

WHO International Scheme to Evaluate Household Water Treatment Technologies

Rubicon-Micro

Product evaluation report

WHO performance classification	Targeted protection (bacteria and viruses only) One-star (★)
Manufacturer	Prideco Holdings (Pty) Ltd Cosmos Crescent 9 Rynoue Pretoria 0035 South Africa www.pridecoholdings.com
Evaluation procedure	Full laboratory testing
WHO report issue date	Round II, 2020
WHO reference	09/5/2016-R2-33

Summary of evaluation

This report summarizes the evaluation results of a flocculant-disinfectant known by the tradename 'Rubicon-Micro', 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 protocols for coagulation-flocculation and disinfection technologies and investigated the ability of the product to reduce bacteria, viruses and protozoa. Based on the evaluation results, Rubicon-Micro meets WHO performance criteria and is classified as providing *Targeted protection* (★) against bacteria and viruses only.

¹ Formerly branded as 'Rubicon'.

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.

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

Rubicon-Micro (formerly branded as Rubicon) is a flocculant-disinfectant containing persulfate salts and Polydiallyldimethylammonium chloride (polyDADMAC). The polyDADMAC acts as a coagulant which aggregates suspended particulates and microorganisms in water. The coagulation results in the creation of larger flocs that then settle in the base of the water vessel. The persulfate salts act as oxidizing agents against microbial contaminants. The product is available in 3.5-gram sachets that can each treat 20–25 litres of water. The full product description, illustrations and use instructions can be found on the manufacturer website: www.pridecoholdings.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 1.0 (WHO, 2018); and the test plans for Coagulation-Flocculation Technologies V 2.0; and Non-Chlorine Disinfection Technologies V 2.0. Testing was conducted at a WHO-designated laboratory, NSF International, in the United States.

Test organisms: Laboratory testing of Rubicon-Micro investigated its performance in reducing bacteria, viruses and protozoa. The test organisms were *Escherichia coli* (*E. coli*); coliphages MS2 and phiX174; and *Cryptosporidium parvum* (*C. parvum*).

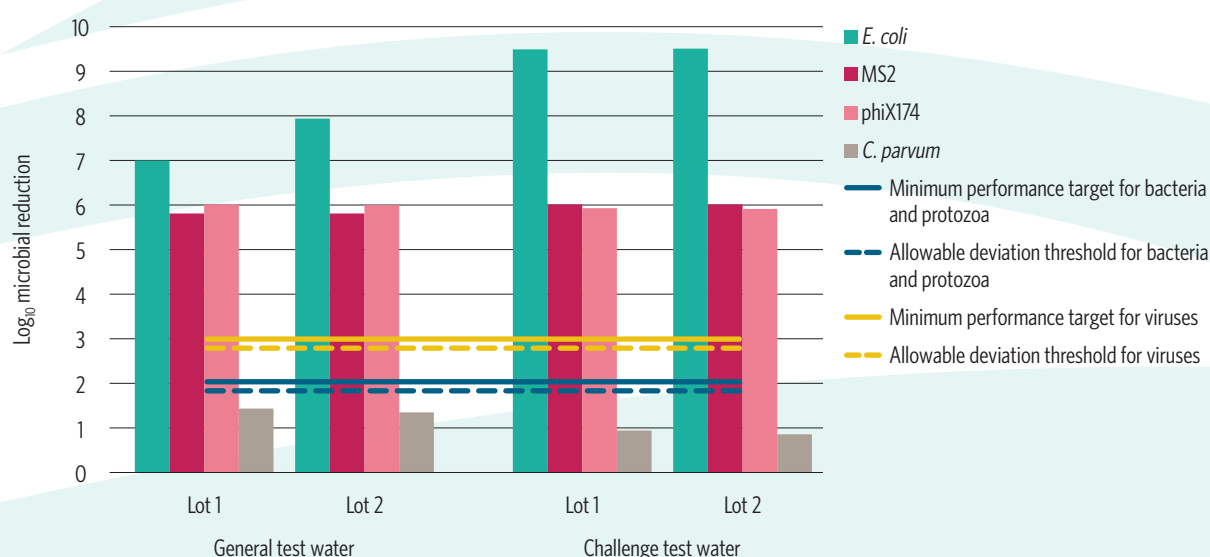
Test waters: The device was tested in two simulated natural waters: General Test Water (GTW), simulating high quality groundwater; and Challenge Test Water (CTW), simulating surface water. Refer to the technology test plans for Coagulation-Flocculation Technologies V 2.0; and Non-Chlorine Disinfection Technologies V 2.0 for details on physico-chemical characteristics of the test waters.

Test set up: Samples from two production lots were provided for the test. All sample units were applied according to the manufacturer use instructions. Pre-treatment and post-treatment water grab samples were analysed using methods identified in the product specific test plan. Three sample units / sachets from each production lot were tested in CTW and GTW, resulting in 12 sample points per test organism: i.e. 2 lots × 3 sample units × 2 test waters.

3. Results

The figure below presents the results of the bacterial, viral and protozoan testing in GTW and CTW.

Performance across test lots¹



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.

Rubicon-Micro achieved mean log₁₀ reductions of reductions of ≥8.5 for *E. coli*; ≥5.9 for MS2 and phiX174; and 1.1 for *C. parvum*. Performance was consistent across the two lots tested.

A very strong disinfectant smell was observed during the testing. Limited investigations on the cause of the smell and potential toxicity were inconclusive. The presence of sulfate in water can cause noticeable tastes and odours (WHO, 2017). Per the Scheme evaluation, residual concentrations of disinfectants or leachates from a wetted contact material in the post-treatment/effluent samples should not constitute a threat to health. However, an exhaustive investigation of material safety is outside the scope of the Scheme evaluation.

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 log₁₀ is acceptable for 25% of sample points at the two-star performance tier and 0.4 log₁₀ 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 log₁₀ for bacteria or protozoan cysts (instead of 2 log₁₀) or 2.8 log₁₀ for viruses (instead of 3 log₁₀). Each phase is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phase.

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.

Performance classification

Rubicon-Micro met and exceeded performance targets of 4 log₁₀ for bacteria and 5 log₁₀ for viruses. The minimum performance target of 2 log₁₀ for protozoa was not met. As such, Rubicon-Micro is classified as providing *Targeted protection* (★) against bacteria and viruses only.

Considerations for product selection



Microbial conditions

Use where contaminant of concern is known to be bacterial / viral microbes.



Physico-chemical water characteristics

Can be used in both turbid and non-turbid water.



Product information and labelling

Check that the device is appropriately labelled and has clear instructions for use. Potential odour concerns should be considered.

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/).

Harmonized Testing Protocol: Technology non-specific version 2.0. Geneva: World Health Organization; 2015 (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).

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

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