World Health Organization

# WHO International Scheme to Evaluate Household Water Treatment Technologies

# Tulip Table Top Water Filter

## Product evaluation report

| | |
|---|---|
| **WHO performance classification** | Targeted protection<br>(bacteria and protozoa only)<br>One-star (★) |
| **Manufacturer** | Basic Water Needs B.V.<br>c/o Dries de Kater<br>Roode Wildemanweg 25<br>1521 PZ Wormerveer<br>The Netherlands<br>www.basicwaterneeds.com |
| **Evaluation procedure** | Abbreviated laboratory testing |
| **WHO report issue date** | Round II, 2018 |
| **WHO reference number** | 27/09/2016-R2-41 |

## Summary of evaluation

This report summarizes the results of laboratory testing of a ceramic filtration device known by the tradename 'Tulip Table Top Water Filter', under Round II of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Testing followed the requirements of the WHO protocol for batch filtration technologies. Testing investigated the ability of the device to remove bacteria and viruses. Performance against protozoa was assigned based on the mean bacterial reduction achieved. Based on the evaluation results, the Tulip Table Top Water Filter meets WHO performance criteria and is classified as providing one-star (★) *Targeted protection* against bacteria and protozoa only.

# 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 (QMRA) methods outlined in the WHO *Guidelines for Drinking-water Quality* (2017) and set out $\log_{10}$ reduction targets against bacteria, viruses and protozoa, as shown in Table 1.

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

| Performance classification | Bacteria ($\log_{10}$ reduction required) | Viruses ($\log_{10}$ reduction required) | Protozoa ($\log_{10}$ reduction required) | Interpretation (with correct and consistent use) |
|---|---|---|---|---|
| ★★★ | ≥ 4 | ≥ 5 | ≥ 4 | Comprehensive protection |
| ★★ | ≥ 2 | ≥ 3 | ≥ 2 | |
| ★ | Meets at least 2-star (★★) criteria for two classes of pathogens | | | Targeted protection |
| — | Fails to meet criteria for 1-star (★) | | | Little or no protection |

## Product description

The Tulip Table Top Water Filter is a ceramic candle filter with activated carbon that is impregnated with colloidal silver. Microorganisms are physically removed from water as it filters through the ceramic candle under gravity. The assembled filter set comprises two 9-litre buckets stacked on top of each other; these buckets serve as receptacles for raw and filtered water. The ceramic candle is screwed to the bottom of the raw water bucket. Water is filtered through the ceramic candle into the clean water bucket. The full product description, illustrations and use instructions can be found at: www.basicwaterneeds.com.

# Test methods

**Product-specific test plan:** A product-specific test plan was developed based on the manufacturer's instructions for use; the Harmonized Testing Protocol: Technology Non-Specific V 2.0 (June 2018a); and the for Gravity-fed Batch FiltrationTechnology Protocol V 2.0 (WHO, 2018b). Testing was conducted at a WHO-designated laboratory, KWR Watercycle Research Institute, in the Netherlands.

**Test organisms:** Evaluation of the Tulip Table Top Water Filter investigated its performance in reducing bacteria and viruses. The test organisms were *Escherichia coli (E. coli)* and coliphages MS2 and phiX174. Based on the available evidence on filtration and removal of protozoan cysts, testing against this microbial groups was not conducted (WHO, 2018). Protozoan reduction is assigned based on the mean bacterial reduction achieved.

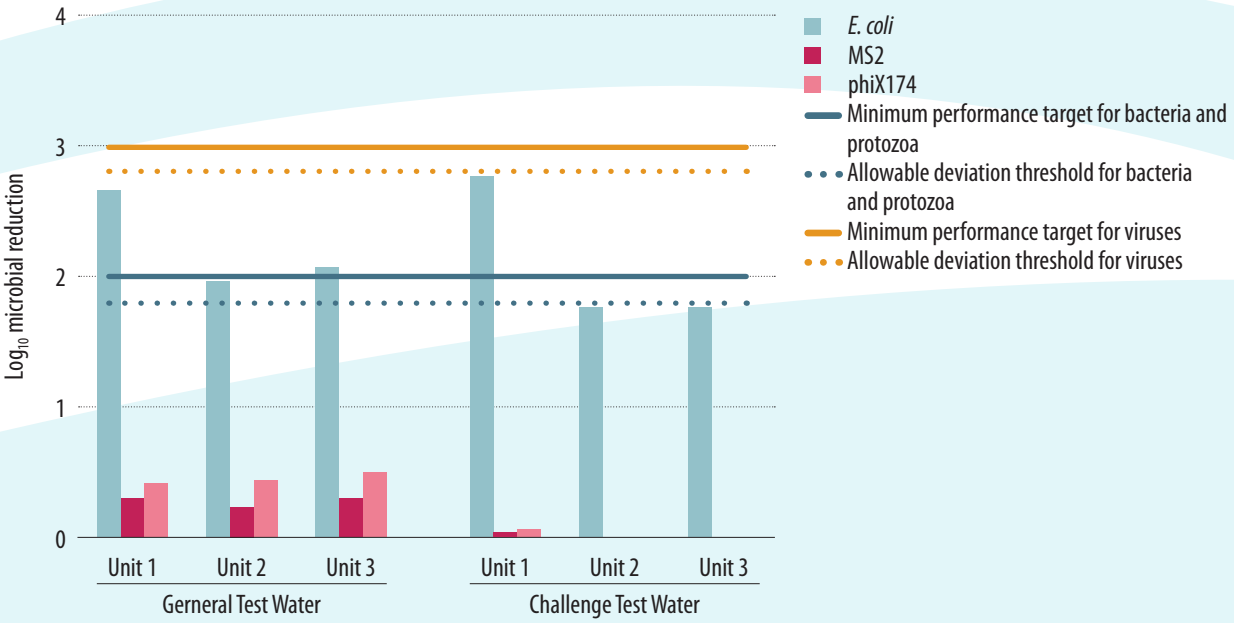
**Test waters:** The device was tested in two simulated natural waters: General Test Water (GTW), simulating high quality groundwater, and Challenge Test Water (CTW), simulating surface water. Details on the physicochemical characteristics of the test waters are provided in the Gravity-fed Batch Filtration Technology Protocol V 2.0 (WHO, 2018b).

**Test set up:** Three production units were provided for testing, and 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 (GTW on Days 1 and 2; CTW on Days 3 and 4), resulting in a total of 12 sample points for each organism (i.e. 2 days × 2 test waters × 3 test units). Posttreatment silver residual samples were collected.

# Results

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

**Fig. 1 Performance across test units**[1]




The Tulip Table Top Water Filter achieved mean $\log_{10}$ reductions of 2.2 for *E. coli*; 0.1 for MS2; and 0.2 for phiX174. Performance across all three units was generally consistent for all organisms tested and in both test waters, although Unit 1 showed slightly higher bacterial reductions. None of the units met the 3 $\log_{10}$ target for viruses.

Posttreatment residual silver concentrations ranged from 0.013 to 0.088 mg/L, which is below the tolerable limit of 0.1 mg/L (WHO, 2017).

# Interpretation and application of results

Performance is classified in three ascending tiers of performance: ★ (one-star); ★★ (two-star); and ★★★(three-star), as shown in Table 1. Both three- and two-star products are classified as providing *Comprehensive protection* against all three microbial groups. One-star products are those that meet performance targets for only two of the three microbial groups, and are classified as providing *Targeted protection*.

Each production unit should consistently meet or exceed the performance target for each microbial group, and 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 twelve sample points can achieve a reduction

[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.

of 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 Tulip Table Top Water Filter met the minimum performance target of 2 $log_{10}$ for bacteria. For the protozoan reduction, a value of 2.2 $log_{10}$ was assigned based on the mean bacterial reduction achieved. The minimum performance target for viruses was not met.

As such, the Tulip Table Top Water Filter is classified as providing *Targeted protection* (★) against bacteria and protozoa only.

## Considerations for product selection

| | | |
|---|---|---|
|  | **Microbial conditions** | Use where contaminant of concern is known to be bacterial / protozoan microbes |
|  | **Physico-chemical water characteristics** | Suitable for all water quality conditions<br>Includes a fabric prefilter to be used when treating turbid water |
|  | **Product information and labelling** | Check that the device is appropriately labelled and has clear instructions for use |

## References


WHO (2011). Evaluating household water treatment options: health-based targets and microbiological performance specifications. Geneva: World Health Organization (http://www.who.int/water_sanitation_health/publications/household_water/en/).

WHO (2017). Guidelines for drinking-water quality, fourth edition. Incorporating the first addendum. Geneva: World Health Organization (https://www.who.int/water_sanitation_health/publications/dwq-guidelines-4/en/).

WHO (2018a). Harmonized Testing Protocol: Technology non-specific version 2.0. Geneva: World Health Organization (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).

WHO (2018b). Gravity-fed Batch Filtration Technology Protocol version 2.0. Geneva: World Health Organization (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).





**For more information, contact:**

World Health Organization
Water, Sanitation, Hygiene and Health Unit
Department of Public Health, Environmental and Social Determinants of Health
20, Avenue Appia
1211 Geneva 27
Switzerland

Email: hhwater@who.int

http://www.who.int/water_sanitation_health/water-quality/household/scheme-household-water-treatment/en/