Access to clean, safe and reliable drinking water is often taken for granted in industrialized countries but is still an obstacle to soldiers deployed in remote, underdeveloped areas and a challenge to basic survival throughout the developing world. Diseases such as cholera and typhoid, long since eradicated in areas served by modern water purification systems, continue to claim thousands of lives every year in emerging nations, like Kenya and Sierra Leone. Dr. Theresa Dankovich, a research scientist at Carnegie Mellon University, in concert with advertising agency DDB North America, devised a revolutionary concept dubbed The Drinkable Book. The project is designed to provide immediate relief in the form of emergency drinking water and offer educational safety information to allow its users to better utilize available water resources in the future. [1] It also has the potential to become a revolutionary tool for the Department of Defense.

The United States Army issues purification tablets containing iodine, halazone and chlorine to deployed soldiers to treat individual canteens of water. These tablets are relatively bulky, slow acting and less effective in low temperature water (sometimes creating the need to heat the water being treated) and in water with extremely high or low pH ratings. Under these conditions soldiers are recommended to double the number of purification tablets used per liter of water, increasing the purification time to as much as 35 minutes per canteen and adversely affecting the taste and odor of the resulting purified water. [2] The Drinkable Book offers a potential solution to these drawbacks by saving weight, acting relatively quickly, and creating no adverse effects in regard to taste or smell of the treated water.

The human health impact of contaminated and disease carrying water is shocking. Worldwide, waterborne diseases are the number one killer of children under five, and more people die from the consumption of unsafe drinking water than from all forms of violent behavior combined, including war. Unsafe or inadequate water, sanitation and hygiene methods cause approximately 3.1 percent of all deaths worldwide. [3]

From the outside, The Drinkable Book is indistinguishable from a normal book. It is approximately one and a half inches thick with 20 pages. But, each millimeter thick page is embedded with silver nanoparticles, which are deadly to the waterborne pathogens and parasites that cause the deaths of about
3.4 million people each year but have no negative health effects on humans. [4] To use the filter the reader simply tears out the page, slips it into the filter holder, and pours contaminated water into filter. As the water passes through the page, microbes are killed by the silver nanoparticles. The paper kills more than 99,999 percent of harmful microscopic organisms, which puts the resulting water on par with U.S. tap water for purity. Examples of bacteria destroyed by silver nanoparticles include cholera, E. coli, and typhoid. [1]

“Essentially,” says Dr. Theresa Dankovich, the Carnegie Mellon Postdoctoral researcher who developed the filter paper, “the microbes come in contact with the silver in the paper and as a result they are killed by the interaction and the water is clean for us to drink.” Dankovich invented the bactericidal silver nanoparticle paper concept at the heart of The Drinkable Book while completing her Ph.D. in Chemistry at McGill University in Montreal. In 2014, she co-founded the non-profit pAge Drinking Paper to complete the product development for this filter paper and to study the health effects of using such a water filter. [5]

Brian Gartsid, a designer at DDB North America, took the paper filter concept and designed an easy to use system around it. Along with WATERisLIFE, a charitable organization helping to test the new technology in Africa, he also added the tips and directions for safe water usage and sanitation procedures on the pages, giving the book an educational component designed to prevent future perils, as well as to address short term water needs. By educating those in need of clean water on how to make the most of available resources and how to avoid waterborne illnesses, the Drinkable Book not only satisfies the immediate needs of the people it is designed to help but arms them with the knowledge of how to live more healthy lives on their own. [6]

Matt Eastwood of DDB said that the scientific principles behind The Drinkable Book will revolutionize water purification techniques around the world. “The product costs only pennies to produce, making it by far the most cost efficient purification method currently on the market. Each filter or individual page is capable of giving one person up to 30 days of clean water…which makes a single book capable of providing someone with clean water for up to one year.” [7]

WATERisLIFE, a charitable organization, believes access to clean water is a human right and hopes the invention will change the world and help to provide clean water for everyone. The organization works closely with local governments and community organizations to focus on an integrated approach that ensures households, schools, orphanages and medical facilities have access to safe water, proper sanitation and hygiene programs, and continuing education in these areas. [8]

Each page contains two filters, and each filter can be used to treat around 100 liters of water. Field tests were conducted in Africa and Asia from 2013 to 2015 along with controlled laboratory tests and a full commercial release is expected within a couple of years, pending approval from the Food and Drug Administration.

The concept of water sterilization through nanoparticles appears to have tremendous commercial potential, as well as being a lifesaving humanitarian aid, due to the cost advantages over traditional water filtering products and the simplicity of use it offers. “It should be something that is widely used because it doesn’t require electrical power and is very intuitive,” Dankovich said. [7]

As the potential for water purification through nanoparticles continues to evolve and military applications will continue to grow as well. The potential of this technology to improve the health and wellbeing of soldiers deployed to inhospitable climates where fresh water is not readily available should not be under estimated. By freeing them of the need to carry large amounts of purified water or harsh chemical purification tablets with them on patrols, they will be able to carry more equipment or to travel lighter to prevent fatigue. This system will also work more quickly than the traditional purification tablets and have no negative taste side effects on the treated water, which could prevent full consumption of the amounts of water needed to maintain hydration.

References

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