A Portable Water Filter that Doubles As a Drinking Fountain

By Suleyman Sharifsoy

Identify a Problem

Drinking fountains are boring, expensive to maintain, old (they were invented in the early 1900s by some dudes called Halsey Willard Taylor and Luther Haws, and since then, they haven't changed much) and rather, ugly. Whilst they were incredibly useful in their time, a new era, the 21st century, has come. Yet we face another problem. Yes, in the U.S., and other highly developed countries, we've got our fancy drinking fountains. But what about those extremely impoverished countries, with little to no access to clean drinking water, such as Eritrea, Papua New Guinea, and Uganda? They can't afford expensive water filtration systems. But, hey, why do we even need these fancy water filtration systems? Why shouldn't we just drink dirty water? Well, see, water can contain dirt, minerals, chemicals, and other impurities that make it smell and taste bad. Filtering water can help purify it, removing these impurities and making it safe to drink, while often also improving its taste. And if there are people who have to bet their lives on getting a single cup of clean water, I want to do anything I can to help out. So, this begs the question, can I design a water filter that is inexpensive, effective, and overall, accessible to the public at an incredibly low cost (essentially, a drinking fountain that doubles as a water filter)? Let's find out...

Imagine the Solution

Solution #1:

I will get a water bottle, a sink strainer, tape, 3 magnets, and a few rocks. The water will enter from the top of the bottle, and the bigger particulates will get caught on the rocks, whilst a strainer that is holding up those rocks will get the rest of them. The bottom will be cut, and the user shall use a container to hold their filtered water. The magnets will allow the user to place the device onto anything that is also magnetic, such as steel beams, fridges, pipes, and et cetera.

Solution #2:

I will get a bit of gravel, some rocky sand, fine charcoal, 2 magnets, and a water bottle. I will then cut ½ of the bottle. Then, I will take the top ½ and flip it over, and put it into the other ½ of the bottle. This design will allow rainwater to fall into it and filter itself, and anyone can place a container below it to collect said rainwater. The cap shall have holes poked in it, big enough for water to get through, but not the gravel. I'll proceed to pour the fine, activated charcoal, packing it in so it doesn't spill out, and the fine sand, also packed in, same with the layer of gravel on top of the fine sand. Magnets will be attached to the device for the same reasons as solution #1. This method is slower than solution #1 but definitely more precise.

Solution #3:

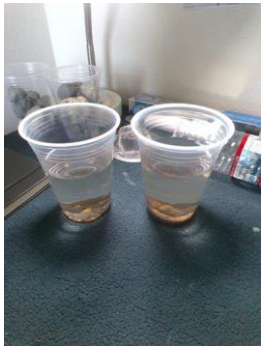
For this solution, I shall get gravel, rocks, 4 magnets, and a water bottle. This design will also allow rainwater to fall into it and filter itself, and anyone can place a container below it to collect said rainwater. The design of the water bottle will be the same as it was for solution #2, where I cut ½ of the bottle, and take the leftover ½, flip it over, and place it inside the other ½. But this time, I will pour the gravel first, and then, the rocks. The cap shall have holes poked in it, big enough for water to get through, but not the gravel. Magnets will be attached to the device for the same reasons as solution #1. This will be slower than solution one, but faster than solution #2.

Make a Plan

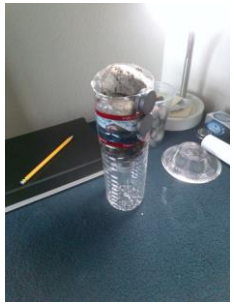
I chose solution #3 as my solution. It's not too slow of a filtration process, nor too fast to a point where the particulates are not getting caught. It's also an easy-to-use design, unlike solution #1, for example. The bottom half can be used as a drinking cup, whilst the top half is a water filter.

Create Your Solution

First I cut the bottle in half, and while it wasn't a perfect measurement, it would work just fine for this project. I took the top half, flipped it over, and placed it in the lower half. I then grabbed handfuls of gravel and pebbles and poured them into the top half, while making sure that the cap was on, so none of it would spill out. Then, I put the bigger rocks into the container, topping it all off. I then realized it was a bit loose, so I tightened it. But then I got to the whole "portability" part of the design. I needed to attach magnets to the device, but had no tape! After frantically searching my entire apartment for it, I had a brilliant idea, and while it hung almost entirely on luck, it was my only option at the moment: putting 2 magnets on the inside of the top half of the cup, and two on the exact opposite side. And surprisingly, it worked! I attached it to my fridge, and while there was a little bit of a slip at the initial attachment, it held. My water filter that doubled as a drinking fountain was complete. But now, the important part: testing.



Improve Your Solution



For the improvements, I have extended the length of the bottom half of the cut water bottle to which the filter is pouring into, and now you can pour an entire cup's worth of water in it without it becoming full. In addition, I have also replaced the rocks at the top of the filter and made the realization that while my device is faster at filtering water than expected, it requires high maintenance, as in, after every use, you must replace all of its contents, or at the very least, the rocks, for it to be as efficient as it was during the first use. It all comes down to choosing between quality and quantity, and I chose quantity.

As you can see, if you only remove the rocks (as I did), and leave the layer of gravel, the water is not as filtered as the first time you do it, but nor is it less filtered than the second time you do it. Again, this proves that while the device I built is fast, it does indeed require high maintenance, needing a full relinquishing of its contents before the second use of it. These results show me that a low-cost water filter that doubles as a drinking fountain is absolutely possible and that it can indeed reduce the health risks that the people of Eritrea, Papua New Guinea, and Uganda have to go through, but it must be carefully, effectively, and responsibly used. And, for example, as much as it rains in Papua New Guinea (you can check here, it rains quite a bit), all that water isn't clean. They need proper water filtration, and this is my way of doing what I can to help out in that endeavor.

Family Safety Agreement

I will care for science materials by handling objects carefully. I will not eat, drink, or taste any science materials.
I will follow all safety rules.
I will not use any toxic chemicals in my STEM Demonstration project. All materials must be appropriate for use in school and at home and approved by an adult at my home.
I will not use fire or burning objects in my STEM Demonstration project.
I will not use firearms, tobacco, drugs, or alcohol in my STEM Demonstration project.
I will not harm any animals in my STEM Demonstration project.

Materials I plan to use for my project are:
6 water bottles, 3 plastic cups, rocks, gravel, and magnets.

Student Signature:
I will follow the above safety rules and complete my STEM Demonstration project in a safe manner.
Student Print Name: Suleyman Sharifsoy
Signature:

Parent Signature:
I acknowledge that the above safety precautions will be followed and that this project will be completed in a safe manner. I also acknowledge that no animals (vertebrates or invertebrates) will be harmed in any way.
Parent Print Name: Alina Sharifsoy
Signature: