Summary of evaluation

This report summarizes the evaluation results of a gravity-fed sand and diatomaceous earth water filtration device known by the tradename ‘MINCH Household Water Filter’, under Round III of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation of the MINCH Household Water Filter followed the requirements of the WHO protocol for filtration technologies, and investigated the ability of the device to remove bacteria and viruses. Reduction of protozoa was assigned based on the mean bacterial reduction achieved. Based on the evaluation results, the MINCH Household Water Filter meets WHO performance criteria and is classified as providing Targeted protection against bacteria and protozoa only (★).
1. 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* (2017) and set out log₁₀ reduction targets against bacteria, viruses and protozoa, as shown in the table below.

**Table 1. WHO performance criteria for household water treatment technologies**

<table>
<thead>
<tr>
<th>Performance classification</th>
<th>Bacteria (log₁₀ reduction required)</th>
<th>Viruses (log₁₀ reduction required)</th>
<th>Protozoa (log₁₀ 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>Meets at least 2-star (⭐⭐) criteria for two classes of pathogens</td>
<td></td>
<td></td>
<td>Little or no protection</td>
</tr>
<tr>
<td>–</td>
<td>Fails to meet criteria for 1-star (⭐)</td>
<td></td>
<td></td>
<td>Little or no protection</td>
</tr>
</tbody>
</table>

**Product description**

The MINCH Household Water Filter is a size exclusion filter employing sand and diatomaceous earth for removal of microbial pathogens. The assembled filter comprises a metallic container with a sand and diatomaceous earth cartridge, and a spigot at the bottom of the container. Water is filtered through the cartridge under gravity to the bottom of the container. The full product description, illustrations and use instructions can be found at www.minchfilter.com.

2. Evaluation approach

**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 3.0* (2019); and the WHO *Testing Protocol for Filtration Technologies V 3.1* (2020). Testing was conducted at a WHO-designated laboratory, KWR Watercycle Research Institute, in the Netherlands.

**Test organisms:** Evaluation of the MINCH Household Water Filter investigated its performance in removing bacteria and viruses. The test organisms were *Escherichia coli* (*E. coli*) to represent bacteria, and bacteriophages MS-2 and phiX-174 to represent viruses. Based on the available evidence on protozoan cyst removal by size exclusion filters, testing against this microbial group was not conducted (WHO, 2019). The protozoan removal is assigned based on the mean bacterial reduction observed.

**Test waters:** The device was tested in two waters: General Test Water (GTW), simulating high quality groundwater, and Challenge Test Water (CTW), simulating surface water. Refer to the *Testing Protocol for Filtration Technologies V 3.1* for details on physicochemical characteristics of the test waters.

**Test set-up:** Three new sample units of the MINCH Household Water Filter were provided by the manufacturer for the test. 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. Testing was conducted over four days: in GTW on Day 1 and 2; and in CTW on Day 3 and 4. This resulted in a total of 12 sample points for each organism i.e. 2 days × 2 test waters × 3 test units.
3. Results

Fig. 1 presents the results of the bacterial and viral testing for the three units in GTW and CTW. All test water characteristics were within specifications.

The MINCH Household Water Filter achieved a mean log_{10} reduction of 6.3 for \(E. coli\); 5.3 for MS-2; and 3.6 for phiX-174.

Minimum performance targets for \(E. coli\) and MS-2 were fully met in both CTW and GTW. For phiX-174, two thirds of the samples in CTW did not meet the minimum performance target of 3 log_{10}.

4. Interpretation and application of results

Performance is classified in three ascending tiers: ★ (one-star); ★★ (two-star); and ★★★ (three-star), as shown in the table outlining performance criteria. 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 production unit should consistently meet or exceed the performance target for each microbial group in both test waters (GTW and CTW). However, a maximum deviation of 0.2 log_{10} is acceptable for 25% of sample points at the two-star performance tier and 0.4 log_{10} at the three-star performance tier\(^2\). This means that for classification as a two-star product, up to three of the 12 sample points can achieve a minimum reduction of

---

1 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 in the table showing the performance criteria. Due to the complexity of using viable organisms, there may be variation in these pretreatment concentrations above what is sufficient, which may lead to demonstrated reductions reported that far exceed the performance targets. However, the emphasis is on whether the performance target has been met and not the extent by which the target was exceeded.

2 These cut-off values were determined using QMRA modelling and selecting ranges that still resulted in appreciable health gains within a specific performance tier.
1.8 $\log_{10}$ for bacteria or protozoan cysts (instead of 2 $\log_{10}$) or 2.8 $\log_{10}$ for viruses (instead of 3 $\log_{10}$). Each phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phage.

**Performance classification**

The MINCH Household Water Filter fully met the performance target for bacteria. For the protozoan reduction, a value of 6.3 $\log_{10}$ is assigned based on the mean bacterial reduction. For viral reduction, the lower performing phage phiX-174 did not meet the minimum performance target. As such, MINCH Household Water Filter is classified as providing Targeted protection (★) against bacteria and protozoa only.

**Considerations for product selection**

<table>
<thead>
<tr>
<th>Microbial conditions</th>
<th>Use where contaminant of concern is known to be bacterial / protozoan microbes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physico-chemical water characteristics</td>
<td>Can be used to treat turbid water</td>
</tr>
<tr>
<td>Product information and labelling</td>
<td>Check that the product is appropriately labelled and has clear instructions for use</td>
</tr>
</tbody>
</table>

**References**


**Disclaimer**

Reference to any company or product in this report, particularly those listed in any of the figures and tables, does not constitute an endorsement, certification or warranty of fitness by WHO of such company or product for any purpose, and does not imply any preference over companies or products of a similar nature that are not mentioned.

WHO does not warrant that any products included in the figures and tables are of acceptable quality; have obtained regulatory approval in any country; or that their use is otherwise in accordance with the national laws and regulations of any country, including but not limited to patent laws. Evaluation under the Scheme is intended to guide UN Member States and procuring UN agencies in the selection of household water treatment (HWT) technologies. Inclusion of any products in this report, particularly in any of the figures and tables listed in the report does not furthermore imply any approval by WHO of these products (which is the sole prerogative of national authorities).

The results in this report reflect the performance level that the product was found to meet at the time of testing. WHO cannot represent that the products reported herein will continue to meet the stated performance levels. Furthermore, the results contained in this report may not be used by manufacturers, suppliers or any other parties for commercial or promotional purposes.