Delivering Low Cost Water

Diego Avena, Nikki Heredia, Karolina Michalewska, Kaylee Nguyen-Phuoc, Jessica Trawick

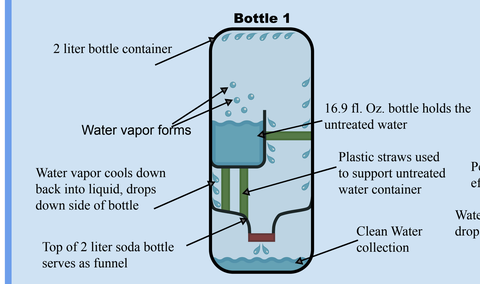
Background

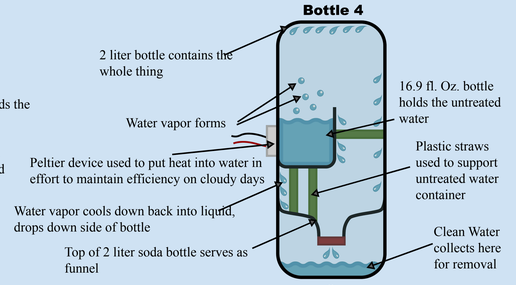
The grand challenge our team has been working on is providing clean, potable water to all areas of the world. Areas that lack access to clean drinking water are affected by the contamination of groundwater with bacteria and chemicals due to industrialization, climate change, and minerals present in the ground (1). In 2004, it was found that more than a billion people lacked access to clean drinking water (2). Previous studies have shown solar purification to be an effective method, so we decided to use a solar purifier, given that previous studies have shown solar purification as being an effective method of lowering the presence of *E. Coli* but did have a low yield (3, 4). We chose *E. Coli* as our contaminant because it has been found to be an indicator of whether or not water sources pose a health threat for human consumption, since the presence of *E. Coli* usually signals the presence of other lethal bacteria (5).

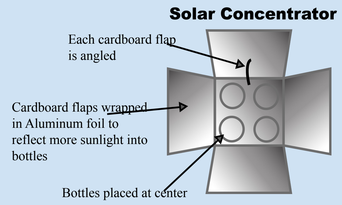
Strategy 1: Solar Purification

The strategy: Separate bacteria from water by having that water evaporate into a gas (form water vapor) and then collecting the liquid that reforms as a result of condensation.

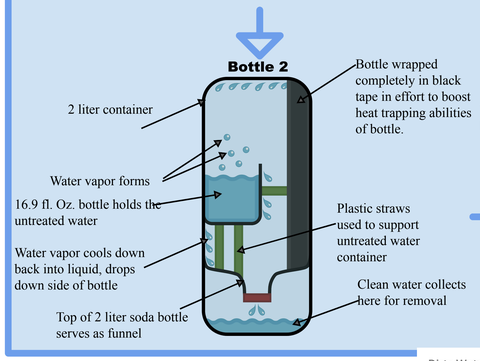
The prototype: Consists of 4 bottle designs, each design was an attempt to address limitations associated with this process.

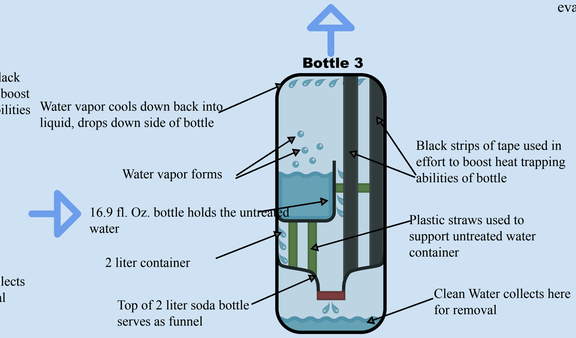


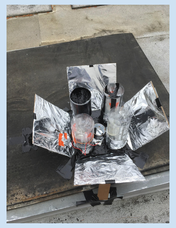




- **SOLAR CONCENTRATOR:** Increases the efficiency of solar energy capture so that the water evaporates faster (1, 2)



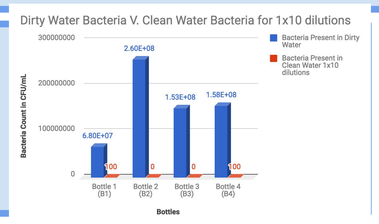




- The built version of this prototype.

The Results:

- Overall decrease in *E. Coli*
- Inconclusive for which design was the best
- The overall decrease in *E. Coli* suggests that this strategy should be further investigated

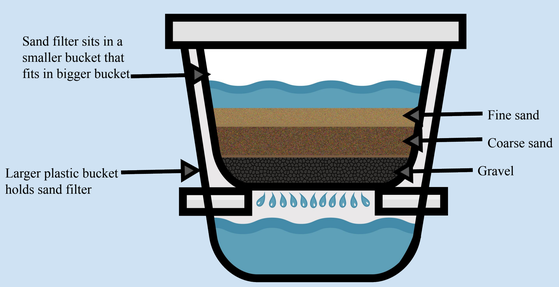


The Procedure

- Plate count used to quantify the *E. Coli* in clean and untreated water samples
- Make dilutions of samples with bacteria and plate them. (image)
- After being incubated for a day, the colonies that are counted

Strategy 2: Sand and Gravel Purification

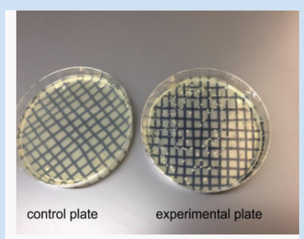
The strategy: Separate bacteria from the water by running it through a sand and gravel filter into a collection tank that will hold the runoff of purified water



The Procedure

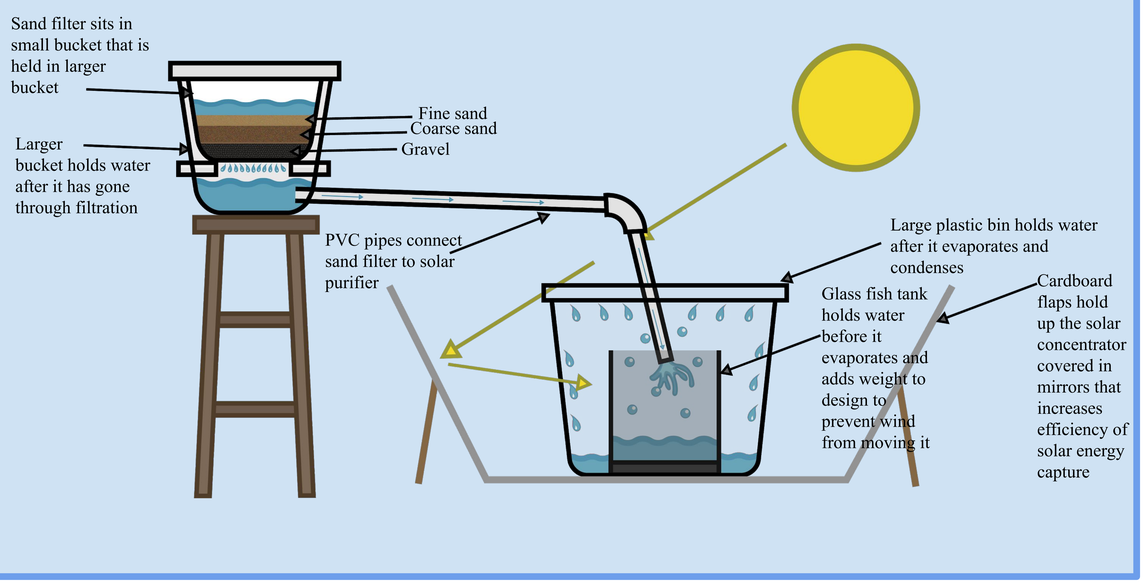
- Wash and sterilize sand
- Run the filter with clean, uninflected drinking water
- Run through spectrophotometry and identify concentration
- Plate onto agar plate
- Contaminate second water container with 9600 µL of *E. coli*
- Run filter once again, use spectrophotometer and plating once more with contaminated water
- Incubate plates at 37*C for 72 hours and count colonies

The Results:



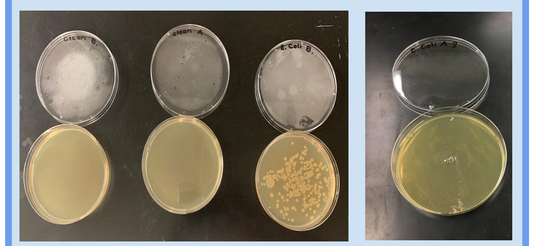
- Control plate: ~5 colonies of *E. coli*
- Experimental plate: ~200 colonies of *E. coli*

Current Strategy



The overall purpose of this experiment is to create and design a filtration system that includes sand/gravel filtration along with solar purification systems that will remove *E. coli* from the treated water that was originally clean. We were able to add the sand filtration in first removing large obstacles, then adding the solar purifier to remove any remaining *E. coli* from the system. After this procedure. We took the measurements of *E. coli* still left in the system. This gave us some information on how effective the procedure was in creating 'clean' water.

The Results:



Conclusion/Takeaways

Overall the proposed sand and solar purifier is a good solution to getting clean water to areas that need it on a budget. However, some areas need to be rethought on our design as the gravel waste heavy for the inside bucket to keep up. There would also have to be consistent cleaning of the system including the sand. Our group believes that with more information regarding how to run the purifier, more underdeveloped areas will be able to gain access to clean water. During this last semester, we were able to see that the process was more difficult using a higher amount of water yield. However, it was possible but the equipment used needed to be more heavy duty. This may be a portion of our project that needs to be reevaluated by the team.

References

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