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Small Scale Water Filtration Project

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Small Scale Water Filtration Project
Elaine Yang, Lang Ming, Alex Tees, Lauren Galle, Tristan Coffey, Andria Tattersfield & Colin Brock
Lincoln High School STEAM Team with PSU Mentors Robb Sutton and Melissa Preciado

PROBLEM/OPPORTUNITY

Access to clean drinking water is a large problem that our world is facing today. Consuming contaminated water can lead to the spread of water-borne illnesses. Populations without the security of water struggle to develop, as seen predominately in Africa. As Oregonians prepare for life after a major earthquake which could devastate the infrastructure that delivers clean water to our homes, a water filtration system should be part of a family's emergency preparedness plan.

There are a large variety of processes for achieving fresh water. Combining all of the necessary components to lead to clean water is a complex process, as we have discovered during our field research. We saw an opportunity to create an inexpensive and user friendly device that encompasses all of the required aspects of purifying water for drinking.

KEY OBSERVATIONS

Originally, we optimistically imagined designing a smart phone application that could detect any contamination (biological or chemical) and advise people what steps to take to make it safe. After visiting the SWEET lab at PSU, we realized the complexity of this idea, and had to shift to a more approachable device, such as a filter.

We learned that it takes 24 hours to detect microorganisms like E.coli in water, making it difficult to answer the question, “is this water safe to drink right now?” When designing our filtration device, we decided to have the user boil the water to remove biological contaminants instead of adding an actual biological sensor.

Dr. Catherine Howell helped us see that in an emergency situation drinking contaminated water and risking gastrointestinal illness from giardia or cryptosporidium or short term exposure to chemicals was better than dying from dehydration. Reducing those risks with a portable filtration system seems valuable.

During our research, we also realized the importance of access to clean water in our world and how privileged our situation is in Portland with access to the Bull Run reservoir.

RESULTS

Our design allows users to filter particulates from water and also senses for chemical contamination to prepare it for boiling. First, the water flows through a funnel to a pipe and goes through two layers of wire mesh and carbon foam. That removes sediments from the water, as well as some organic compounds. The carbon film can also reduce certain heavy metals, such as fluorine and lead.

Next, the water flows through a sensor. The sensor can detect the presence (or high concentration) of heavy metals and rapidly respond to them. If the sensor picks up these harmful contaminants, the light will be red. In that case, the water would have to be discarded. If the water simply needs to be put through the filter again, the light will blink yellow. If the water is safe to drink, the light will be green.

Finally, the water will exit the pipe into a pot that the user provides that will collect the water. The water can then be boiled to remove all biological contaminants.

CONCLUSIONS

In conclusion, our problem may have been too big for us to solve. We faced issues with biological detectors and heavy metals. In the end, there are some sacrifices to make in order to survive. Even if there is no pure water available, it is still preferable to consume contaminated water. Our design is an attempt to lower the risk of water-borne illness in those kinds of situations. A large percentage of the world does not have access to clean water, so this project is very worthwhile.

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