Removal of arsenic from water under static-state conditions.
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Introduction
Previous testing has shown that Nicaraguan ceramic filters are effective at removing microbes from groundwater retrieved from wells. However, the ceramic filters are not able to remove Arsenic from the groundwater and have actually been shown to increase the arsenic concentration in the filtered water. The objective of this study was to test different media that could be used in conjunction with these ceramic filters, within the catch basin with static-state conditions, to make potable water with concentrations of arsenic below the U.S. EPA threshold of 10 ppb. The media tested were activated alumina, activated charcoal, ferric oxide, and silica sand.

Materials and Methods
Part 1
A GBC 906 Atomic Absorption Spectrophotometer with a GBC GF3000 Graphite Furnace was used to analyze the arsenic concentration in the water samples down to levels <2 ppb. Twenty-five gallons of 40 ppb arsenic water was made using non-chlorinated, as it would be in the wells, distilled water and a 1000 ppm stock solution of arsenic. Test buckets were made to conditions similar to the catch bucket used with the ceramic filter and 1 inch of the media was placed in each bucket. Three runs of each media were set up as well as three controls. An equivalent volume of 40 ppb arsenic water was poured into the test buckets and the time was recorded. Five mL aliquot samples were taken at 1 hour, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours, 36 hours, and 48 hours for activated charcoal and silica sand (1 to 48 hours). Within the first 10 minutes the activated alumina reduced the concentration of arsenic in the water sample to a level of 2.9 ± 0.5 ppb.

Part 2
Within the first 10 minutes the activated alumina reduced the concentration of arsenic in the water sample to a level of 2.9 ± 0.5 ppb.

Results
Part 1
The activated alumina and the ferric oxide were both effective at decreasing the level of arsenic in the water in a short period of time. By the time the first sample was taken at 1 hour, analysis showed that the arsenic level in these samples were at an average of 2 ± 0.5 ppb for the activated alumina, and 3 ± 0.7 ppb for the ferric oxide. Neither the activated charcoal or silica sand were very effective in a static setting, with levels of arsenic at 48 hours averaging 34 ± 1 ppb for activated charcoal and 26 ± 2 ppb for silica sand.

Conclusions
The activated alumina and ferric oxide proved to be effective at removing arsenic to acceptable levels within the first hour, with the activated alumina performing best. The activated charcoal and silica sand still had unacceptable levels of arsenic after 48 hours. In follow up testing, using shorter sampling intervals, within the first 10 minutes activated alumina decreased arsenic to an acceptable level of below 3 ppb.

Future
The next step is to test how long the media continues to be effective after repeated exposures to arsenic, and at what point it needs to be reactivated or changed out. Another possible test is to see how effective the media is when put inside the ceramic pot instead of at the bottom of the catch bucket.

Acknowledgments
The research activities were supported by the United States Department of Agriculture and Water Resources Institute at California State University San Bernardino. USDA NIFA AWARD No. 2011-38422-31204

References