World Health Organization

WHO International Scheme to Evaluate Household Water Treatment Technologies

WATA-Standard™

Product evaluation report

WHO performance classification	Targeted protection (bacteria and viruses only) One-star (★)
Manufacturer	WATALUX Avenue de la Grenade 24 1207 Geneva Switzerland www.watatechnology.ch
Evaluation procedure	Abbreviated laboratory testing
WHO report issue date	Round II, 2019
WHO reference number	1/12/2016-R2-45

Summary of evaluation

This report summarizes the evaluation results of a chlorine generator known by the tradename 'WATA-Standard' under Round II 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 chlorine generator disinfection technologies and comprised bacterial inactivation testing, review of existing data on viral inactivation and measurement of chlorine dose delivered, and posttreatment concentrations of free available chlorine. Based on the evaluation results, the WATA-Standard™ meets WHO performance criteria and is classified as providing *Targeted protection* (★) against bacteria and viruses 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 *Guidelines for Drinking-water Quality* (WHO, 2017) and set $\log_{10}$ 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 WATA-Standard™ is an electrolytic chlorine generator. The device operates under electricity grid or solar power and uses salt and water solution (brine) to produce a concentrated sodium hypochlorite solution through electrolysis. The full product description, illustrations and use instructions can be found at www.watatechnology.ch.

Evaluation approach

Product-specific test plan: A product-specific test plan was developed based on the manufacturer's use instructions; the WHO Scheme Harmonized Testing Protocol: Technology Non-Specific V 2.0 (WHO, 2018a); and the Chlorine Generator Disinfection Technology Protocol V 2.1 (WHO, 2018b). Testing was conducted at a WHO-designated laboratory, NSF International, in the United States of America.

Test organisms: Laboratory testing of WATA-Standard™ investigated its performance in inactivating bacteria. *Escherichia coli* (*E. coli*) was the test organism. Evaluation of performance against viruses was based on a review of existing data. The available evidence on chlorine indicates that it is generally not effective against protozoa and therefore testing against this microbial group was not conducted.

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 of the physicochemical characteristics of the test waters are available in the Chlorine Generator Disinfection Technology Protocol V 2.0.

Test set up: Three production units were provided for the test 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. Each unit was tested over 2 days in CTW and GTW, resulting in 12 sample points (i.e. 3 units × 2 test days × 2 test waters).

The concentrations of free residual and total chlorine delivered in deionized, demand-free water were measured as a general indication of product quality[1]. Posttreatment free residual and total chlorine samples were collected and analysed. Per the *Guidelines for Drinking-water Quality* (WHO, 2017), a minimum of 0.2–0.5 mg/L of residual chlorine should be maintained at the point of delivery to ensure sufficient disinfection. However, the concentration of total chlorine should not exceed the health-based guideline value of 5 mg/L.

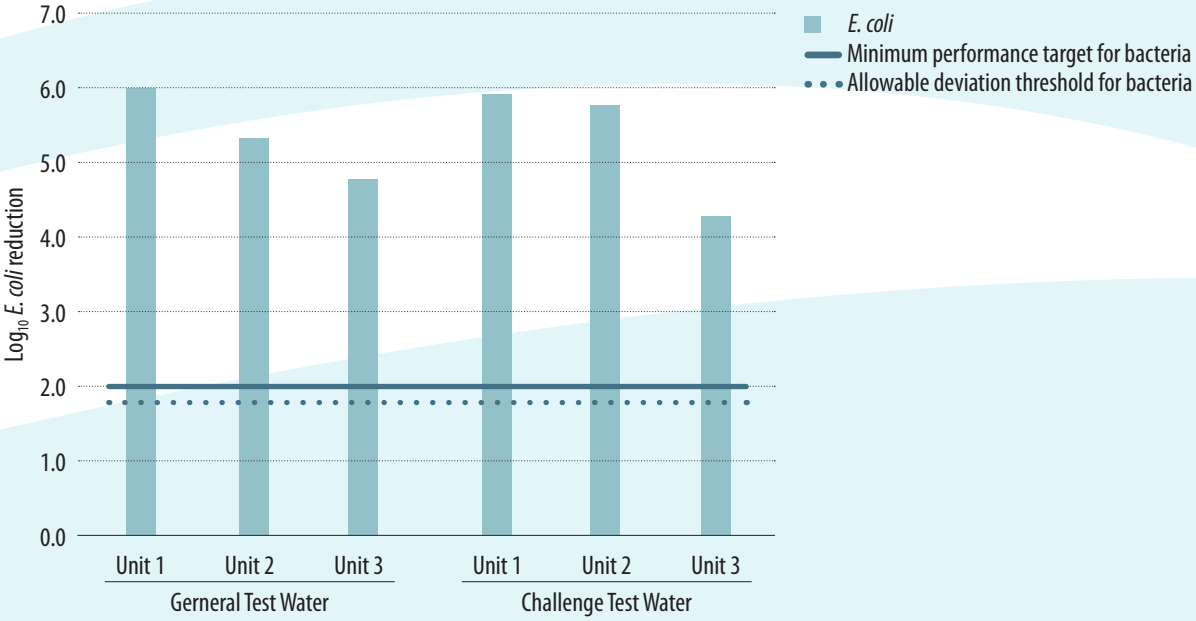
[1] Most commercially available chlorine products are generally designed to deliver a dose of 2 mg/L in clear, nonturbid water.

Results

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

The WATA-Standard™ achieved mean log_{10} reductions of 5.3 and 5.5 log_{10} in GTW and CTW, respectively, with an overall mean reduction of 5.4 log_{10}. Performance across the three units was generally consistent.

Fig. 1 Performance across test units[1]



Interpretation and application of results

As shown in Table 1, performance is classified in three ascending tiers: ★ (one-star); ★★ (two-star); and ★★★(three-star). 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, and in both test waters (GTW and CTW). 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 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; the overall reduction for viruses is based on the lower-performing phage.

Performance classification

[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

WATA-Standard™ met the minimum performance target of 2 $\log_{10}$ for bacteria. The review of existing data on viral inactivation by chlorine and measured concentrations of free residual chlorine in the posttreatment samples suggest that the product would likely meet the minimum performance target for viruses. As such, WATA-Standard™ is classified as providing *Targeted protection* against bacteria and viruses only.

Considerations for product selection

Microbial conditions	Use where contaminants of concern are known to be bacterial / viral microbes
Physico-chemical water characteristics	Use in nonturbid source water, or as a secondary treatment for water that has been pretreated through e.g. filtration to reduce turbidity and organic demand Regularly measure chlorine demand and free chlorine residual to ensure sufficient disinfection
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/).

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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). Chlorine Generator Disinfection 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/).

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