



TRUE PANI

"Keeping Safe Water Safe."

Background

TruePani is focused on using the antimicrobial properties of copper to kill microbes in drinking water at the point of use. The idea for the company began during the summer of 2015 when Samantha Becker and Shannon Evanchec traveled to Nagpur, India for a research project through a collaboration with Georgia Institute of Technology, the National Environmental Engineering Research Institute of India, and the London School of Hygiene and Tropical Medicine. The project, "Using Crowdsourcing to Assess Water Quality in Rural India," required them to travel to villages in central India and take stored and tap water samples in 500 homes. Upon analyzing the data obtained, they saw that the stored water was significantly dirtier than tap water, something that is commonly known in public health. They also observed that household drinking cups (made of stainless steel) could contaminate sterile water. A small case study was conducted where sterile water from the lab was poured into household cups and then into presence absence (PA) test kits. These kits detect the presence of *E.coli* in water. Over 90% of the kits were positive, indicating a harmful amount of *E.coli* present. This discovery led Becker and Evanchec to investigate antimicrobial coatings through a literature review. After conducting the literature review, it was determined that using copper as an antimicrobial surface was a practical and cost effective solution to rid drinking water containers of biofilm.



Figure 1: A local woman tests water using PA Test kits during the "Using Crowdsourcing to Assess Water Quality in Rural India" project in summer of 2015.

The Need

In 2015, it was reported that 91% of the world's population had access to an improved drinking-water source. However, 'improved sources' are not always safe. In reality, at least 1.8 billion people drink water from a source with fecal contaminants. 1.2 billion cases of illness and 2.2 million deaths per year are attributed to drinking contaminated water. Piped water can often be contaminated, especially if the supply is intermittent (which is common in many underserved areas.)¹ In India, we experienced intermittent water supply first hand – villages that we visited would only get running water in the mornings. In fact, only two cities in India have 24-7 supply. Household hygiene is another major factor. Even if the microbial quality of the source water is good, it can quickly become contaminated during transportation or storage in the home. TruePani is different from other water purification techniques because it is specifically designed to combat contamination during distribution and within the home. By focusing on the point of use, we can ensure that the water people are **drinking** is safe, not just the water that people are **accessing**.

The TruePani Lotus

The initial product, the lotus, was designed with the Indian culture in mind. A lotus flower symbolizes purity in Hinduism and Buddhism and grows in water. The TruePani lotus is made of a stainless steel core and electroplated in copper. The lotus has a surface area calculated for 11L of water through lab testing to significantly reduce *E.coli* colonies. Additionally, TruePani has been working with NGOs to design a device to reduce biofilm in drinking water that is sitting for an extended period of time in a tank or cistern.



Figure 2: The TruePani lotus, featured in Georgia Tech's Research Horizons Magazine.

How to Use

Using the lotus is very simple. Simply place the lotus in an 11L stored water container of any material. Copper ions are released from the surface of the lotus, and the positive charge of the ions attract to the negative backbone of DNA and RNA, killing harmful pathogens. The lotus will kill initial microbes in the water, will combat poor household hygiene practices from causing further contamination. The lab estimated lifetime of the lotus is 5 years, indicating that it can treat over 20,000 liters of water. The stainless steel core will show through when the copper wears off, making it easy to know when it is time for a new lotus.

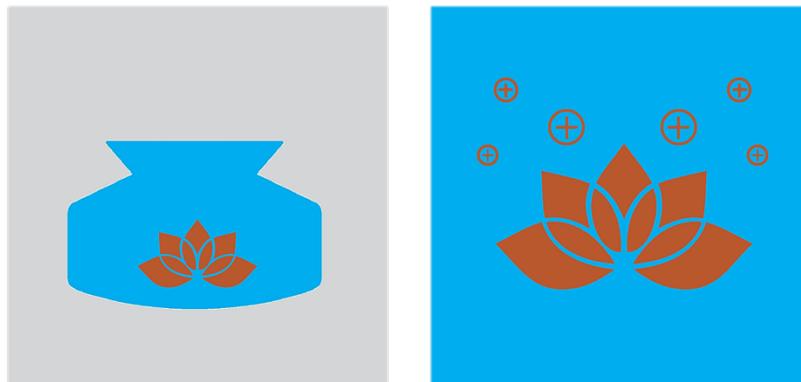


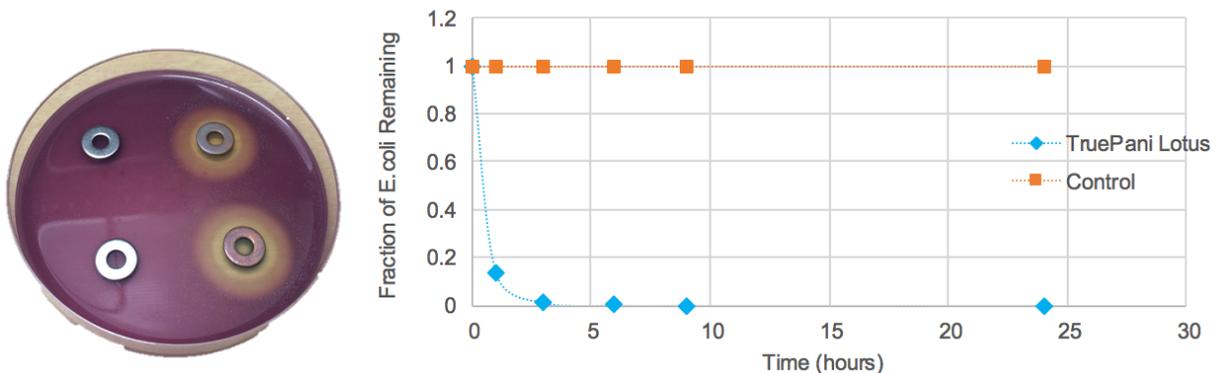
Figure 3: The TruePani lotus is a simple, easy to use, and inexpensive technology – simply drop it in a storage water container and the lotus will release copper ions, killing microbes (viruses, bacteria, fungi, and protozoa).

Does it Work?

Yes, the TruePani lotus kills microbes in drinking water. It has been known that copper is antimicrobial since the discovery of the oligodynamic effect in the late 19th century. The biocidal effects of copper have been proven. A study conducted by the University of Swaziland showed a 100% *E. coli* reduction using various masses of copper in clay pots.³ Additionally, a study published in the showed that *E.coli*, *Salmonella Typhi*, and *Vibrio cholera* in water stored in a container with a copper coil would not grow during incubation whereas the controls showed a 1

to 2 log increase during incubation.⁴ A study published in the Nepal Journal of Science and Technology found that among copper, brass, and silver, copper “proved to be the best oligodynamic metal against most of the water isolates.”²

We have been repeatedly testing the effectiveness of the lotus using *E. coli*, a fecal indicator, in a microbiology lab at Georgia Tech. After 1 hour exposed to 10⁵ CFU/ 100mL of *E. coli* the lotus reduced colonies by 87%, compared to the control. A log 4 (99.99%) reduction was seen after 6 hours, and no *E. coli* was detectable at 9 hours (as shown in Figure 5). This efficacy is based on a stored water volume of 11 liters. However, since the surface area of the lotus is known we have test the lotus in a variety of volumes of water and obtain several surface area to volume ratios. Using these ratios and the respective copper concentrations, we are working to kill microbes in a variety of setting - whether it is a lotus in a household storage container or a cistern for a school. The TruePani solution has the potential to impact millions of lives worldwide.



Figures 4 (left): Zone of lysis testing using stainless steel washers vs. stainless steel washers electroplated in copper. Figure 5 (right): Reduction of *E. coli* B colonies, normalized to the control, using an initial concentration of 100,000 CFU/100mL.

Is it Safe?

Only a very small concentration of copper ions in water is required to benefit from the antimicrobial effect. We have conducted testing by ICP–optical emission spectroscopy proving that the copper concentration in water treated with the lotus does not exceed the limits set by the Environmental Protection Agency (EPA) and The World Health Organization (WHO). The EPA limit for copper in water is 1.0 mg/L, and the WHO limit is 2.0 mg/L.⁵

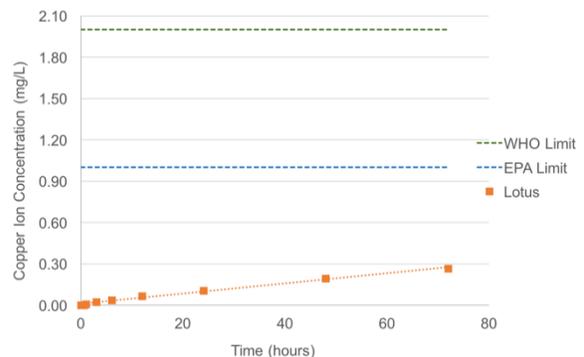


Figure 6: Concentrations of copper ions in water with the TruePani lotus over time.

We are currently testing the lotus over an extended period of time to show that the same amount of copper is released every day during the lifetime of the product.

Get Involved

Currently, we are working to establish partnerships with NGOs to facilitate a case study. Through this case study, we will obtain before and after data showing the difference that

TruePani can make in a real world environment. In India, this application may be through using the lotus. However, in other parts of the world the solution may need to be customized to fit the customs, cultures, and methods of accessing drinking water.

Initially, we will assist organizations in conducting microbial testing to determine the preliminary quality of drinking water in the area to be served. Based on this, TruePani can calculate the needs for the system.

We hope that your organization is interested in joining us on our mission for safe drinking water at the point of use. Together, we can achieve more.

Cheers,

Sam and Shannon

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