



AN IN-DEPTH LOOK AT SAWYER WATER FILTERS

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WHY CHOOSE A SAWYER FILTER

THE 0.1 MICRON ABSOLUTE DIFFERENCE

- Sawyer’s fiber walls are thicker and more robust than other Hollow Fiber Membranes. This allows for higher pressure both for filtering and for backwashing. Sawyer filters can handle 60 PSI forward and 20 PSI backwards.
- Sawyer has a proprietary process of making all pores more uniform in size.
- Sawyer’s proprietary process allows for more pores giving better flow and less cleaning.
- Sawyer’s proprietary design has a self priming mechanism to eliminate air locks making them much easier to restart.
- Sawyer 100% tests all filters to insure no pore is larger than 0.1 micron.
- Sawyer 100% flow tests all filters to insure adequate flow.
- Sawyer 100% tests filters after final assembly to insure quality.
- There is nothing to wear out inside the filter. If water is flowing, it’s good.

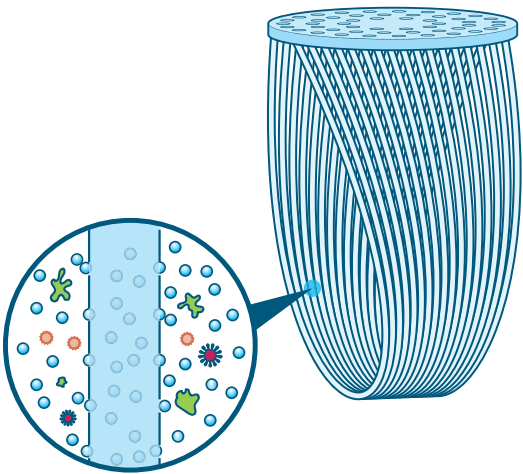


FIGURE A.1

THE 0.02 MICRON ABSOLUTE DIFFERENCE

- The 0.02 micron purifier has all the advantages of the 0.1 micron filter but with 0.02 micron pores.
- It is the only filter that removes viruses so effortlessly. Gravity does all the work.
- There are no harmful chemicals or heavy metals in the filter.

SAWYER FILTER REMOVAL RATES

		WATERBORNE DISEASES	EPA REQUIREMENT	EXCEEDS EPA REQUIREMENT	SAWYER REMOVAL RATES
PURIFIER	FILTER	BACTERIA WHICH CAUSE I.E.: Cholera, Botulism, (Clostridium botulinum,) Typhoid, (Salmonella typhi), Amoebic Dysentery, E. Coli, Coliform Bacteria, Streptococcus, Salmonella	99.9999% 6 log	YES	99.99999% 7 log
		PROTOZOAN (CYSTS) I.E.: Giardia, Cryptosporidium, Cyclospora	99.9% 3 log	YES	99.9999% 6 log
		VIRUSES I.E.: Hepatitis A (HAV), Poliovirus, Norwalk, Rotavirus, Adenovirus, Hepatitis E (HEV), Coxsackievirus, Echovirus, Reovirus, Astrovirus, Corona Virus (SARS)	99.99% 4 log	YES	99.9997% 5.5 log

*SAWYER Filters DO NOT remove VOC’s, heavy metals, or chemicals in solution such as fluoride and arsenic

THE BENEFIT OF CONTINUOUS BACK FLUSHING CAPABILITIES

At this point we do not know what the lifetime limitations of the fibers are. We have working filters that have been in continuous use for over six years and we have filters which have filtered hundreds of thousands of gallons of water. Sawyer's fibers are so robust, they can be backwashed and reused perpetually.

- When backwashing, even the stubborn dirt can be forced off the fibers.
- Sawyer's robust fibers will not "wear out" over time.
- Sawyer fibers will not break or become damaged if dropped. Only breaking the sealed casing and "playing" with fibers or freezing the cartridge after it is wet could damage the fibers.

CONTINUAL IMPROVEMENTS

Since 2008, Sawyer has made numerous improvements to make the filter system easier to use and to accommodate cultural nuances.

- When people started opening the filters to see and touch the fibers we welded the casing closed.
- When they dropped the filters and broke them, we increased the strength of the filter casing.
- We include pictorial guides for both cleaning and set-up.
- We include a picture label affixed to the bucket showing how to clean the filter.
- We changed to special colored tubing that will not show the dirt nor promote algae growth in the tube.
- We designed an easier method to remove the filter for cleaning which also allows it to be used on standard 28mm plastic bottles. This adds a whole new portable dimension for the user.
- We designed a bucket fitment that is more forgiving if the hole is not perfectly round and also prevents kinking of the tube.
- We added a removable cap to keep the end of the filter clean.
- We developed a cleaning coupling that can be used to backwash the filter with a plastic bottle in case the syringe is lost or damaged.



CURRENT BUCKET FILTER



OLDER VERSION OF THE BUCKET FILTER

LONG TERM / SHORT TERM WATER STORAGE

Sawyer filters are designed for on-demand use. Their fast flow makes storage of water unnecessary. However, we realize some people will want to store water they have filtered. We recommend that if they do, they need to clean and sanitize their storage vessel thoroughly before adding the filtered water to it. They also need to make sure the storage vessel has a lid that seals tight against bacteria. Ideally, a very small amount of disinfectant such as chlorine would also be added to the water. This could be an amount below the threshold of taste. However, the longer the water is to be stored, the more disinfectant that would need to be added to the water – either initially or over time. We do not recommend storing water beyond a few days.

FOR BEST RESULTS

- Frequent backwashing – The more frequent the better, especially with turbid (muddy) water. Do not let the filter dry out when it is dirty. If the filter is clogged with dirt go back and forward with warm water (water no hotter than you can put your hand in) to loosen up the dirt.
- Always discard the first few ounces of water after backwashing.
- Never run soap through the filter, use bleach water or clean water. If you do not have bleach water, flush the filter thoroughly with clean water.
- If there is a calcium build-up, soak the filter in vinegar for an hour then backwash with warm water.
- The push pull caps add an extra layer of protection. Use them and regularly clean them.
- Keep the outside of the filter clean and away from animals.
- When properly taken care of there is no reason for the filter to fail for many, many years.



UNDERSTANDING COLIFORMS

WHAT ARE THEY

Coliforms are a broad class of bacteria found in the environment.

WHERE DO THEY COME FROM

Both the harmful and non-harmful bacteria primarily come from the feces of humans and other warm-blooded animals. They can also come from rotting vegetation. The presence of non-harmful coliform bacteria in drinking water may indicate a possible presence of harmful, disease-causing organisms.

HARMFUL VS. NON-HARMFUL

Most Coliform bacteria do not cause disease. Coliforms are broken into 3 groups:

Total Coliforms They include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste.

Fecal Coliforms both harmful and non-harmful: They are the group of the total coliforms that are considered to be present specifically in the gut and feces of warm-blooded animals

E. Coli - a sub group of the Fecal Coliforms: Some strains of E. Coli can cause serious illness.

PROLIFIC VS. NON-PROLIFIC

E.Coli is generally not found growing and reproducing in the environment. Total Coliforms (of the non-harmful type) are very prolific and once introduced to a surface can spread quickly. These non-harmful types include both fecal and non-fecal Coliforms.

COLIFORMS AND CLEANLINESS

The spread of Coliforms can be combated through good Hygiene. Simple washing with soap and water will prevent the spread of them.

SPREAD OF COLIFORMS

Coliforms can spread by touching the clean end of the filter with a dirty hand, by animal contact, or even by dust particles. Proper hygiene techniques must be taught with the use of the filters. Otherwise contamination of the discharge side occurs. This is supported both by the Tuft's study and the Messiah/John Hopkins study referenced later in this handout.

TESTING FOR COLIFORMS

Because Total Coliforms reproduce very quickly they are easy to test for. A high indication of total Coliforms is usually a good and inexpensive way to determine if water needs treatment but it does not guarantee the presence of E. Coli. This type of testing is broad and encompasses most of the non-harmful types of Coliforms.

COMMON MISTAKES MADE WITH TESTING

Because the Total Coliform testing is inexpensive most people believe it is a simple way to see if the filter is working. What they really end up testing is not that the filter is working, but whether or not the discharge end has been contaminated. It only takes a small amount of Coliform bacteria on the discharge to contaminate the sample. Once contaminated the bacteria very quickly grow in the test solution giving a positive test result.

HOW TO PROPERLY TEST A FILTER

There is no quick and easy field test to see if a filter is working. Even an E. Coli test can yield false positive results if the discharge end of the filter is not clean. Tufts University proved this in their study. First the filters failed and then after cleaning they passed the E.Coli test. However, the proper test protocol would have been to sanitize the filter and then challenge the filters with a known affluent and measure the counts in the effluent. This testing needs to be done in lab conditions using very strict lab procedures. Simply running water through the filter and doing a total Coliform test does not prove if the filter is working or not. Unless the filter's discharge has been cleaned of ALL bacteria, you are going to get a false positive result. People believe that because they processed their sample correctly, they tested the filter correctly. They do not take into account the contamination that could have occurred on the discharge side of the filter and wrongly assume the filter is not functioning. Every time we hear of filter failure it always turns out to be procedural errors. Backwashing and flushing will remove the harmful bacteria, but will not remove all the bacteria. The small amount of non-harmful bacteria that remain will multiply very quickly and yield a false positive test result.



SAWYER FILTERS ARE BEST PRACTICE

FIJI MINISTRY OF HEALTH DETERMINES

Since 2008, Give Clean Water has been installing Sawyer Filters in rural Fijian villages. Their model for training and sustainability has been so successful, the Health Ministry of Fiji has awarded Give Clean Water an MOU for Fiji's "Best Practices" for rural water treatment. As a result, the Ministry of Health has partnered with Give Clean Water to assist in the implementation of the filters. In a short time, all rural villages in Fiji will have access to safe water primarily with Sawyer Filters.

A FEW TESTIMONIALS FROM FAMILIES IN FIJI:

In August of 2008, Prakesh and his family received the very first Sawyer Point One filter in Fiji. Their well continues to be contaminated with harmful bacteria, but since the installation of their Sawyer filter system the family has been drinking bacteria free water. Their health improved dramatically. Stomach sickness went away, and their persistent cough and sore throats went away as well. Give Clean Water's system of follow up interviews created sustainable behavior change for the family where they use and clean their filter every day. In 2013, Give Clean Water revisited Prakesh and his family. Their original filter from 2008 was still working properly. For a "job well done" in maintaining their filter, Give Clean Water upgraded them to the latest Sawyer filter design. As of September, 2015, the family continues to drink bacteria free water from their Sawyer filter.

84 year old Mohamed's story: In 2010, Give Clean Water installed filters in Varavu village where Mohamed was the recipient of a Sawyer point one filter. He is 84 years old now and continues to use and clean his filter every day, and is in great health. His stomach sickness and cough have disappeared for the past 5 years. His village recently began receiving a treated government water supply. Mohamed said he still uses his filter every day because the government water supply is not always reliable.



The Pradeep Kumar family has only a dirty well for a water source. The well is very contaminated with bacteria and lots of sediment. The wife in the family, Prem Wati, gave the testimony of having a cough for 20 years. She had gone to the doctor numerous times over the years. She was given antibiotics, cough syrup and other treatments, but nothing ever seemed to work. The first week of August, 2015 Give Clean Water installed a Sawyer Point One filter in her home. 3 weeks later we followed up with the family and Prem's cough had completely gone away. As of October 8th, 2015, she is still cough free!

MARASA VILLAGE TESTIMONIAL:

August, 2015 twenty families in the Marasa Village (89 adults, 23 children age 0-5, 39 children age 6-17) received Sawyer Water Filters. Prior to receiving the filters:

Before receiving filters:

- 43 days of diarrhea per month were reported among children 0-5 years old.
- 53 days of diarrhea per month were reported among children 6-17 years old.
- 76 days of diarrhea per month were reported among adults.
- The cumulative children population missed an average of 53 days of school per month due to diarrhea.
- The cumulative adult population missed an average of 82 days of work per month due to diarrhea.
- The village population spent \$955 USD per month on medical costs due to water borne sickness prior to receiving filters. That is \$47.75 per family in savings per month.
- The village population spent \$820 USD per month to purchase clean water prior to receiving filters. That is a savings of \$41 per family per month.

Follow up conducted in October, 2015:

- There have been ZERO days of diarrhea reported by anyone in the village.
- There have been ZERO school days missed due to diarrhea.
- There have been ZERO medical costs spent on water borne sickness.
- There have been ZERO costs associated with purchasing clean water.

BOLIVIA STUDY

SAWYER FILTERS IN THE AMERICAN JOURNAL OF TROPICAL MEDICINE AND HYGIENE

(PUBLISHED MAY, 2014)

A CLUSTER RANDOMIZED CONTROLLED TRIAL TO REDUCE CHILDHOOD DIARRHEA USING HOLLOW FIBER WATER FILTER AND/OR HYGIENE-SANITATION EDUCATIONAL INTERVENTIONS

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ABSTRACT.

Safe domestic potable water supplies are urgently needed to reduce childhood diarrheal disease. In periurban neighborhoods in Cochabamba, Bolivia, we conducted a cluster randomized controlled trial to evaluate the efficacy of a household-level hollow fiber filter and/or behavior change communication (BCC) on water, sanitation, and hygiene (WASH) to reduce the diarrheal disease in children less than 5 years of age. In total, 952 households were followed for a period of 12 weeks post-distribution of the study interventions. Households using Sawyer PointONE filters had significantly less diarrheal disease compared with the control arm during the intervention period, which was shown by diarrheal prevalence ratios of 0.21 (95% confidence interval [95% CI] = 0.15–0.30) for the filter arm and 0.27 (95% CI = 0.22–0.34) for the filter and WASH BCC arm. A non-significant reduction in diarrhea prevalence was reported in the WASH BCC study arm households (0.71, 95% CI = 0.59–0.86).

SUMMARY OF RESULTS

Diarrheal disease prevalence and stratified diarrhea prevalence ratios are specified in Figure 3 and Table 2 (shown in the full published study) and were based on CGV reported monthly reported data. The diarrhea prevalence ratio (DPR) effect estimate compared with the control group for the filter arm was 0.15 (95% confidence interval [95% CI] = 0.10–0.22) or a mean reduction in diarrheal disease of 85% after controlling for clustering within geographic clusters. Additionally, the filter and WASH BCC arm DPR effect estimate was 0.22 (95% CI = 0.16–0.30) or a 78% mean reduction in diarrheal disease. The lower mean reductions in diarrhea prevalence were significant for both the filter and filter and WASH BCC study arm households compared with the control arm households; both had identical P values of 0.0286 using the Wilcoxon rank sums with the exact method.

For the complete article, visit:

www.sawyer.com/boliviastudy



Photo courtesy of MAP International

TUFTS UNIVERSITY STUDY

A BREAKDOWN

Tufts University published an article in the Journal of Water Sanitation and Hygiene titled “Fouling in hollow fiber membrane microfilters used for household water treatment (2015) Murray, A., Goeb, M., Stewart, B., Hopper, C., Peck, J., Meub, C., Asatekin, A. & Lantagne, D. J. WASHDev 5 (2), 220–228ttdoi:10.2166/washdev.2015.206”

TUFT’S STUDY CLAIMS: Field effectiveness data has found bacterial contamination in 18-54% of tested filter effluent water in studies ranging from 3 months to 3 years of use.

SAWYER’S RESPONSE: There are many types of coliform (bacteria) but not all are harmful (see page 7 for further explanation). Testing for coliforms in untreated water in general is a good inexpensive way to see if water needs to be treated. There is a 90% chance that if in untreated water any coliforms are present that the harmful E. Coli are also present. However, the presence of coliforms in treated water is not an indication as to if a filter is working or not. Sawyer’s filters remove the harmful coliforms. To confirm that E. Coli (a harmful coliform) is removed, a more thorough test is required. When that more thorough test was completed on 2 properly cleaned filters, the test confirmed that the filters did not allow the harmful E. Coli to pass through.

The Tufts study actually supports Sawyer’s claim that the filters were still removing all E. Coli:

“There was no bacterial growth on the EMB or MAC plates from the new filter’s effluent, indicating the absence of total coliforms and fecal coliforms. Plates from both used filter effluents showed dark pink lactose(p) growth on the EMB plates, and light pink presumptive of lactose (p) growth on the MAC plates, indicating potential total coliforms in effluent from both used, cleaned filters. MUG-agar plates of these two filter effluents exhibited no fluorescence, indicating the absence of E. coli in effluent from the cleaned filters.”

TUFTS STUDY CLAIMS: In this investigation of poorly functioning PointOnes used for 23 months for household water treatment, we identified an internal membrane that: exhibited a dense, highly cohesive irreversible fouling layer of inorganic particles, organic biomacromolecules, and biofouling on the exterior membrane fiber surface; was fouled on the inner fiber surface; and appeared to have burst fibers.

SAWYER’S RESPONSE: There is no irreversible fouling as suggested. Dirt traps on the outside of the fibers which can be cleared by backwashing. Calcium deposits can form on the fibers if the water has high calcium content and the fibers are allowed to dry. If the cap is placed on the filter after each use this will not be a problem as this prevents drying out. However, should the filter become fouled with calcium a simple cleaning (soaking) with household vinegar will dissolve it and restore the fibers to new condition.

The two pictures of the cut-aways show a new vs. a used filter. The picture indicates that the filters were not cut in same place. The new filter was cut high enough that the fibers were not disturbed. The used filter was cut down into the top of the fiber bundle where the fibers were probably damaged. The fibers are rated to 60 PSI. The casing will burst at 40 PSI as a safe guard on the fibers. To suggest that the fibers “burst” when the picture indicates damage when cut, is a premature conclusion. To be fair early filters were easy to be forced open and the filter-user may have opened the filter to see what was inside and “played” with the fibers and broke them. (Current filters and those produced for several years have been modified so they cannot be easily opened.) But the picture shows more likely the damage is a result of cutting the filter too close to the fibers.

A more detailed response from Messiah College on the flaws in the Tuft’s research is on the following page.

A review of: Fouling in hollow fiber membrane microfilters used for household water treatment (2015) Murray, A., Goeb, M., Stewart, B., Hopper, C., Peck, J., Meub, C., Asatekin, A. & Lantagne, D. J. *WASHDev* 5 (2), 220–228 doi:10.2166/washdev.2015.206

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Over the past 5 years, hollow fiber membrane microfilters have been introduced into much of the developing world to combat waterborne illness stemming from microbially compromised water sources. One such filter, the PointONE™ Filter (Sawyer Corporation) has performed well in laboratory trials, in the 5 and 6 log reductions of protozoan parasites and bacteria, respectively (Hydreion LLC 2005). In a field study conducted in Cochabamba, Bolivia and recently published by Lindquist *et al.* (2014), households using PointONE filters had significantly less diarrheal disease compared with the control arm during the intervention period. Diarrheal prevalence ratios of 0.21 (95% confidence interval [95% CI] = 0.15–0.30) were observed for the filter arm and 0.27 (95% CI = 0.22–0.34) were observed for the filter and WASH BCC (education) arm. These diarrheal disease reductions occurred in only a 3-month intervention period, and showed marked improvement in the health of children under the age of 5 years old. An *in situ* study on long-term filter performance has been an important need for organizations that are currently using or are considering using these filters in the developing world. The relatively new introduction of the PointONE filter has precluded long-term study of its performance before this time.

In this issue of *Journal of Water, Sanitation and Hygiene for Development*, Murray *et al.* (2015) endeavor to contribute to this needed body of information. In particular, their study suggests several potential shortcomings of the PointONE filter after household use over the course of nearly 2 years. These include: filter fouling, sediment buildup, discolored

membrane fibers, and membrane rupture. Admittedly, if such shortcomings were verified through rigorous scientific study, they would certainly cast doubt on the long-term effectiveness of hollow fiber membrane microfilters for household level point of use in the developing world. A long-term field study of the PointONE filter is an admirable undertaking and has the potential to answer important questions on long-term filtration efficacy, filter longevity, and effective life cycle.

In review of this research article, we deem it necessary to bring to light several substantial concerns we encountered with respect to the methods used and the claims made. Shortcomings in this article can be seen in the following areas: (1) poor pre-analysis filter storage conditions; (2) crude filter cartridge entry; (3) small sample size; and (4) inconsistencies in the article figures.

POOR PRE-ANALYSIS FILTER STORAGE

In our view, the most significant oversight of this study is that, to the best of our understanding, the investigators took filters collected in the tropics (Honduras), sealed them in a plastic bag, and undertook the cleaning and analysis 2 months later. Microbiologically, these conditions would appear to promote microbial growth and thriving from the moment of sealing. If water from the input side of the filter were to have spilled into the inner surface of the storage bag, chances are good that they could have reached the output side of the

filter. This potential for contamination is too great to be ignored. Likewise, if the transport of the bag-stored filters was in the cargo hold of an aircraft where freezing occurred, the water held in the pores of the hollow fiber membrane could very easily have expanded and applied a tearing force to the fibers. Detail of physical placement and ambient conditions during transportation was not provided. Likewise, insufficient detail was given as to whether all six of the filters were individually sealed in a bag, or collectively were combined into one bag. Had the latter scenario been followed, then the possibility of cross-contaminating input and output water is problematic to this study.

A better method would have been to have each filter cleaned (as per manufacturer's instructions), each side sealed to prevent input-output contamination, single-filter transportation bag storage for transport, then immediately analyzed upon arrival to the host institution laboratory (within 48 hours). However, ideally, the microbiological testing should have been done *in situ*, in a situation where contamination and storage- and transport-related methodologies would not introduce doubt into the methods used.

CRUDE FILTER CARTRIDGE ENTRY

In Figure 2, the crude manner of filter cartridge entry affects the visual interpretation of the photos (Murray *et al.* 2015). It is clearly visible that plastic fragments and powder from the membrane cartridge housing have fallen onto the input end of the filter fibers during the entry into the filter cartridge. We were left wondering how much of this minute plastic debris was depicted as the fouling layer in Figures 3 and 4.

SMALL SAMPLE SIZE

The interpretation of the results should recognize the uncertainty due to the small sample size ($n=6$) and biased sample. It is unclear if the six filters selected for evaluation were ones that showed poor results by Goeb (2013), which would not provide a representative sample of the whole. We have included the citation for Goeb (2013) here, but could not locate this article online or in any library resource in order to verify the sample collection methods.

INCONSISTENCIES IN THE ARTICLE FIGURES

This article mentions burst fibers, yet no photo is shown. In Figure 2(b), it does appear as if the entry method into the filter cartridge may have damaged some filter fibers (in the upper left of the image) (Murray *et al.* 2015). We were puzzled as to why the comparative images in Figure 3 did not use equal magnifications for comparison. In the cases where a flaky fouling layer is seen (Figure 3(e) and (f)), magnifications are much higher than the comparator (new filter). This appears misleading, especially if the flakes are minute residues of plastic from the filter cartridge entry method. Figure 4 did use equal magnifications for direct comparisons, yet we had difficulty seeing the fouling that the text discussed.

FINAL REMARKS

Other aspects of this article raised questions. In Lindquist *et al.* (2014), household caregivers were trained on filter usage and cleaning, then were later (2–4 weeks later) tested on these skills. We wondered if the same was done in the Trojes, Honduras communities; not just training. Lastly, the introduction cites many publications by Goeb which we could not locate online or in library resources. Whereas the Murray *et al.* (2015) microbiological methods are known, Goeb's are unknown.

VERIFYING RESULTS IN THE LONG TERM

Although this study raises some potentially important concerns for long-term use of hollow fiber membrane microfilters, many of these seem to be left unsubstantiated in large part due to the study methods selected by the authors. At the same time, this article does point to the need for a microbiological study in the near future on long-term *in situ* filter performance in communities that have been using these filters for extended periods. As such, it is our intention to conduct such a study for filters in use over a 5-year period, and it is our hope that the findings from this study would be welcomed for future publication in the *Journal of Water, Sanitation and Hygiene for Development*.

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LIBERIA STUDY, 2016

Sawyer is partnering with an NGO to install 100,000 0.1 micron absolute filtration systems in rural Liberia. Under the direction of a university research team, data will be collected over both short term and long term intervals to measure the impact of the filter on the population's health, and to measure the filters sustainability from both the technical and usability perspective.



Photo courtesy of Let Them LOL

IN THEIR OWN WORDS

TESTIMONIALS FROM AROUND THE WORLD

“We have recently completed a test (actually three tests). These test were taken using direct flow from a septic tank. Flow directly from the Jokasu waste treatment tank (This tank actually has another name but we do not pass it on at this time). What I can tell you is the tank biologically treats the water from the septic and lowers the E. Coli Count and the Bacteria count considerably. Then we ran through both and then through the Sawyer Point One Filter. Of course the conclusion was ZERO Bacteria, ZERO E. Coli and ZERO Coliforms.” - **BILL DRURY, PURA VIDA AGUA HONDURAS**

“We see signs of improved health in the poorest children: kids we have known for years as listless, underweight, and constantly complaining of parasite symptoms, now show signs of thriving. Their moms and teachers tell us they see a remarkable difference.” -**SISTER LARRAINE LAUTER, WATER WITH BLESSINGS, WINNER OF THE PAHO AWARD FOR EXCELLENCE IN VOLUNTARY SERVICE ORGANIZATIONS**

Overall, 1,820 people in Ecuador were effected by the MAP clean water project. There was a 90% reduction in diarrhea among children, as well as a 50% reduction in stomach pain. Before the filters came into the communities, 70% of the families complained weekly or monthly of diarrhea, but afterward, only 6% had continued complaints.

-MAP INTERNATIONAL ECUADOR STUDY

“Another direct effect of water intake was less expenses that diseases had on the families. As we saw before there are 6 recurrent diseases in the families, whose treatment are mostly through purchasing antibiotics, this caused an expense of approximately 40 dollars per month. With the introduction of the filter there is a reduction of 50%. By the end of the study there is an average expense of 20 USD per month.” -**MAP INTERNATIONAL ECUADOR STUDY**

*In Ecuador, the filter payed for itself in less than 3 months. A \$40 water filter saved the families \$240 in medical expenses.

“The villages who have implemented the filters correctly have virtually eliminated their abdominal pain, parasites, worms, diarrhea, cholera, typhoid and other deadly disease.” -**JANA TURNS, DOCTORS GIVING BACK**

“Before we received the Sawyer filters, 5 to 6 children would die every month due to water related diseases. Since receiving the filters the number of deaths has decreased significantly.” -**BISHOP ALEX WABWILE, KENYA**

“School attendance was about 72%. After we installed Sawyer filters into the school, the attendance increased to 90%” - **DR. FEROZ ISMAIL, PAKISTAN**



PROVIDING CLEAN WATER ACROSS THE GLOBE



SAWYER.COM