Tiny Teabag Filter Offers Tremendous Hope For The World's Thirst

Stellenbosch University

When an earthquake and tsunami devastated Japan in 2011, international aid groups raced to bring assistance to the beleaguered country. After their filtration plants were damaged, a key necessity was securing safe drinking water for the residents.

To this end, an aid group contacted South African businessman Tony Karsten hoping to buy thousands of inexpensive water bottles with built-in filters that his company, AquaQure, is developing for exactly such disasters. The bottle was still being perfected so Karsten couldn't send any, though he says, "They would be perfect for Japan."

The innovation grew out of research by Professor Eugene Cloete, Ph.D., at Stellenbosch University in Stellenbosch, South Africa. It uses a filter that resembles a teabag with a bacteria killing compound spun into its fibers. Not only does it sit on top of a reusable water bottle, it's also an extremely economical and easy way to deliver potable water to regions that need it most, namely those that have experienced a natural disaster, as well as poor areas around the globe that face a daily struggle for clean water.

> *According to the United Nations, 2 out of 10 people in the world do not have access to safe*

> *drinking water, and millions of people, mostly children, die every year from related diseases.*

Karsten said that his phone has been ringing off the hook since he signed a licensing agreement in late 2010 with the university to bring the teabag water filter to market. Much of the excitement and interest is coming from aid organizations, government ministers and international philanthropists.

“There is such a dire need,” Karsten says. “We have created a spark of hope now that there’s a clean option that they’ll be able to afford.”

A Big Idea in a Little Package

The genesis of the filter involves a serendipitous conversation, some teabags borrowed from a university boardroom and a hair straightener.

Cloete arrived at Stellenbosch University in early 2009 to become the dean of the faculty of science. In his previous job at the University of Pretoria in Pretoria, South Africa, he had been working on integrating an enzyme into industrial water systems to keep filters from clogging.

A few weeks into the new job, he was on a tour of the science facilities and heard a short presentation by a recently minted doctoral student. The student had used a process called electro-spinning or nano-spinning to turn a polymer gel into silk-like fibers.

Cloete got so excited about the potential of this technology that he couldn’t stop thinking about it. Upon returning to his lab, he called his former colleagues in Pretoria and asked them to send him some of his enzymes. His idea was to use electro-spinning to integrate the enzyme into the filters instead of having to incorporate the enzyme after the fact.

But since he was too excited to wait the week for the enzyme to arrive, he said, “Let’s try something else and put it in the fibers.”

Cloete had some biocide, an antibacterial gel that he had helped develop with Karsten over the past eight years. The two had worked on integrating the biocide into agricultural water systems to combat algae.

He asked his two postdoctoral students, Michéle de Kwaadsteniet, Ph.D., and Marelize Botes, Ph.D., to try spinning the biocide into fibers. They started experimenting with ways to integrate the biocide fibers into industrial filters to prevent contamination from bacteria.

“When you test them, you don’t test on an industrial scale,” Cloete explains. “You test in the lab so you can demonstrate the principle.”

The group needed a small-scale way to test the principle. They realized that teabags could act like a filter and provide a material onto which the biocide nanofibers could be spun. Cloete grabbed some teabags from the boardroom, emptied them of their leaves and they spun the biocide nanofibers onto the teabags. Then they filled the modified teabags with activated carbon — the same material found in your Brita water filter at home, which removes the water’s impurities. To seal the teabags back up, they needed something hot — one of the students had her hair straightener with her and used it to complete the operation.

The researchers discovered that the prototype filters worked in the lab, but turned their thoughts to scaling up the approach for industrial water treatment. Then Cloete — who presses his students to think about how changes in size and shape can improve innovations and was well-aware from his research that there is a massive global need for cheap, clean drinking water — had quite the reverse inspiration.

“We were cleaning 3 to 4 liters of water at a time” to test the filters, he says. “I asked myself, ‘Why don’t we design a filter for only 2 to 3 liters of water?’ That’s when it dawned on me that this was a very good idea.”

The World Takes Notice

The group switched its focus to smaller, water-bottle-size applications and spent the next year and a half laboring in the lab to perfect the technology.

At the same time, Stellenbosch University launched the Hope Project to mobilize its faculty to use its knowledge to solve the world’s problems. The university decided to showcase the teabag water filter for local media in the summer of 2010.

After that, “Things moved pretty quickly,” says Philip Marais, with considerable understatement. Marais is a business developer with InnovUS Technology Transfer, the university’s technology transfer company.

A story about the filter in the local paper was noticed by media around the world, and the teabag water filter was suddenly the subject of articles from China to Europe to the United States.

Cloete was flooded with inquiries from 120 organizations on six continents that were interested in licensing the technology. He passed each person along to Marais.

“How do you follow up with 120 organizations?” Cloete says, in explaining how grateful he is to Marais and his office for taking over the business side of the project. “They’ve played a very important role. You need people who can do that as a service to the scientists.”

For his part, Marais says he’s learned an enormous amount about the marketing potential of leveraging the media when an exciting innovation comes along.

“It’s quite staggering the value of that advertising that we’ve paid nothing for,” he says.

Doing the Most Good Possible

Marais had already been in discussions with Karsten, who was interested in licensing the technology, before the media frenzy. Despite the 120 other interested parties, Stellenbosch University decided to stick with Karsten’s AquaQure and signed an agreement with the company in November 2010.

“Tony is the perfect champion for the product,” Marais says, noting his “passion for the product and determination to see it go to market.”

AquaQure hopes to have full production under way at a Cape Town plant in the fall, with bottles on the market by the end of the year. He wants to keep the cost of the bottles as small as possible to provide access to the most people. The goal is that the bottles, which will come with a month’s supply of filters and a pictogram explaining how to use them, will cost less than $5 (U.S. currency). Additional filters, each of which can be used for a day, would cost less than a penny, Karsten says.

While the main focus is on providing safe drinking water to people who can’t access or afford it, Karsten says there’s an upscale version of the bottle being considered for hikers.

But, the main intention has always been to help those in desperate need.

Cloete said he has two big goals for the teabag water filter. He hopes it inspires other academics to use their knowledge toward solving humanitarian problems. And his main goal is chipping away at those massive problems himself.

“I want to see this make a difference in the lives of people who need it most,” he says. “To bring hope to people in the world who need this technology, where children are dying of disease. That’s my dream.”

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