



Purely Water

A Joint Project between Engineers for a Sustainable World and UVNITY

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Overview

Purely Water's goal is to create a small-scale water sanitation system that can be attached to any two-liter bottle. The system includes a coarse filter for suspended solids, a UVC light to disinfect the water, and a fine filter to remove small particles. Purely Water's vision for this product is that it will be used to help people who have been affected by natural disasters. This product addresses a major cause of disease and malnutrition, which can lead to death, and is affordable due to the small profit margin associated with a non-profit status. Purely Water's product is a superior choice for disaster relief situations because it is far more affordable than other UVC-based purifiers, is effective against a broader range of microorganisms than chlorine, and does not have the negative side effects of iodine tablets. It is portable and provides a reusable option for on-site acquisition of clean water, making it more sustainable and cost-effective than transporting clean water into an area by truck or plane.

I. Problem:

Around the world, 780 million people do not have access to clean drinking water.¹ Natural disasters exacerbate the problem by contaminating water sources and limiting the availability of potable water. For example, earthquakes can damage pipes and infrastructure, contaminating the water supply.²

Clean water is an essential nutrient that is required by a healthy human body. A major problem that results from drinking contaminated water is diarrhea. Diarrhea is "one of the main causes of morbidity that results in malnutrition. Malnutrition contributes to almost 60% of deaths of under five year olds in developing countries and has been a major concern in refugee situations."³

In emergency situations, a refugee needs a minimum of seven liters clean drinking water every day.⁴ The methods that are currently implemented are oftentimes expensive, politically driven, and not sustainable. Current efforts do not sufficiently provide even the minimum recommended requirement of seven liters of clean drinking water to each person.

II. Current Solutions:

Several ways to deal with the provision of clean water at the site of a disaster are currently employed, but they are economically and/or environmentally unsustainable. The most common approach is to transport containers full of clean water by land, water, or air from a distant location. However, this method incurs large transportation costs and can result in pollution when the plastic containers are thrown away. Another common solution is to use

tablets or packs of chemicals that kill viruses, bacteria, and other microorganisms when dissolved in water, but this method requires a constant supply of these chemicals and cannot deal with suspended solids or metals. Also, iodine tablets may cause harmful side effects to those who use them. On site filtering systems are also used to purify water, but these may require energy or not deal with viruses, bacteria, and other microorganisms. In contrast to these methods, Purely Water's product can extract both suspended solids and viruses, bacteria, and other microorganisms and can be used without any additional costs for several years.

Main competitors in this market include Aquatabs, a provider of water-purifying tablets, and two providers of filtering technology, Hydration Technology Innovation (HTI) and espWaterProducts. Aquatabs sells a pack of tablets that can purify up to 57 liters of water at \$9.99. HTI sells sets of single-use filtering packs that clean up to 2.13 liters at USD\$25.99, while espWaterProducts sells a tank-like filtration system that can purify up to 6813 liters at \$159.00. In terms of liters of water purified per dollar, Purely Water's product outperforms these designs due to its long life cycle. However, P&G's Children's Safe Drinking Water will produce and donate enough water-purifying chemical packets by 2020 to purify 2 billion liters of water per year. This product will, however, provide a more sustainable, long-term solution.

III. Proposed Solution:

Purely Water is proposing a product that will be able to provide clean water in a time of emergency to people affected by a natural disaster or people in any time of emergency situation in which they will not have access to clean water. This product will be an innovative water bottle system that will kill bacteria and viruses with a UVC light and filter out other microbes and finer particles.



Figure 1. Picture of a similar product by SteriPEN.



Figure 2. Picture of all the components of the SteriPEN product.

The system consists of a recycled two-liter bottle that will be inverted so that a small UVC light is inserted into the bottle opening (see Figures 1 and 2), a 30-10 micron filter to remove suspended solids, a hand crank generator to power the light, and a tap dispenser containing a 5-1 micron filter to filter out small particles from the pathogen-free water and dispense the potable water to be consumed. The water will initially be filtered through a coarse filter and into the bottle to remove large particles. It is necessary to pre-filter the water for the UV light to work properly. The UV light will not work properly if suspended solids diffuse the light. After filtering out suspended solids, the water in the container will be exposed to UVC light, powered by a hand crank generator, for a few seconds. The use of a UVC light “is simple but effective [at] destroying 99.99 percent of harmful microorganisms without adding chemicals to the water.”⁵ Pathogens in the water is a major problem in areas affected by a natural disaster, and the UVC

light kills almost all of the disease-causing bacteria and viruses in the water. After the water in the container is pathogen-free it will be filtered using a fine filter that removes smaller harmful chemicals and ions and dispensed through tap.

Purely Water's idea is innovative because it provides a large quantity of clean water in a few relatively easy steps and for a reasonable price. It is also an improvement on an item that already exists on the market called Steripen because of the extra features which make it more suitable for a more general disaster relief situation rather than a home use or camping situation as advertised by SteriPEN. These improvements include: two filters, a larger bottle, and a cheaper price. The system will include a coarse filter to take out large particles and a fine filter to take out small particles. This allows for a more general use of Purely Water's product because it will be able clean more water more effectively than the SteriPEN product will be able to.

Purely Water's method of water purification is better than other methods on the market because it allows for improved aspects such as allowing the water to be filtered twice, and the UVC light provides a cheap way to clean out almost all of the impurities in the water. The fact that this products makes use of recycled two-liter soda bottles is also important because it creates a chance to reuse a product that would otherwise contribute to pollution.

IV. How would it work? Organization & Financials:

Purely Water is affiliated to the non-profit Engineers for a Sustainable World (ESW) student organization at Georgia Tech, and is sponsored by UVNITY, a company that produces water purification products with a similar combination of UV and filtering. Purity Water will stay as a non-profit venture and will receive collaboration from UVNITY to design, prototype, and create our product. We will stay as a non-profit because this is in line with our vision to help people in disaster situations in a sustainable manner. If the profit margin of our product is kept to a minimum, as is done with a non-profit, the price of the product will be lower, and Purity Water will be able to aid more people in disaster situations.

As a small non-profit with no salaries to its staff and collaboration from a for-profit sponsor, the major costs incurred will consist of prototyping and production of initial batches of our product. Estimating a production cost of \$15 per unit, an initial batch of 500 units, and a prototyping cost of \$500, the startup costs for Purity Water are estimated at \$8000.

V. Milestones and Measuring Success:

Success will be achieved when Purely Water's product reaches somebody who needs it, and protects his or her health and life. A good measurement for Purely Water's impact would be to look at units sold, since it is reasonable to assume that each unit sold is being put to use. Purely Water plans to start production of the product by November 2014, in order to leave a year and a half for design of the product and the setup of necessary machinery and suppliers for manufacturing. For the first year, it is predicted that approximately 500 units will be produced. The profits of the first year will be reinvested and Purely Water will have the capacity to increase production to 1,000 in the second year, and 2,000 in the third. Purely Water would continue to increase its capacity, and thus its ability to influence the lives of people in disaster situations.

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Photos:

Buy a SteriPEN Portable UV Water Purifier. Digital image. *SteriPEN Blog RSS*. N.p., n.d. Web. 26 Mar. 2013. <<http://www.steripen.com/sidewinder/>>.