Summary of evaluation

This report summarizes the evaluation results of a sodium percarbonate disinfectant known by the tradename ‘BioCool CleanWater’, 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 chemical (non-chlorine) disinfection technologies and investigated the ability of the product to inactivate bacteria and viruses. Based on the evaluation results, the product does not meet WHO performance criteria and is classified as providing little or no protection.
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 Table 1.

Table 1. WHO performance criteria for household water treatment technologies

<table>
<thead>
<tr>
<th>Performance classification</th>
<th>Bacteria (log_{10} reduction required)</th>
<th>Viruses (log_{10} reduction required)</th>
<th>Protozoa (log_{10} 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>Targeted protection</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>
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</tbody>
</table>

Product description

BioCool CleanWater are disinfection tablets with the active ingredient sodium percarbonate. When added to water, the tablets dissolve and the sodium percarbonate dissociates into sodium and carbon ions as well as hydrogen peroxide. The peroxide disinfects microbial contaminants through oxidative processes. The product is available in a bottle containing 250 tablets, each of which can treat 5 L of water. The full product description, illustrations and use instructions can be found at www.biocool.se.

Evaluation approach

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 (WHO, 2018a); and the Chemical (non-chlorine) Disinfection Technology Protocol V 2.0 (WHO, 2018b). Testing was conducted at a WHO-designated laboratory, NSF International, in the United States of America.

Test organisms: Laboratory testing of BioCool CleanWater investigated its performance in inactivating bacteria and viruses. The test organisms were Escherichia coli (E. coli) and coliphages MS2 and phiX174, as viral surrogates. The available evidence on hydrogen peroxide suggests that it is not effective against protozoa. As such, 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 on the physicochemical characteristics of the test waters are available in the Chemical (non-chlorine) Disinfection Technology Protocol V 2.0.

Test set-up: Sample tablets from one production lot were provided for the test1. All sample units were tested according to the manufacturer’s use instructions. The manufacturer’s direction for use is to add one tablet to 5 L of water and wait 3–24 hours before use. For the evaluation, a wait time of 3 hours was used. Pretreatment and posttreatment water grab samples were analysed using methods identified in the product-specific test plan. Six sample units / tablets were tested in each test water, resulting in 12 sample points per test organism (i.e. 6 sample units × 2 test waters). Posttreatment hydrogen peroxide residual samples were collected and analysed.

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1 Two lots are requested for the evaluation for products manufactured as lots. However, the manufacturer only provided a single production lot, and did not indicate whether the product is manufactured as a continuous process. As such, testing was conducted using replicates from one lot.
Results

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

Fig. 1. Microbial performance across test waters

The BioCool CleanWater achieved mean $\log_{10}$ reductions of 0.98 for *E. coli*; −0.15 for MS2; and 0.08 for phiX-174. Residual hydrogen peroxide concentrations in treated water ranged from 1 to 14 mg/L in GTW and 5 to 13 mg/L in CTW.

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 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 of 0.4 $\log_{10}$ at the three-star performance tier. 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 phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower-performing phage.

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 shown in Table 1. Due to the complexity of using viable organisms, there may be variations in these pretreatment concentrations above what is sufficient. As these variations may lead to demonstrated reductions that far exceed the performance targets, the emphasis is on whether the performance target has been met and not the extent by which the target was exceeded.
Performance classification

BioCool CleanWater did not meet the minimum performance targets for neither bacteria nor viruses. BioCool CleanWater tablets are classified as providing little or no protection.

References


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