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Effectiveness of Muslin Fabric Filtration for Drinking Water Treatment in Developing Countries

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Introduction

In many developing countries, clean water is rare. There are a number of ancient traditions used to filter water to remove solids. One way is using fabric to filter water (Figure 1).

The purpose of this research was to optimize fabric filtration by testing different types of muslin fabric. All lab tests included measurement of the turbidity (cloudiness) of the water and the flow rate.

Independent variables included:

- Number of layers
- Fabric type (thread count and bleached or unbleached)
- Initial water turbidity
- Filtration process

Figure 1: Women using fabric filtration

Methods

Baseline Column Study

This method involved filtering 100 mL water samples with a predetermined turbidity through a certain number of layers of fabric. Each run would start with a new sample of water and a new number of layers.

Effect of Volume

Tests were run to determine the effects of the water volume on the percent removal of turbidity. Each test used water samples with different volumes (100, 200, 300, 400, and 500 mL). For each test, eight layers of fabric were used.

Sequential Filtration

In these tests, one 250 mL sample of water was used with a set of eight layers of fabric. The filtered water was refiltered through the same eight layers of fabric multiple times.

Figure 2 shows the general set up of the apparatus which consists of a column, the fabric, and a jar to collect the filtered water. The fabric was suspended at the end of the column without stretching.

Figure 2: General Setup of Filter

Results and Discussion

Figure 3 shows the percent removal for a high turbidity sample (140 NTU) for three types of fabric with respect to the number of layers used. Fabric A is unbleached and has a high thread count of 264 per in^2. Fabric B is unbleached with a low thread count (180 per in^2). Fabric C was bleached with a low thread count (180 per in^2). Fabric A had the highest percent removal of turbidity for each number of layers used. Fabrics B and C were both lower in percent removal than fabric A .

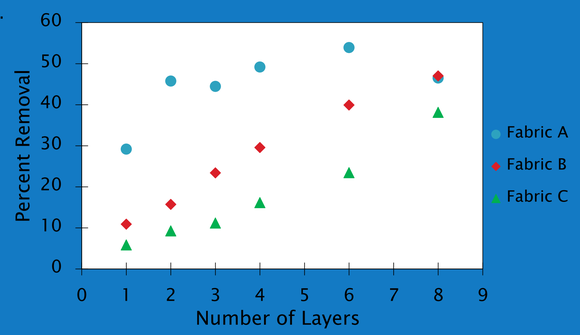

Figure 3: Removal of High Turbidity

Figure 4 shows the percent removal for a low turbidity sample (40 NTU) for fabrics A, B, and C. Again, fabric A had a higher percent removal than fabrics B and C. Fabrics B and C were roughly around the same percent removals for each number of layers used.

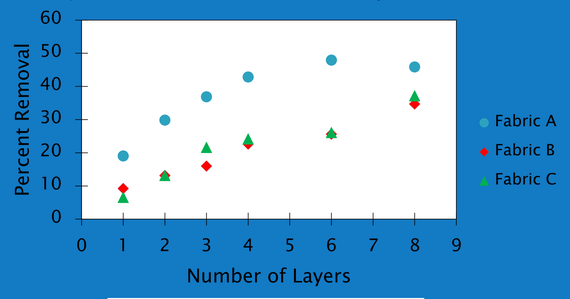

Figure 4: Removal of Low Turbidity

Figure 5 shows the results from using different volumes of water each with the same initial turbidity of 140 NTU. Eight layers of fabric A was used for these tests. The general trend was that as the volume of water increased, the percent removal of the initial turbidity increased as well. This may represent increased removal due to filter clogging.

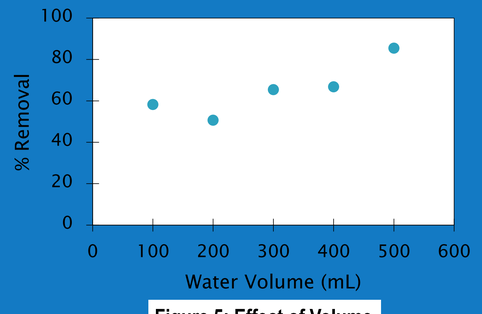

Figure 5: Effect of Volume

Results and Discussion (Continued)

Figure 6 shows the results from sequential filtration. This test used one sample of water (250 mL and an initial turbidity of 136 NTU) with 8 layers of fabric A. The turbidity decreased after every run. By the 12th run, it had an effluent turbidity of about 0.5 NTU. This level of turbidity would meet the U.S. standards for drinking water. The exponential decrease in turbidity is consistent with filtration theory.

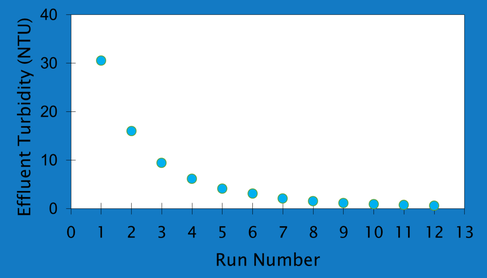

Figure 6: Sequential Filtration

Conclusion

- Unbleached fabric was more efficient than bleached fabric
- More layers resulted in better turbidity removal
- Higher thread-count fabric was more efficient
- Increase in the volume of water used resulted in a higher turbidity removal
- Sequential filtration was more efficient and was capable of achieving very low turbidity treated water

Future Work

- Test how well muslin fabric can remove pathogens from a water source
- Use authentic fabrics
- Implement the results of this work in the developing world

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