JPUR

JOURNAL OF PURDUE
UNDERGRADUATE RESEARCH

ENGINEERING/TECHNOLOGY

Slow Sand Filters to Improve Drinking Water Quality in Rural Areas within Developing Countries

Student researchers: Ananth Raman and Fernando Segovia, Seniors

Access to sufficient quantities of clean drinking water is a serious problem in the rural areas near Barbosa, Colombia. Due to limited groundwater resources, rural elementary schools and local residents rely on collecting and boiling water from mountain streams to meet their needs for safe, potable water. However, because of high turbidity levels, the resulting water can be of poor quality. To address this issue, technologies are required that: (1) remove turbidity from the water, (2) are user/operator-friendly, (3) require low maintenance, and (4) are inexpensive to build. Slow sand filtration (SSF) was explored as a cost-effective, low-maintenance treatment technology to meet the needs of the local population. The team's original SSF design, implemented at three schools, required much labor to prepare all the construction materials, including several sizes of gravel and sand, and required some level of expertise for final on-site assembly. To alleviate this, an improved design that used a porous plate was implemented, which replaced the gravel layer and maximized the sand depth, effectively increasing flow. However, commercially available components were too costly for a scaled-up design of the porous plate. Utilizing a mechanical model, pore size, spacing, and plate dimensions were optimized such that maximum stress, σ_{max}, on the plate was minimized. These factors allowed for a design fabricated using a resin material via a 3-D printing-rapid prototyper supplied by the Purdue University Ideas to Innovation (i2i) Learning Laboratory. Ultraviolet (UV) light and ozone are currently being evaluated as options for disinfection after filtration.

Research advisors John Howarter and Chad Jafvert write, "Low cost drinking water treatment technologies for developing regions do not need to be rudimentary or only made from local resources. The research conducted by Raman and Segovia shows that by manufacturing and transporting small but essential parts, more robust and easy-to-assembly water treatment systems can be constructed anywhere around the world."

Raman, A., & Segovia, F. (2013). Slow sand filters to improve drinking water quality in rural areas within developing countries. *Journal of Purdue Undergraduate Research*, 3, 88. http://dx.doi.org/10.5703/1288284315160