The Use and Performance of the BioSand Filter* in the Artibonite Valley of Haiti: A Field Study of 107 Households

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*an intermittent slow sand filter designed for affordable household water treatment
Characterization of Households and Water Sources

- **107 households studied**
  - Average 5.4 people per house
  - 71 children, aged 5 and under

- **Long term users of the Biosand Filter**
  - 1 to 5 years; average 2.5 years
  - 91% use water for drinking only

- **Water Sources:**
  - 61% shallow dug wells
  - 26% springs and deep wells
  - 13% combination of above

- **Source Water Quality:**
  - Average fecal contamination= 202 (E. coli, cfu/100 mL)
  - Average turbidity= 6.2 NTU
Is the BioSand Filter Effective?

- **Bacterial Removal Efficiency:** 98.5%
  - Using membrane filtration, with E. coli as index bacteria
  - Sample points: Water from Filter Spout versus Water from Source
  - # in source minus # in filtered divided by # in source

- **Turbidity Removal Efficiency:**
  - Source water: average 6.2 NTU
  - Filtered water: average 0.9 NTU
Removal Effectiveness and Recontamination using Average values (E. coli, cfu/100 mL)

<table>
<thead>
<tr>
<th>Sample Points</th>
<th>Average E. coli (cfu/100mL)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water from Source</td>
<td>202</td>
<td>107</td>
</tr>
<tr>
<td>Supernatant</td>
<td>220</td>
<td>106</td>
</tr>
<tr>
<td>Filter Spout</td>
<td>1</td>
<td>106</td>
</tr>
<tr>
<td>Storage Container</td>
<td>23</td>
<td>107</td>
</tr>
</tbody>
</table>
Removal Effectiveness and Recontamination using Percent Ranges (E. coli, cfu/100 mL)

Source Water, n=87
Transfer Bucket, n=107
Supernatant, n=106
Filter Spout, n=106
Storage Container, n=107
Does the BioSand Filter meet the “Criteria of the Poor”?

- **Basic criteria:**
  - Cost / affordability
  - Local materials & labor skills
  - Input energy required
  - Effectiveness

- **Perceptions** (critical to sustained use):
  - Taste, smell, appearance
  - Ease of use, maintenance req.
  - Durability, longevity of filter
  - Health benefits
  - Problems encountered

- **Overall Perceptions:**
  - Do they like it?
  - Would they recommend it?
Perceptions; Taste, Smell, Appearance

Question: Tell us about the taste of the water – is it better, worse or about the same?
  99% Better
  1% Worse

Question: What about its smell?
  99% Better
  1% Worse

Question: What about its appearance?
  99% Better
  1% Worse
Ease of Use, Quantity of Water Produced

**Question:** *Is it easy to use the filter?*
- Yes 100%
- No 0%

**Question:** *Do the children know how to use the filter?*
- Yes 100%*
- No 0%
  *except those too young

**Question:** *Does the filter produce enough clean water for the entire household?*
- Yes 99%
- No 1%
Problems Encountered, Durability, Longevity

**Question:** Have you had any problems with the filter?

Problems Encountered
Yes 13% ➔ 14 / 107 flow rate slow
No 87%

**Question:** Do you ever require help to fix the filter?

How often & what?
Yes 6% ➔ 6 Users required help restoring flow rate
No 94%

**Observations by Enumerators:**
Write down any problems with the quality of construction.
0% Leaking 3% Concrete body*
3% Lid / Diffuser 0% Other issues
94% No problems
*1 filter had a crack, 2 were chipped
Health Perception and Results

Health Perception

Question: Since you started using the filter, do you think your family’s health has improved, stayed the same, or become worse?

95% Better
0% Worse
5% Stayed the same

Health Results

For the 71 children, under 6:

10 - diarrhea in prior 2 weeks
7 - took medicine for diarrhea
2 - saw a physician
Overall Perceptions

**Question:** *Do you like the filter?*
Yes: 100%  ➔ Yes, because:
No: 0%    22% protects health
          49% better water
          7% it serves well
          22% other, or no
          reason given

**Question:** *Would you recommend the filter to others?*
Yes: 95%
No: 5%
Conclusions

In the context of this field study;

- **Perceptions:**
  - High level of overall satisfaction
    - Quality of water
    - Ease of Use
    - Quantity of water

- **Observations:**
  - Overall; filters were durable, well-maintained, functioning properly, and used regularly
  - The major user problem: plugging of the filter due to clay / silt in the source water
  - Lack of knowledge regarding:
    - Maintaining the filter to remove clay / silt and restore flow rate
    - Disinfecting the water post-filtering
    - Safe water storage practices and containers
    - Transmission of water-borne disease

- **Water Analyses:**
  - Good turbidity removal
  - Significant bacterial removal
  - Substantial recontamination occurred post-treatment.