



Kopo Safi: Low-Resource Water Desilting For Developing Countries

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1 in 10 people in this world **don't** have access to clean drinking water. **2 million people die** every year from **preventable** water-borne diseases.

Kopo is a company developing a system to collect and carry water, and use sunlight to eliminate disease-causing bacteria and coliforms from river water.

Kopo Can
• 14 litre capacity
• Designed for the SODIS method

Kopo Roller
• 1 roller holds 6 Kopo cans
• less physical stress on body

Kopo Wai
• An indicator that shows when the can has received enough UV radiation from sunlight

Kopo Safi
• A low-resource filter add-on to the Kopo can, enabling the SODIS method to work effectively

METHODS

REACHING TURBIDITY STANDARDS

Turbidity is cloudiness or haziness of a fluid caused by large numbers of individual particles that are (individually) invisible to the naked eye. Turbidity can be calculated in NTU's, or Nephelometric Turbidity Units, which measure scattered light at 90 degrees from the incident light beam.

Water needs to be clear to the eye for SODIS to work effectively. Our team's goal was to reduce turbid water to 30 NTU or less, while maintaining a reasonable flow rate through the filter.

MATERIAL SELECTION

Seven different fabrics were tested with low volume of turbid water, and each fabric was layered until the turbidity goal was reached. Next, the top three performing fabrics were tested with high volumes of turbid water. Each fabric was layered about half as many times as when tested at low volumes. Finally, selected materials were paired and tested at high volumes to maximize the filtering ability and flow rate.

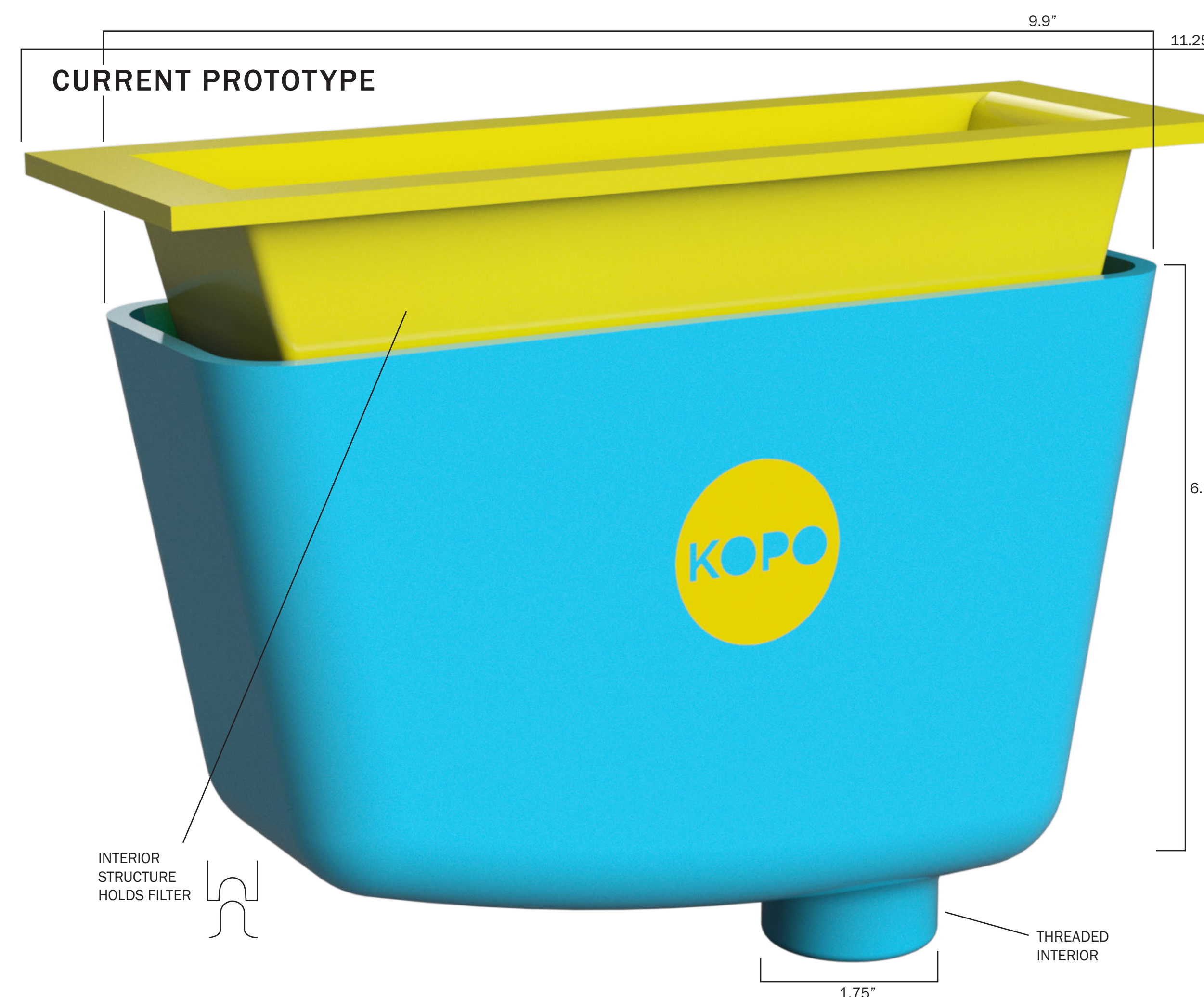
TURBIDITY TESTING

To test the effectiveness of materials, we used a highly concentrated silt sample, a 2100Q Hach Portable Turbidimeter, a styrene funnel, and fabric.

TESTING PROTOCOL

1. Mixed silt sample with tap water to reach the desired turbidity level and volume
2. Measured turbidity prior to filtration
3. Measured turbidity once per liter of filtered water
4. Each sample was measured 4 times to increase the accuracy.

DESIGN



The current Kopo Safi prototype is a two-part filter-funnel. The larger (blue) component screws securely onto the Kopo can, while the second component sits like a basket inside. A simple structure at the bottom of the funnel mates with its counterpart in the basket to pull the cloth filter taut and hold it.

The two-part design allows the filter to be quickly taken out for cleaning (with silt rinsed or shaken off) while filling the Kopo can, if necessary. The tight, double-walled design of the component that holds the cloth filter ensures the fabric stays securely in place and no turbid water leaks through, nor does the cloth sag, reducing its filtering effectiveness.

MATERIAL & MANUFACTURING

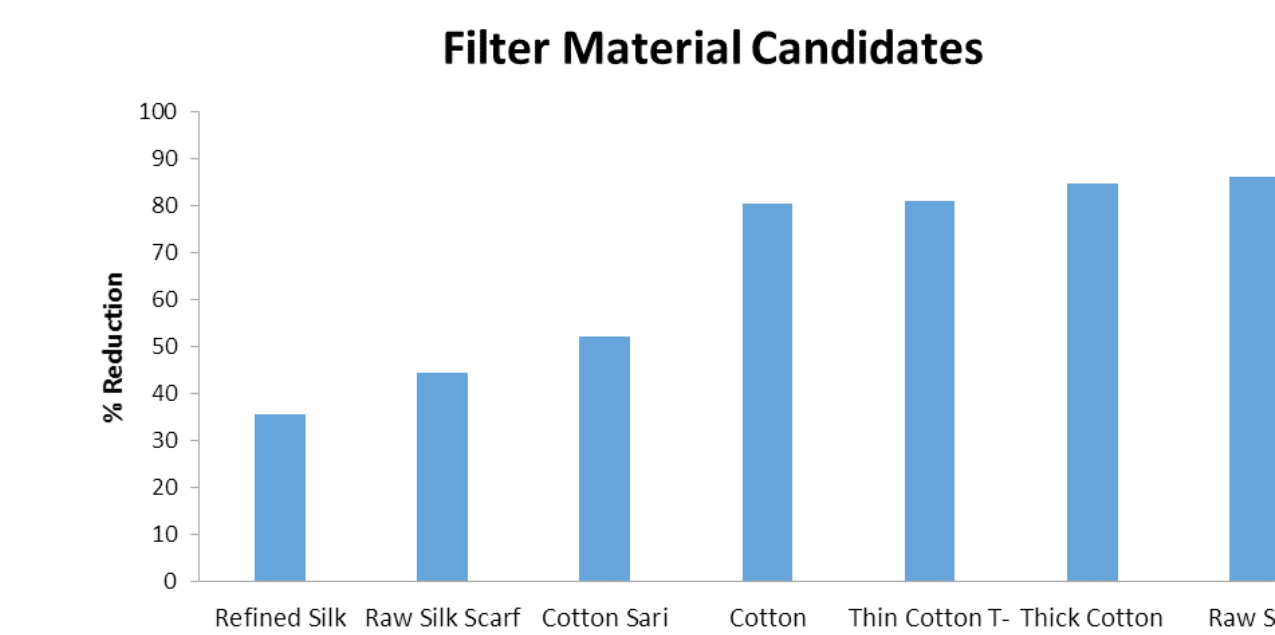
The funnel and filter-holding component will each be produced as a single piece of molded PET plastic, with a snap-joint style closure mechanism. PET is the same durable material used to make the Kopo can, ensuring the Kopo Safi funnel will have a lifetime at least as long as the Kopo can it will be used with.

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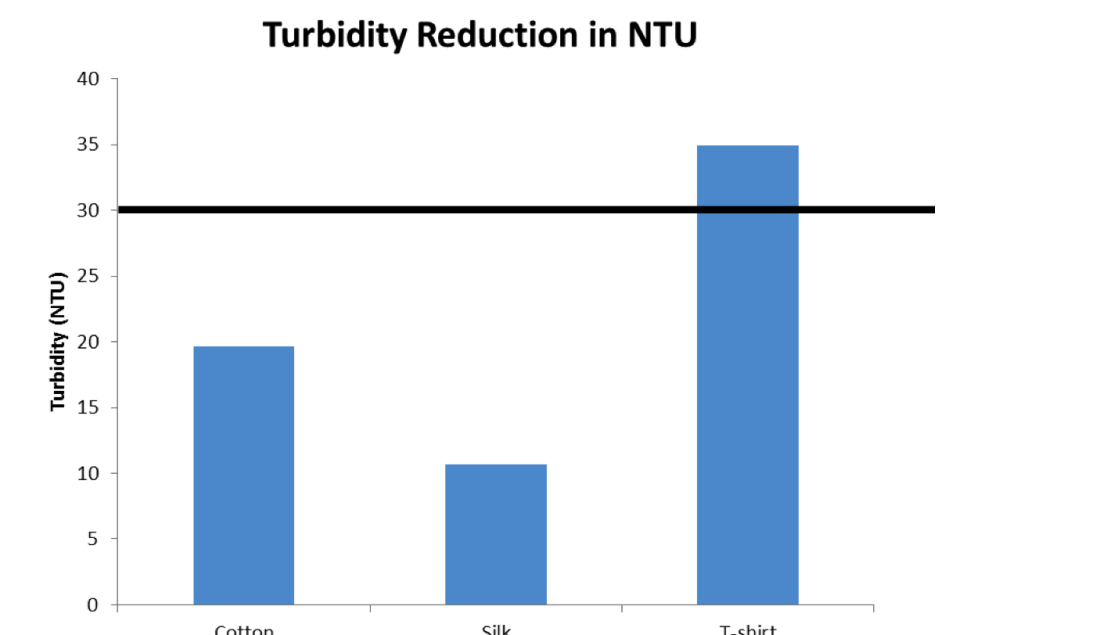
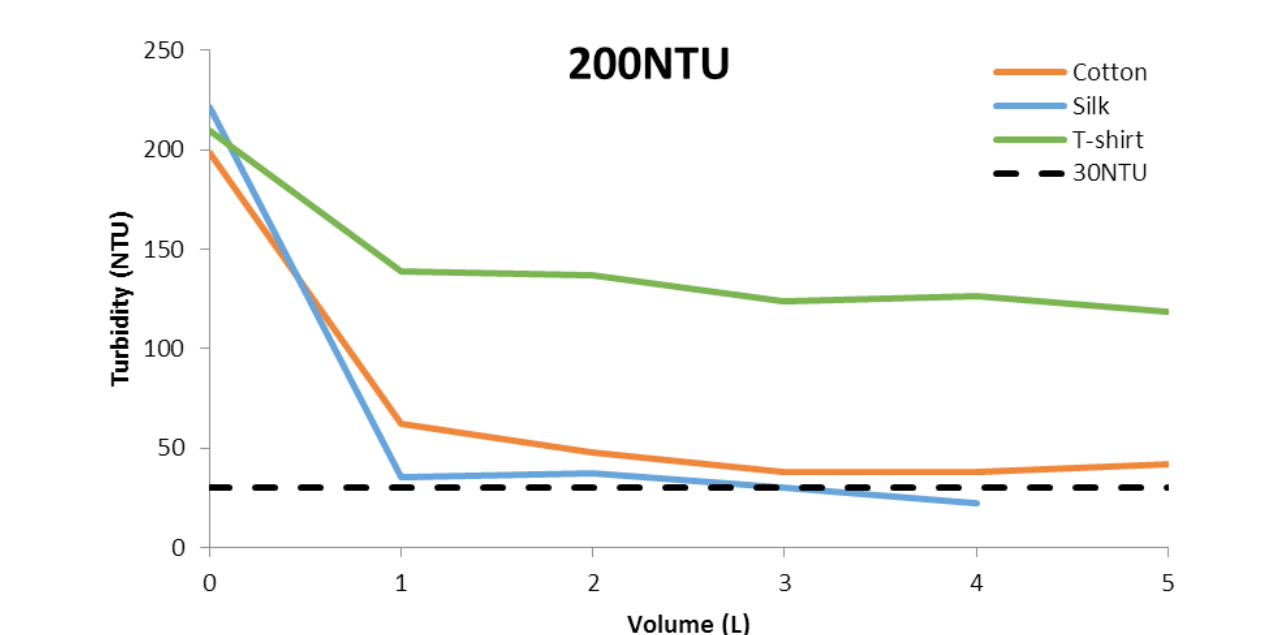
RESULTS

MATERIAL SELECTION



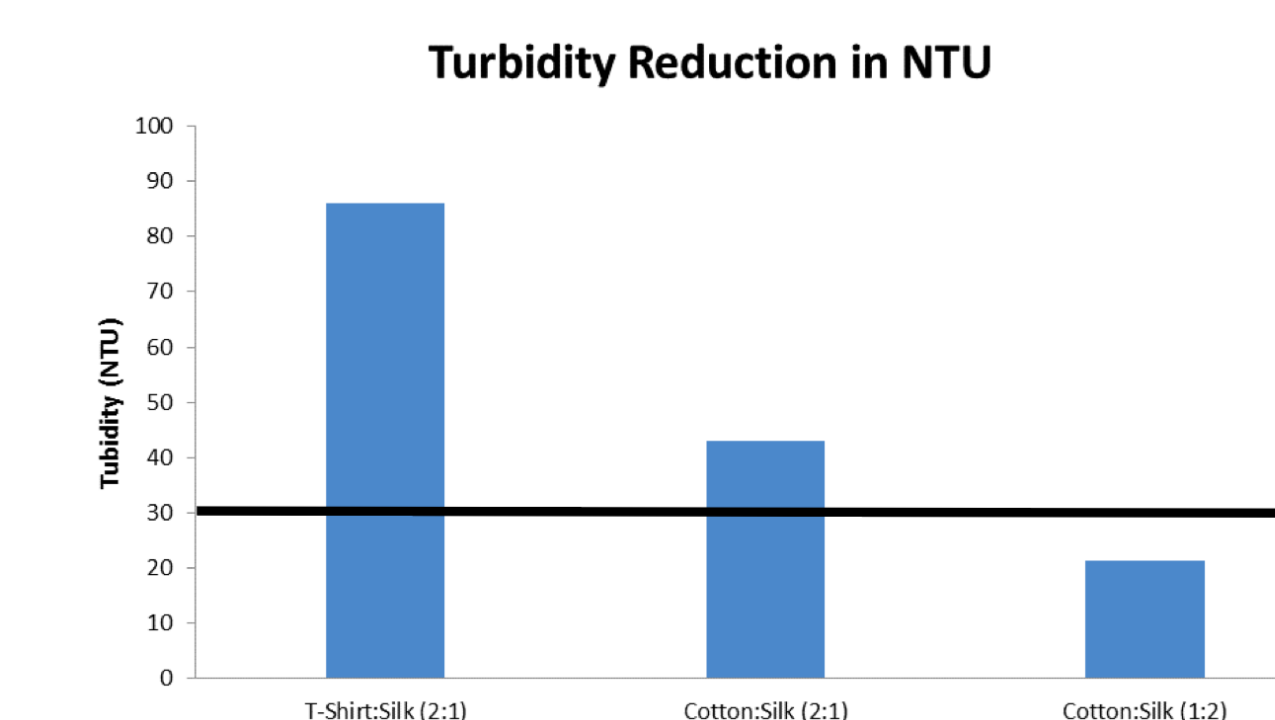
Upon testing the seven materials, it was determined that cotton, t-shirt, and raw silk were the most capable filter materials. (Because of their similarity in performance, both the thin and thick t-shirt are grouped on this chart, as simply 'tshirt'.)

HIGH-VOLUME TESTING



When large volumes of water were tested on the three best materials, it was found that the accumulated silt layer aids in filtration, but also slows down the flow. Silk performed the best, but was too slow for practical use. To solve this, combinations of fabrics were considered.

OPTIMIZATION



When testing fabric combinations, a one cotton layer on two layers of silk was found sufficient to filter to the benchmark turbidity. Using this combination also allowed the water to filter faster than the previous mono-fabric filters.

CONCLUSION

Our filter and funnel will be able to clean water to WHO standards for solar disinfection, while being low-cost and easy to use. Together, the Kopo can, Kopo Safi filter and Kopo Wai indicator will help provide clean drinking water to people who need it.