

Worms Cutting Costs

This article introduces a creative approach to water and waste treatment as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

The Market

Chlorine is one of the most common elements in the biosphere, representing about 2 percent of the mass of ocean water. The world production reaches approximately 50 million tons good for an estimated \$30 billion dollar turnover in 2010. About 2.5 million tons valued at just under \$1.5 billion is used to disinfect water. More than 70 percent of waste water treatment plants in North America, Europe and Japan use chlorine as part of the process. These three markets represent more than two thirds of the chlorine for water treatment in the world, but are mature and are not expected to grow. Consumption of chlorine is growing at 9 percent per annum in the rest of the world.

The World Bank committed to a 10 year drinking water campaign with an investment budget of approximately \$450 billion dollars in order to make public drinking water available to at least half of the 1.1 billion citizens who have none today. China is the largest investor in water treatment plants, opting for large scale facilities. India has chosen a different path, focusing on small scale water treatment centers. There are an estimated 20,000 companies offering their services worldwide and the perspective for growth is tremendous. Worldwide, only 14 percent of the waste water is treated, in South America and Africa the number drops to 2 percent. The average chemical cost for chlorine is \$100 per cubic meter of potable water. Siemens is the largest supplier of gas chlorine disinfection systems.

The Innovation

Chlorine is the cheapest primary disinfectant available on the market today. It has an unlimited shelf life and is readily available. However, the product is toxic. An exposure to more than four parts per million damages lungs and while the transport and handling is thoroughly regulated, accidents do happen. Unfortunately, chlorine is not effective against giardia (a parasite that causes intestinal infection) and cryptosporidium (a microscopic parasite that causes diarrhea). Today these are the two most common causes of water transmitted diseases in North America. Recent studies have demonstrated that the use of chlorine creates two by-products (THM and HAA) which are known causes of cancer. While ozone and ultraviolet filters have complemented chlorine to reduce the health risks, their cost is considerably higher than chlorine, and thus out of reach for the millions of small treatment facilities that will have to be built in the near future.

Matías Sjögren Raab graduated as an industrial civil engineer from the Catholic University of Chile in Santiago, and complemented his science-based training with an MBA from the same school. His exposure to agro-industrial projects brought him in touch with earthworms. Just like the first exposure to this animal inspired Tom Szaky to build up his TerraCycle company (Case 52), Matías realized that he was face to face with an innovation that would permit him get out of the traditional cost trap of public works. After due study, he concluded that a biofilter made from earthworms would ideally suit the development of small scale water treatment plants. He would not only eliminating the need for chlorine, activated carbon, flocculating agents, he saw an opportunity to generate additional revenues as well. This is one of the core principles of The Blue Economy.

Matías went on to create Biofiltro Ltda, a Chilean-based provider of water treatment systems. He tested aerobic water treatment systems based on an filter of worms which cleanse the water without the creation of any sludge. Better even, the bio-sludge produced by traditional treatment systems can be processed on site. Since the production of biogas from this slurry is only commercially viable when operated at large scale, the earthworm-based biofilter positions itself as an ideal alternative for small scale facilities which represent the bulk of demand in the world. The company went on to obtain the 2011 Green Start-Up of the year award offered by Fundación Chile and UDD Ventures, the venture capital arm of the private Universidad del Desarrollo.

The First Cash Flow

The prime competitor to the biofilter is activated sludge - which controls perhaps 95 percent of the market. However, the first two commercial scale projects confirmed that the investment cost is 30 percent lower, and even more important, the operational expenses dropped by 70 percent mainly thanks to cutting electricity cost by 66 percent. Then, on average each cubic meter requires polymers and flocculation agents. None of this is required in the biofilter system. In addition, every traditional water treatment plant generates 500 grams of sludge per cubic meter treated, this system generates nothing. The system reduces the need for labor, putting some 15,000 earthworms per square meter to work 24 hours a day for 7 days per week.

The additional advantage is that each cubic meter of treated water generates 60 grams of humus, a by-product enjoying increased demand. While earthworms have been used as a medicine in China, its use as an immune system booster for patients who have undergone chemotherapy or have been infected by AIDS, has been recognized in various studies. The combination of reducing expenses on one hand and increasing revenues on the other is a change of the rules of the game. This offers the simple and basic biofilter technology a strong market potential.

The Opportunity

The market for small scale water treatment plants is explosive. Since the pressure is on to produce more drinking water, one of the obvious first sources is waste water. In Chile, a country where 85 percent of the communities' water is already treated, the market for sewage systems still represents a \$450 million. The market for treating industrial waste water surpasses the 1.5 billion mark spurred by new regulations for wineries and salmon processing plants. The mining sector is another ready candidate for the earthworm based biofilter water treatment plants. Thanks to the versatility of the earthworms, which adjust rapidly to the differing waste streams and levels of toxicity that characterize each industry, the performance can be guaranteed without the need for genetic manipulation or chemical controls.

Aristotle called the earthworms the intestines of the Earth, now it seems that this animal which most people cannot distinguish head from tail, is the water source of the Earth. Whereas the application in large scale facilities would impose an economy of scale that is not ideal for a biological process, the small scale treatment provides an ideal opportunity for entrepreneurship. Matías is already expanding his activities throughout Latin America and is setting up a first venture in India and we hope that many will follow suit.

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... Further information on the 100 innovations at www.theblueeconomy.org and www.zeri.org.

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