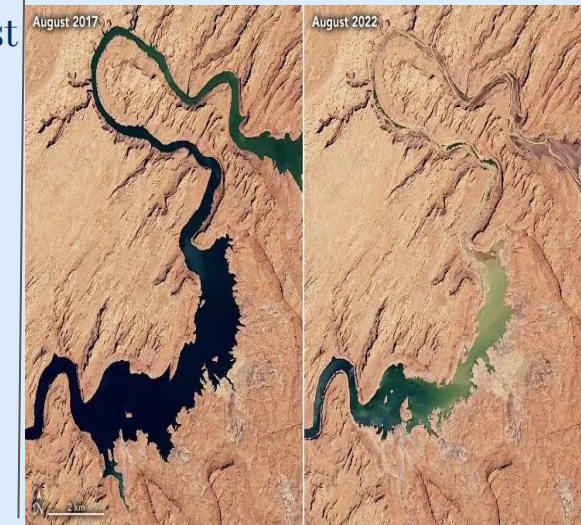
Operation Desert Deluge

Conserving, reusing, and purifying water for the better.

What's The Problem With Water?

One of the biggest problems our world faces is droughts. Many places suffer from droughts, and our home of Tucson, Arizona is one of those places. Drought is a serious issue that has to be dealt with carefully. We may think that if we still have running water, and water to drink, we are not in drought. The average Arizona resident uses about 146 gallons of water each day in the state of Arizona. 70% of our water comes from the Colorado river, which is in tier 2a of water shortage, and that water will keep dwindling. (Sustainable Tucson) Our engineers have come up with a few solutions to our problem, but we need more! One of our most common solutions that we have is a system called grey watering. Drought is a serious issue, but that is not the only water problem we're facing. Places such as Niger, Somalia, Ethiopia, Indonisia, parts of India, and many other areas suffer from severe toxic water where it is not safe to drink, cook, or even wash their clothes with. These people do not have the money to pay for proper filtered water, and are left with no other choice than to drink the toxic water. This leads to 3,800-9,500 deaths each day. (World Health Orgainization)

The Colorado River, one of the most important rivers providing water for approximately 40 million people and several states, including Arizona, New Mexico, Nevada, California, and Colorado (Sustainable Tucson)



The Research

- Grey watering: the process of watering plants with the water from your washing machine.
  - Grey watering can only work if it is lightly used water
  - It only goes to watering plants
  - Costs $1,000-20,000+ to install

- Scientists and engineers have came up with a invention known as the LifeStraw. This is a tube that will filter any water for you so it is safe to drink.
  - The LifeStraw is not big, and can only be used for drinking water
  - The LifeStraw is expensive, costing people $17-50
  - The LifeStraw needs to be replaced every 2 months.

- Saving water can lead to a much better future.
  - Droughts are a very destructive natural disaster, and lead to huge impacts on our ecosystem. Many animals are forced to migrate, habitats are destroyed, water sources dwindle, many plants and animals die, and wildfire risks increase. Droughts also cause us to lose revenue and crops.

What Can I Do, And How Do We Do It?

What can I do so we can reuse, and purify water so people can drink free of disease, and also help reduce our world's drought?

I have always worried about wasting water but didn't know how to help. I came up with a idea, and now I plan to make it work! My goal is to build a filtration system that is portable, easy to use, and can purify water no matter if it is toxic, or went down your drain. This filtration system is called MyFilter. MyFilter will work in two ways; it can be used to provide clean and purified water to those who don't have access to clean water. The filtration system can also go into plumbing and recycle the water that goes down your shower drain so you can use it again knowing it is just as clean, if not cleaner, than the water before it.

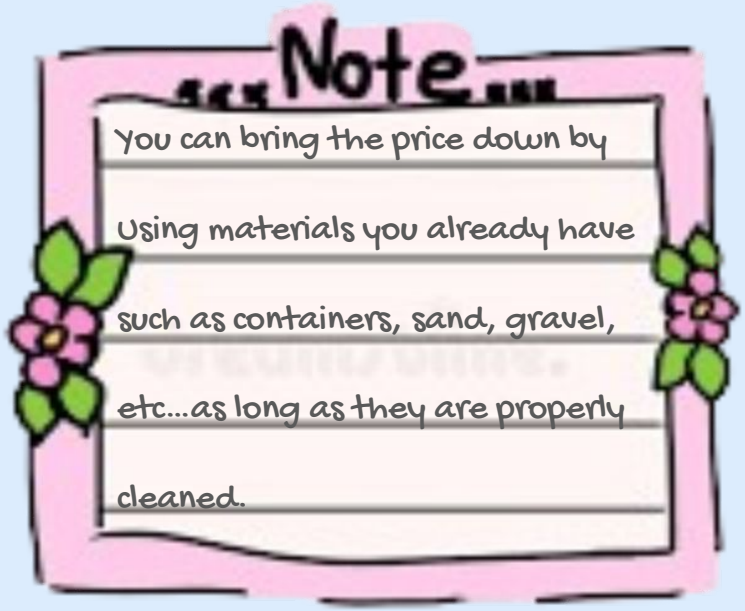
Criteria And Constraints

Criteria:

- Should remove up to 99.99% of germs, bacteria, and viruses
- Must take cloudy water over 50 NTU, and make it clear so it is below 5 NTU
- Must remove Nitrates and Arsenic
- Should be fast, and fill around 0.5 liters per minute
- Failsafe

Constraints:

- Portable
- No more than $50
- No electricity
- Easy to clean



Materials Needed

To make this filter I used

- 2 gatorade bottles 20 fl oz
- ⅜” I.D.---¼” O.D.---push to connect ball valve
- ¼” I.D. plastic vinyl tubing
- Copper mesh
- Polypropylene mesh
- Sticky cotton tack cloth
- Activated carbon
- Washed fine grain sand
- 4 different sizes of washed gravel
  - Tiny
  - Medium
  - Regular
  - Large
- Tool to cut the bottles and meshes
  - A round file
  - Drill with drill bite
  - Hack saw
  - Scissors
  - Gloves (safety first)

What Do The Materials Do?

Everything I used has a specific property in the MyFilter.

The gravel is used to grab the larger pieces of debris like leaves, rocks, and twigs. The sand is used to grab anything the gravel missed like food, bugs, and leaves. The activated carbon is used to remove weird tastes and odors, and chemicals such as chlorine. The tack cloth grabs items like any sand and activated carbon, the copper mesh removes bacteria due to the fact copper has antibacterial properties, and finally the polypropylene mesh is a kind of ultrafiltration that removes microplastics.

Then the ball valve helps water flow.

Procedure

Step 1: Cut the top off of one Gatorade bottle, and cut the bottom off of the other Gatorade bottle

Step 2: Cut the tack cloth, copper mesh, and polypropylene mesh to equal square sizes of 4x4 inches, then secure it around the mouth of the Gatorade bottle with no bottom with a rubber band.

Step 3: drill a hole that is roughly ¼ inch in the Gatorade bottle with no top. Start small and try to push an inch of plastic tubing through the hole; It should fit snugly. Then put the ball valve at the end of the tube.

Step 4: Place the bottle with the meshes on top of the Gatorade bottle with the valve.

Step 5: Put a light layer of the sand, activated carbon and tiny gravel into the bottle. Add a little bit of copper mesh every layer.

Step 6: Add another light layer of the medium and regular gravel on top of the copper mesh

Step 7: Add the final layer of copper mesh, and add 3-5 large pieces of gravel

Step 8: Run plain tap water through it to make sure the water can fill the bottom bottle, and flow through valve.

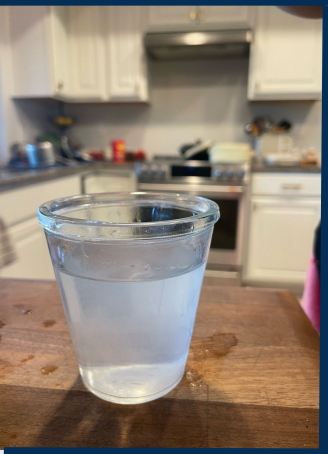
To see if it filters and purifies water, you can use the safe alternatives of toxic water...

Salt water: If you can not taste the salt that means it can, make whacky tasting water taste good

Food dye in water: To see if it can remove the color, if it does it means that it can remove small particles of water

Dirt water: the closest to toxic water we can use and see if it can remove multiple sizes of debris.

Experiment 1

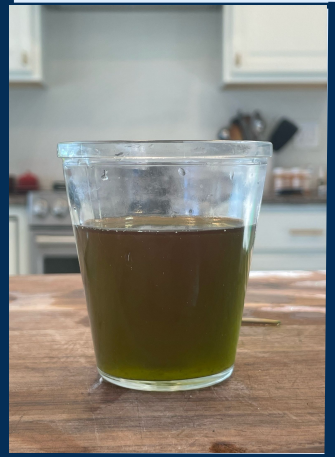


SALT REMOVAL

Target: Ocean water
Sample: 2 tsp. Salt in 1 c. water

Test: I ran it through the MyFilter, it took around 5 minutes to fill up halfway, and it was clear! Of course I tasted it to see if it was still salty; It was less salty than before, but still very salty!

Experiment 2



FOOD DYE REMOVAL

Target: Carbon based toxins
Sample: 4 drops green and 3 drops yellow

Test: I ran it through the MyFilter, it did become lighter and less cloudy. But was still green and not clear.

Experiment 3

DIRT WATER REMOVAL

Target: Different sized particles and bacteria.
Sample: 1 tbsp potting soil, 1 tbsp fine grain sand, 1 tsp coffee grinds

Test: I ran it through the MyFilter, it came out with not debre, but did have a tint of yellow/brown. It was from the coffee grind.

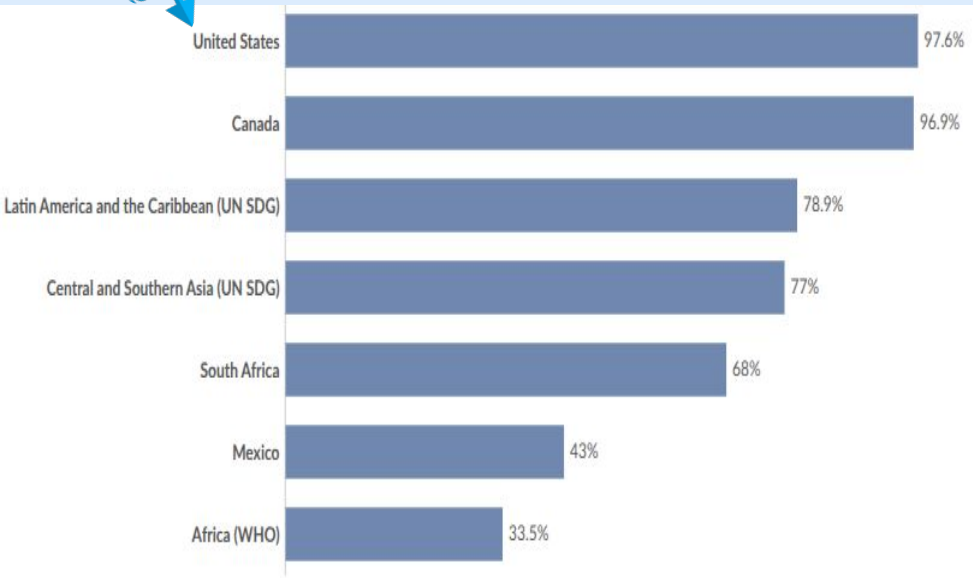
Results

Unfortunately the MyFilter did not purify water to a drinking extent. In the future I would probably use other materials to help with the taste and coloring, but as of now, it did not work.

The filter also started leaking in the end, and I have figured out that drilling a hole in a bottle has not worked. My first filter I built alo cracked and broke completely, so I would probably also use a bucket instead of a plastic bottle.

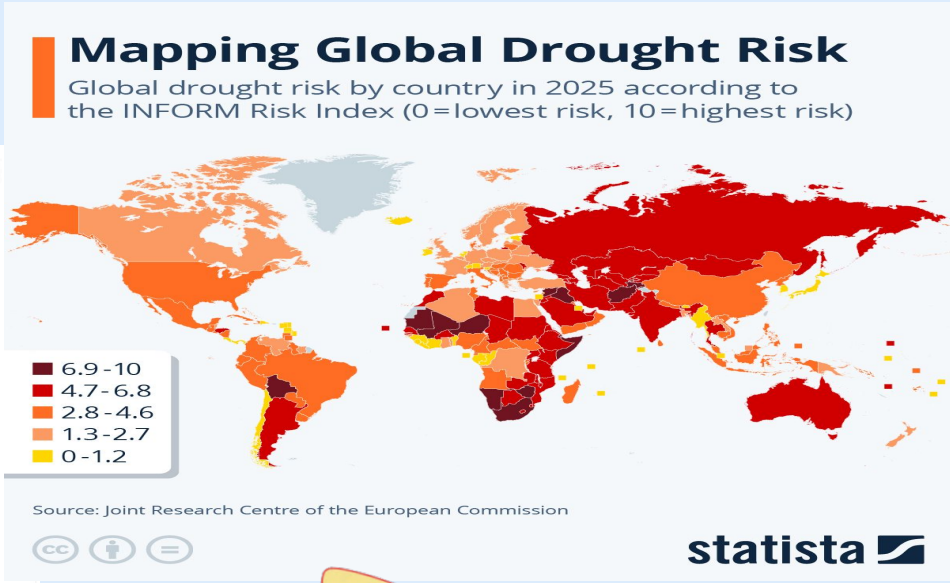
Charts

In this graph, it shows how many people have access to purified drinking water



(statica)

(Our World In Data)



This graph shows the global drought risk

Future Research

For the future if I were to continue this project, I would like to try to make it look neater. I personally feel that the MyFilter filtration system looks a little messy, and even though it is supposed to be cost efficient, it should still look nice. Another thing I would like to try is running other kinds of water through it other than salt water, dirt water, and colored water. I would also like to find a way to make it run faster so I could fill an entire bottle in 1-2 minutes. I used copper mesh to filter out bacteria because copper can kill bacteria on contact. MyFilter may have actually been successful at filtering out bacteria, but I had no way of testing that. I would also like to figure out how to make this as a kit where we can send out to people around the world with little money and resources so they can put together their own MyFilter. Finally I would like to figure out how we could take this filter, put it into our plumbing system and reuse the water without worrying about toxins, dirt, bacteria and more!

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