Ishika Muchhal
May 22, 2017

Water Filter Abstract

One third of the world's population lacks access to clean drinking water, and most of these people come from developing countries. Waterborne diseases such as cholera, *E.coli*, typhoid, etc. are rampant in their water sources which are also inconveniently located far away from their homes. In their situation, commercial water filters are either too rare or too expensive. So why not make a 'filter' that is both cheap and easy to reproduce using materials found in their environment? Many people have tried creating such a homemade filter using materials like cotton, charcoal, banana peel, sand, gravel, dirt, and plastic water bottles. But does this water filter work at the biological level, or just as the physical level?

I started by testing the commonly-used filtration materials with filtration and/or absorption properties: cotton, charcoal, sand, coconut/rice husk, and banana peel. These were washed, dried, and rinsed with clean water to make sure they didn't add any bacterial load to the water. The banana peel, which is used since it removes metal from water, ended up adding a significant amount of bacteria to the sterile water, so I took it out of my filter materials list. Next, the filtration efficiency of the remaining materials was tested by running water mixed with a known quantity of *E. coli* through each material, plating 100 µL of the filtrates on agar plates, incubating them, and performing a colony count. Results showed that charcoal was most efficient in filtering but also reduced water flow rate significantly. With this data, I designed three straw-style filters based on common designs with different material arrangements and repeated the *E. coli* filtration experiment, recording flow rate and efficiency. The results showed that the filtrate had significantly more bacteria than even the *E.coli* solution so I decided to boil and roast all the materials to eliminate any bacterial input from the materials themselves and eliminate coconut husk all together due to its bacterial input. Using the purified materials, I created two more bottle-style filters and tested a control for a sterile water rinse and for the *E.coli* filtrates. Each filter used cotton as a plug to keep the filtration contents (sand and charcoal) inside. A colony count of the agar plates showed that although the control showed no added bacteria from the materials, the filtrate's number of colonies was not significantly different from the count in the original E.coli solution. Thus, I concluded that even though this standard water filter may work visually by cleaning the water's appearance, it does not remove the bacteria found in many water sources.