ANNUAL NEWSLETTER

PureMadi

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The intersection of water, societal, & human health disciplines

Table of Contents:

Dertig Filter Distribution

As part of PureMadi's 10th Anniversary celebrations, ceramic water filters were sold at a discounted rate of R10 per package to all Dertig residents. A filter package is normally priced at R350 (about US$22). Fliers were posted in public places telling residents they could visit our filter production facility to pick up their highly discounted filters. Filters were limited to our current inventory. Dertig has been the home to PureMadi's filter production since 2017. The facility is just a few kilometers from Hammanskraal and about an hour's drive north of Pretoria. Most Dertig residents are relatively poor, and very few have a consistent source of safe drinking water. Municipal water in Dertig is typically of low quality and often lacking a residual disinfectant. Water service is also intermittent. Water often only flows from taps for a few hours per day, or even just a few hours per week. Residents therefore must store their water, and it often becomes more contaminated with pathogenic microorganisms during storage in the absence of a residual disinfectant. The exciting news of the filter sale spread quickly and hundreds of families came to the facility within a few days to purchase the discounted ceramic water filters. Proof of residence was required to ensure that only Dertig residents benefited from the exercise which lasted from the 6th of December to the 13th of December 2021. A total of 350 filters were sold and over 2000 beneficiaries now have access to clean drinking water. The Dertig leaders and community members were very grateful for such an act and mentioned how PureMadi's ceramic water filters could potentially lower the incidence of waterborne illness in the Dertig area. "This will have a very positive impact on the community" says Nkosi Ndebele, the Dertig facility manager. "We know our filters are highly effective, simple to use, and locally produced with excellent quality control. The entire community will have safer water and better health as a result of this campaign."

What Are PureMadi Filters?

In the USA and other developed parts of the world, we have high quality drinking water that is purified in water treatment plants. The water is typically chlorinated to insure there are no pathogenic microorganisms. Sufficient chlorine is added to insure it is safe through the distribution system. It is highly regulated and available 24/7. Unfortunately, several billion people do not have access to this level of service. As a result, their water is often unsafe to drink and consumption results in gastrointestinal infections that lead to vomiting, diarrhea, and in extreme cases, death. More than 1 million children die each year from unsafe drinking water, and countless more suffer adverse affects like growth stunting and cognitive impairment.

In many parts of the world, municipal governments do not have the financial resources to provide safe water continually to regional populations. Therefore, the World Health Organization has indicated a possible solution path is to provide water treatment options at the household, or point-of-use level. In other words, people can treat their drinking water in their home right before they consume it.

Our PureMadi filters are a sustainable way to provide this point-of-use drinkingwater technology. PureMadi filters are manufactured with mostly local materials: clay, sawdust, and water. These materials are combined in appropriate proportions, pressed into the shape of of a pot. After air drying, the filters are heated in a kiln (a high-temperature oven) at 900 ˚C. During firing, the clay sinters to form a ceramic, and the sawdust combusts, leaving pore space for fluid flow. After firing, the filters are painted with an aqueous suspension of silver nanoparticles. The nanoparticles lodge in the filter pore space. After a quality control flow check, the filters are then placed in 20-liter plastic buckets with a cover and a spigot. Water is poured into the top of the unit, and then percolates through the filter. Suspended particulates (turbidity) is removed by physical filtration and microbial pathogens are disinfected by silver ions that oxidize and release from the silver nanoparticles.

By using local labor to produce filters, a revenue stream is created to provide employment to workers. Filter production and distribution benefits the entire community by providing a low-cost source of safe drinking water.

Our Impact at a Glance

5,000
filters distributed

25,000
people impacted with clean water

350
children received water & hygiene education

30
jobs created in two communities

500
volunteers and supporters engaged

UVA Team Visits South Africa

Doctoral student Jamie Harris, Civil Engineering student Julia Davis, and Chemical Engineering student Maya Reese recently traveled to South Africa for a research project combining MadiDrops+ with point-of-use filtration systems to quantify the value-added by the MadiDrop+. This work built upon work conducted in the laboratories of Professor James Smith (University of Virginia) and Professor Joshua Edopkayi (University of Venda, South Africa). They conducted their research with the help of Lucas Mavhungu, the Chief of the village of Tshibvumo, located about 40 km south of the South African border with Zimbabwe. Chief Lucas has been a long-time partner in PureMadi's activities, and many residents own PureMadi ceramic filtration systems. The student team had a highly successful research trip and were able to visit the new PureMadi production facility in Hammanskraal on their way from Johannesburg to Thohoyandou.

The UVA student team visits the new PureMadi production facility in Hammaskraal

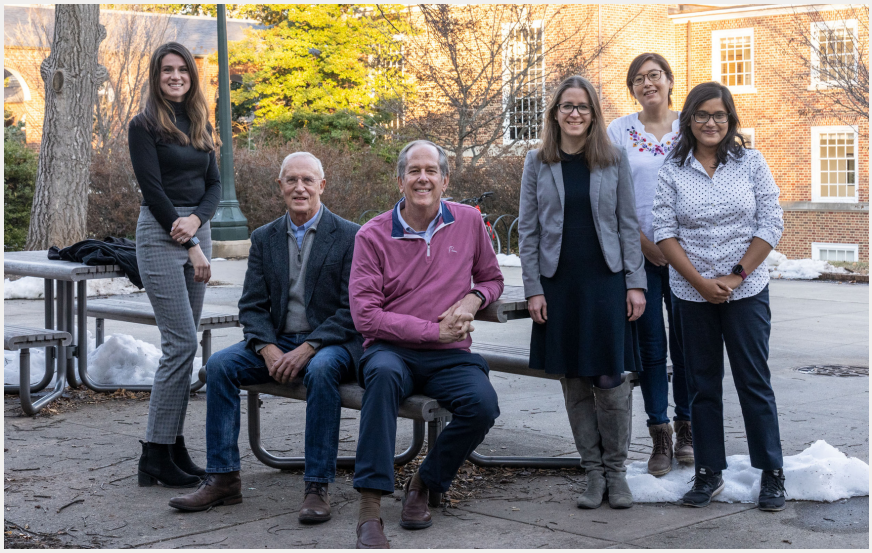
The UVA student team and students from the University of Venda meet Chief Lucas at his home.

PureMadi's Response to the Pandemic

In March 2020 PureMadi closed down our filter facility for 5 months at the start of the COVID-19 pandemic. We were extremely fortunate, through the generosity of our donors, to be able to continue paying our employees throughout this time. When the facility reopened, PureMadi Dertig's Manager Nkosi Ndebele created a safety response plan using guidelines from the South African Government and the World Health Organization. Given the close proximity that filter making requires, filter production remained on hold as we worked on filter quality audits and donations in the community as able. Over the last two years, Nkosi and the PureMadi workers have been adaptable and resilient in the face of a variety of shutdowns during waves of the pandemic and changes in safety guidelines. The team has remained eager to participate in creative ways to continue working even throughout the uncertainty. Our safety and sanitation measures remain in place and the team is looking forward to re-establishing filter production and engaging the surrounding community in the coming months as they learn to work in this new normal. We are extremely thankful that the workers have remained healthy and continue to be passionate about distributing filters to populations in need.

Making Better PureMadi Filters

Students and faculty from the University of Virginia are continuing to perform research on silver-ceramic technologies for water purification. With a recent $250,000 grant from the National Science Foundation, the synergistic disinfection of silver, chorine, and copper are being quantified. Additionally, new methods for the release of these disinfectants from porous ceramic media are being studied. This is a collaborative effort between Silivhere Technologies, Inc. (manufacturer of the MadiDrop+), and the Departments of Chemical Engineering and Engineering Systems and Environment at the University of Virginia. For chlorine release, Professor Rachel Letteri is leading the effort to develop a polymer with chloramine functional groups. When placed in water, the polymer is hypothesized to release Cl +1 , which in turn reacts to form hypochlorous acid and hypochlorite ions. These are the chlorine-based disinfectants commonly used in water treatment. The fabrication of a working polymer has been completed, and the team is working to optimize the polymer for use in conjunction with silver ceramic technologies like the MadiDrop+ or PureMadi ceramic filters. Israt Duti and Ana Estrella-You are doctoral students working with Professor Letteri on this research topic. Concurrent with this work, Professor James Smith and doctoral student Jamie Harris are developing ways to release copper into treated drinking water. Although they are in the early stages of data collection, the team has developed a 200-mesh copper scaffold that produces200-400 µg/L of copper ions in 10-liter volumes of water and the results are reproducible for multiple days in a row.



The student-industry-faculty team studying the synergistic disinfection effects of silver, copper, and chlorine. (l. to r. Jamie Harris, Chris Conti, Jim Smith, Rachel Letteri, Ana Estrella-You, and Israt Duti).

The team of investigators have also established that silver, copper, and chlorine work synergistically together to disinfect water, and copper and chlorine give a particular disinfection boost to viral pathogens like adenovirus and rotavirus.

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You're Invited!

Join us in celebration of PureMadi's 11th Anniversary!

Visit us online to buy your tickets and show your support!

UVA Alumni Hall
September 9, 2022