Summary of evaluation

This report summarizes the evaluation results of a membrane filter known by the tradename ‘LifeStraw® Community’ under Round I of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation followed the requirements of the WHO protocol for batch filtration technologies and comprised a desk review of existing laboratory data on the product’s performance against bacteria and protozoa and laboratory testing of its performance against viruses. Based on the review of existing data and the abbreviated testing conducted, the product meets WHO performance criteria and is classified as providing Comprehensive protection (★★★) against bacteria, viruses and protozoa.
Background

Evaluation under the Scheme is based on performance criteria set out in Evaluating Household Water Treatment Options: Health-based targets and microbiological performance specifications (WHO, 2011). The criteria were determined by applying quantitative microbial risk assessment methods outlined in the WHO Guidelines for Drinking-water Quality (2011) and set out log$_{10}$ reduction targets against bacteria, viruses and protozoa (Table).

<table>
<thead>
<tr>
<th>Performance classification</th>
<th>Bacteria (log$_{10}$ reduction required)</th>
<th>Viruses (log$_{10}$ reduction required)</th>
<th>Protozoa (log$_{10}$ reduction required)</th>
<th>Interpretation (with correct and consistent use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>★★★</td>
<td>≥ 4</td>
<td>≥ 5</td>
<td>≥ 4</td>
<td>Comprehensive protection</td>
</tr>
<tr>
<td>★★</td>
<td>≥ 2</td>
<td>≥ 3</td>
<td>≥ 2</td>
<td>Meets at least 2-star (★★) criteria for two classes of pathogens</td>
</tr>
<tr>
<td>★</td>
<td></td>
<td></td>
<td></td>
<td>Targeted protection</td>
</tr>
<tr>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td>Little or no protection</td>
</tr>
</tbody>
</table>

Product description

The LifeStraw® Community is an ultrafiltration membrane device that physically removes microbial contaminants from water as it is forced through hollow fibre membranes under gravity. The Community is the high-volume version of the LifeStraw range of filters. It comprises a dirty water storage tank and a built-in safe water storage tank, each with a capacity of 25 L. The full product description, illustrations and use instructions can be found at: www.vestergaard.com.

Evaluation approach

The manufacturer produces several models of the LifeStraw® filter, that is, LifeStraw® Family 1.0, LifeStraw® Family 2.0 and LifeStraw® Community, that employ the same membrane ultrafiltration technology. The laboratory data submitted for the Family 1.0 model, based on the United States Environmental Protection Agency (US EPA) Guide Standard for Microbiological Water Purifiers (1987), demonstrate the required performance against WHO criteria for all three microbial groups. Laboratory data were also submitted for the Family 2.0 and Community. However, it was necessary to perform abbreviated laboratory testing against viruses to verify the integrity of the seal of the membrane in these models. This report outlines the evaluation approach for the Community model.

Review of existing data

The laboratory data reviewed were for performance testing of the LifeStraw Family 1.0 model against bacteria (Escherichia coli) and protozoa (microspheres) based on the Evaluating Household Water Treatment Options: Health-based targets and microbiological performance specifications (WHO, 2011).

Seal integrity testing

Product-specific test plan: A product-specific test plan was developed based on the manufacturer’s instructions for use; the WHO Scheme Harmonized Testing Protocol: Technology Non-Specific V 1.0 (WHO, 2015); and the Mechanical Filtration Batch Systems Technology Seal Integrity V 1.0 (2014) technology-specific protocol for the demonstration of seal integrity. Testing was conducted at WHO-designated laboratories, KWR Watercycle Research Institute, in the Netherlands, and NSF International, in the United States of America.

Test organisms: The seal integrity test investigated the performance of the LifeStraw® Community in reducing bacteria and viruses. The test organisms were Escherichia coli (E. coli) and the coliphages MS2 and phiX174.$^1$

$^1$ Seal integrity performance is based primarily on the viral reduction; the bacterial test is included as (text to be finalized).
**Test waters:** The product was tested in General Test Water (GTW) only, simulating high quality groundwater. Refer to the technology test plan for Mechanical Filtration Batch Systems Technology Seal Integrity V 1.0 for details on physicochemical characteristics of the test water.

**Test set up:** Three production units were provided to each laboratory for testing. All units were operated according to the manufacturer’s use instructions. Pretreatment and posttreatment water grab samples were analysed using methods identified in the product-specific test plan. Each unit was tested over three days, resulting in nine sample points per organism (3 units × 3 days).

## Results

### Existing data

The test organisms and test procedure applied to generate the existing laboratory data were deemed to be comparable to those of the Scheme and sufficient to determine the bacterial and protozoan reduction of the product. Based on the review, the LifeStraw® Community meets or exceeds the three-star (★★★) performance targets for bacteria and protozoa.

### Abbreviated testing results

Figure presents the results of the bacterial and viral laboratory testing for the seal integrity of the LifeStraw® Family 2.0 in GTW at both laboratories. All test water characteristics were within specifications.

**Performance across test units**

![Graph showing microbial reductions](image)

The LifeStraw® Community achieved mean log_{10} reductions of 8.4 for *E. coli* and of 6.2 for both MS2 and phiX174. Performance across the three test units was generally consistent at both designated testing facilities, and all units full met the three-star performance targets for each organism tested.

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2 The maximum microbial reduction that can be demonstrated is limited by the pretreatment challenge concentration delivered. For each organism tested, the pretreatment concentration must be sufficient to allow for the demonstration of the performance targets shown in Table XXX. Due to the complexity of using viable organisms, there may be variations in these pretreatment concentrations above what is sufficient. Although these variations may lead to demonstrated reductions that far exceed the performance targets, the emphasis is on whether the performance target has been met and not the extent by which it was exceeded.
Interpretation and application of results

Performance is classified in three ascending tiers ★ (one-star); ★★ (two-star); and ★★★ (three-star), as shown in Table. Both three- and two-star products provide Comprehensive protection against all three microbial groups. One-star products meet performance targets for only two of the three microbial groups, providing Targeted protection. Each phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phage.

Performance classification

Based on the review of the laboratory data submitted, the LifeStraw® Community meets or exceeds three-star performance targets for bacteria and protozoa. From the seal integrity testing, the three-star reduction target for viruses was fully met. As such, the LifeStraw® Community is classified as providing Comprehensive protection (★★★).

Considerations for product selection

<table>
<thead>
<tr>
<th>Microbial conditions</th>
<th>Effective against bacteria, viruses and protozoa; can be used under all microbial water quality conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicochemical water characteristics</td>
<td>Can be used in both turbid and non-turbid water</td>
</tr>
<tr>
<td>Product information and labelling</td>
<td>Check that the device is appropriately labelled and has clear instructions for use</td>
</tr>
</tbody>
</table>

References


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