Best Practices for Dosing Chlorine in rural community water supplies of Ecuador

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At the beginning of summer, I had the opportunity to travel to Ecuador with a team of seven Calvin students and three professors to study the water systems in rural villages in the mountains. The team had a three-pronged goal; first, to look at the chemistry of the water both before and after being dosed with chlorine; second, to study the terrain of the system in order to build digital models; third, to study the reaction of the population of each community to varying chlorine levels of chlorination. We found that although every community that we visited had some method of dosing chlorine into the water, only approximately half were using that technology appropriately, the rest had either no chlorine in their water, or so little that it would have practically no effect.

Chlorine is essential in a water system as a method of disinfection. It rapidly eliminates disease causing organisms such as *E. coli* and cholera. Due to an outbreak of cholera in Ecuador in the 1990s, the government advises that all community water systems have a form of chlorination installed, but as was seen in Ecuador, many of these methods of chlorination are ineffective.

One of the least expensive chlorination methods, frequently used in Ecuador, is an in-line tablet chlorinator. These chlorinators work by allowing water to flow over a stack of chlorine tablets. The tablets erode when exposed to water, providing chlorine to the system.

Over the course of the summer, I evaluated two different in-line tablet chlorinators. One was a pool chlorinator, the other a chlorinator provided by Water Mission International, an NGO that installs and maintains water systems around the world. Each chlorinator was evaluated at four different flow rates and with two different types of chlorine tablets. Additionally, flow setting (the amount of water passing through the chlorinator) was measured at different points, and for the pool chlorinator other parameters such as water level in the chlorinator, internal pressure, and the presence or absence of internal tubing was evaluated.

Each day, the chlorinator was run at a specific flow rate. The chlorine level was measured with a colorimeter every hour for four to eight hours in order to determine both the amount of chlorine dosed for a given set of parameters, as well as the variability in the chlorine level.

We found that the pool chlorinator functions much more effectively at higher flow rates between 1.5 and 2 liters per second and with softer, Calcium Hypochlorite tablets. The Water Mission chlorinator is much more effective for lower flow rates up to 1.5 liters per second and with the harder, Trichlor tablets. This information, along with several other recommendations, will be passed on the groups working in Ecuador to provide a set of best practices when installing chlorinators in water systems.

This summer has been influential in helping me to decide what I want my post-graduation life to be like. I am interested in doing research once I graduate, and I would like to use my engineering degree to develop technologies to help those who are underserved in developing nations. This research opportunity has helped me to do both, and to see ways in which many scientists and engineers are combining engineering and international development to work for change around the world.