

PURE DRINKING WATER MAGIC

A HUMANITARIAN APPROACH TO ENGINEERING DESIGN

Recognizing that our lives would be impossible without water, the United Nations established international World Water Day on March 22, 1992. The main areas covered by the U.N. proclamation are water for health, biodiversity and environment, agriculture, and energy.

At the University of Idaho (UI), a student team was searching for a capstone design project, a requirement of senior engineering students. They were inspired by the clear

and clean waters of Idaho that are lacking in impoverished and drought-laden third world countries addressed in the U.N. proclamation.

Looking at possibilities, Eric Morris of Seattle, Wash., entered the picture and challenged the UI team to address the problem of safe drinking water being sparse in third world countries, particularly in East Africa.

Morris, a Boeing retiree, travels to Kenya annually, working with people living in the slums and/or are nomadic. According to Morris,

students, test the turbidity of contaminated water using a purification process involving Moringa seeds. Jennifer Miller and Sam Creason (background), mechanical engineering students, run a second test to verify results. Inset: Moranga seeds.

infants are the hardest hit by the lack of pure drinking water, with a mortality rate of approximately 7 percent in this group alone.

The UI student design team took on the challenge of designing a biofilter that would be able to remove all contaminants, both biological and other natural particulates, without the use of electrical power. The filter construction also had to be adapted to local materials and fit into the culture of the users. The problem was multifaceted, and a solution required expertise in many areas.

ASABE member Cami Johnson and Michelle LeBaron,

biological systems engineering students, researched bacteria and viruses common in Africa's water. With the help of Tom Hess, professor in biological and agricultural engineering, the team identified ways to test for these bacteria to verify the filter design.

"I have always maintained that if you want to save more lives, become an environmental engineer rather than an M.D.," Hess remarks, adding that a major avenue to a healthy population is healthy drinking water.

The UI College of Engineering stresses inter-disciplinary education, and the biological systems engineering students teamed with Nate Cropper, Jenn Miller, and Sam Creason, mechanical engineering students. The mechanical engineering students, under the direction of mechanical engineering professor, Don Elger, took on the task of designing the physical apparatus that needed to be inexpensive, could filter water for small groups or families, and be easily carried by nomadic groups.

The team named themselves "Clearwater Idaho Aid," in part because they recognized the tremendous humanitarian need in this desperate part of the world. Brainstorming, they came up with many ideas and, finally, one prototype design.

After many laboratory tests, the group realized the next step was on-site testing, and Miller was designated as the person to travel to Africa under the guidance of the more experienced Morris.

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The duo first tested the filter with the Maasai tribe in the slums of Tanzania. Arriving at the water source, Miller could see that the water conditions were much worse than the team had anticipated. The tribal members shared the same water supply with their cattle, often at the same time. Whether it is a river, a pond, or often times, just a mud puddle, contaminants are deadly to human life, particularly to children whose immune systems cannot fight off life-threatening, water-borne diseases.

As problems arose in the purity of the filtered water, a quick e-mail was sent back to the team at UI. The biological members of the team set about tweaking and testing the ingredients in the filtering process and sent adjustments back to Africa.

"We had to explore the vegetation of East Africa to find the right species and quantity to remove the clouded turbid-



Top: Cami Johnson and Michele LeBaron (foreground), UI biological systems engineering

students, test the turbidity of contaminated water using a purification process involving Moringa seeds. Jennifer Miller and Sam Creason (background), mechanical engineering students, run a second test to verify results. Inset: Moranga seeds.

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ity of the water,” says LeBaron. “We had to depend on Jenn’s eyes to relay the conditions of the water source.”

A main ingredient adjustment called for the increase of crushed Moringa seeds, which are available locally in Kenya. Adding additional time for the seeds to set in the test water reduced the turbidity of the liquid to a fraction.

The filtered water now appeared crystal clear, and the tribal elders declared that the process was magic! However, appearance alone can be deceptive. After testing for disease-carrying, micro-biotic “bugs,” the water was deemed drinkable. At this point the elders and other tribal members were eager to be involved in the process that would bring new life and health to this small segment of Africa.

The filter prototype was left with the Simba Maasai Outreach Organization in Africa, and Miller

returned to the UI with first-hand experience and new ideas of how the team could further refine and re-design the unit.

So innovative was the team’s approach that they won two awards for excellence at the 2006 Engineering Design Expo, an event that gives a public stage for engineering seniors to show their design projects.

The team members graduated in May, and LeBaron will continue on at the UI as a graduate student in biological and agricultural engineering. The rest of the team will be working in industry or attending other graduate programs. However, LeBaron and some of the industry-bound members plan to become mentors to next year’s design team, who will be developing a second-phase water filter that will incorporate native materials from other parts of clean-water-starved Africa.



Jenn Miller, the eyes and ears of the capstone team in Eastern Africa, introduces members of the Maasai tribe to the idea of using crushed Moringa seeds found locally, to aid in the purification process of contaminated water seen in the background.

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