

International Scheme to Evaluate Household Water Treatment Technologies

Solageo Better Water Maker

Product evaluation report

WHO performance classification	Targeted protection (bacteria and protozoa only) One-star (★)
Manufacturer	Trade Without Borders (HK) Limited Room 19, 9/F, Block D, Wong King Industrial Building 192-198 Choi Hung Road San Po Kong, Kowloon China, Hong Kong SAR www.solageo.com
Evaluation procedure	Abbreviated laboratory test
WHO report issue date	Round III, 2020
WHO reference	24/1/2020-R3-15

Summary of evaluation

This report summarizes the evaluation results of an ultraviolet (UV) water treatment device known by the tradename 'Solageo Better Water Maker', under Round III of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation of the Solageo Better Water Maker followed the requirements of the WHO protocol for (UV) technologies, and investigated the ability of the device to inactivate bacteria and viruses. Inactivation of protozoa was assigned based on the mean bacterial inactivation achieved. Based on the evaluation results, the Solageo Better Water Maker 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

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 Solageo Better Water Maker is a handheld ultraviolet (UV) water treatment device. It comprises a low-pressure UV lamp with a pump, plastic, stainless steel mesh and non-woven fabric pre-filters, and a carbon cartridge filter. To operate, the device is submerged in a vessel containing the water to be treated, connected to a power supply, and the pump draws up the water through the filters and along the UV lamp. The Solageo Better Water Maker can be operated when connected to a 12-volt direct current power supply from a hand crank, solar charged battery or alternating current / direct current (AC/DC) adapter. The full product description, illustrations and use instructions can be found at: www.solageo.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* (WHO, 2019); the *Testing Protocol for Ultraviolet Technologies ((with or without pre-filtration and/or disinfection addition) V 3.2* (WHO, 2020), and the manufacturer's use instructions. Testing was conducted at a WHO-designated laboratory, NSF International, in the United States.

Test organisms: Evaluation of the Solageo Better Water Maker investigated its performance in inactivating 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 inactivation by UV, testing against this microbial group was not conducted (WHO, 2019). The protozoan inactivation is assigned based on the mean bacterial inactivation observed.

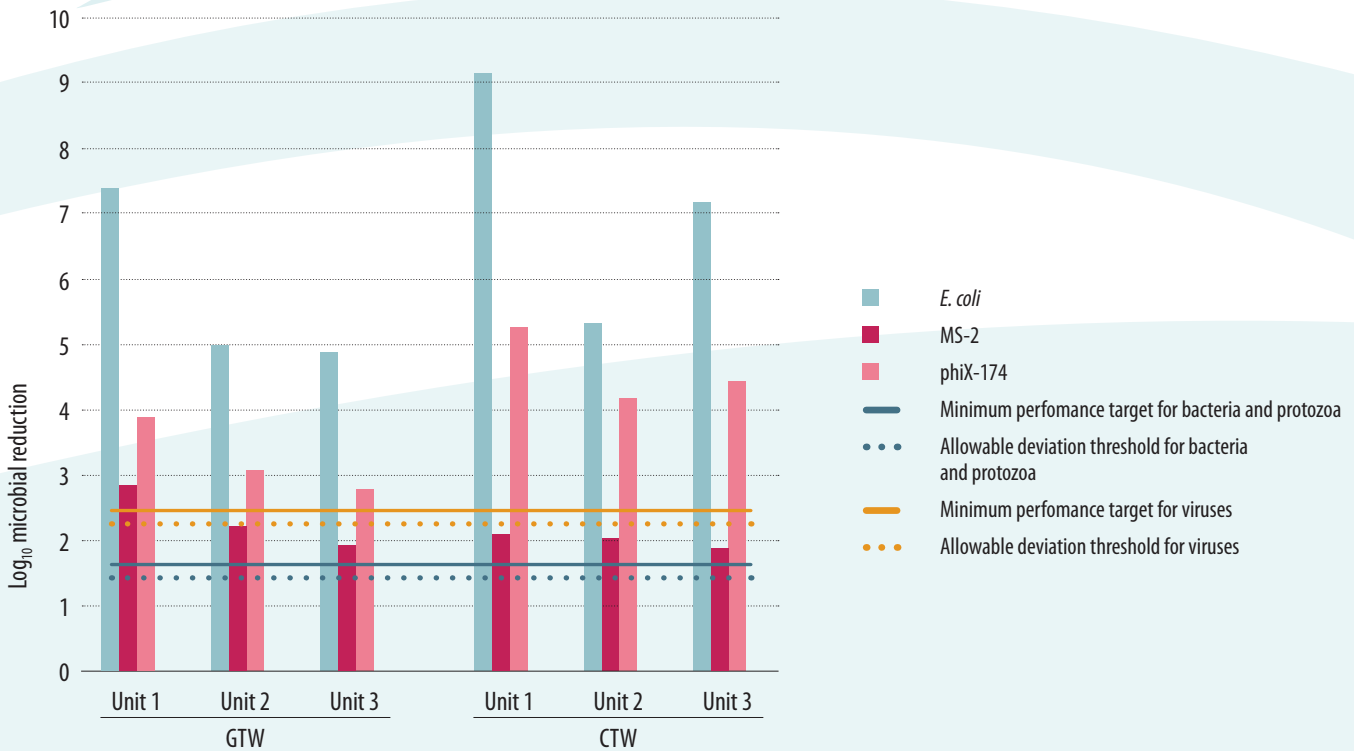
Test waters: The device was tested in two simulated natural waters: General Test Water (GTW), simulating high quality groundwater, and Challenge Test Water (CTW), simulating surface water. Refer to the *Testing Protocol for Ultraviolet Technologies ((with or without pre-filtration and/or disinfection addition) V 3.2* for details on physicochemical characteristics of the test waters.

Test set-up: Six new production units were provided by the manufacturer, and of these, three were randomly selected 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 two days, in GTW on Day 1 and in CTW on Day 2, with microbial sampling at the start and end of each test day. 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.

Performance across test units¹



The Solageo Better Water Maker achieved a mean \log_{10} inactivation of 6.5 for *E. coli*; 2.2 for MS-2; and 3.9 for phiX-174.

Performance was generally consistent across the three units. None of the units tested fully met the minimum viral inactivation target of 3 \log_{10} for MS-2.

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 tier². This means that for classification as a two-star product, up to three of the 12 sample points can achieve a minimum reduction of 1.8 \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

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

phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phage.

Performance classification

The Solageo Better Water Maker fully met the performance target for bacteria. For the protozoan reduction, a value of $6.5 \log_{10}$ is assigned, based on the mean bacterial reduction. The minimum performance target for viruses was not fully met. As such, the Solageo Better Water Maker 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	Can be used to treat turbid water
	Product information and labelling	Check that the product is appropriately labelled and has clear instructions for use

References

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

Guidelines for drinking-water quality, fourth edition incorporating first addendum. Geneva: World Health Organization; 2017 (http://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/).

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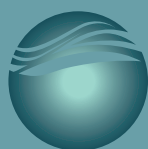
Ultraviolet Technologies (with or without pre-filtration and/or disinfection addition) Testing Protocol: version 3.2. Geneva: World Health Organization; 2020 (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).

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