Summary of evaluation

This report summarizes the results of laboratory testing of a chlorinated disinfectant known by the tradename ‘Germisep 0.5g’ under Round IV of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation of Germisep 0.5g followed the requirements of the WHO protocols for chlorine disinfection technologies, and investigated its ability to inactivate bacteria and viruses. No testing against protozoa was conducted.

Based on the evaluation results, Germisep 0.5g does not meet WHO performance criteria and is classified as providing little or no protection.
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 the 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>
<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>Meets at least 2-star (★★) criteria for two classes of pathogens</td>
</tr>
<tr>
<td>★</td>
<td>—</td>
<td>Fails to meet criteria for 1-star (★)</td>
<td>—</td>
<td>Little or no protection</td>
</tr>
</tbody>
</table>

### Product description

Germisep 0.5g is a tablet containing sodium dichloroisocyanurate (NaDCC). The tablets effervesce in drinking water to release free chlorine in the form of hypochlorous acid which acts as a disinfectant. The product is available as 0.5 g and 2.5 g tablets that can treat 80 L and 400 L of water at 4 mg/L free chlorine, respectively. The full product description, illustrations and use instructions can be found on the manufacturer’s website: www.germisep.com.

2. Evaluation approach

**Product-specific test plan:** Germisep 0.5g was evaluated under Round IV of the Scheme. Testing followed the requirements of the WHO *Chlorine Chemical Disinfection Technology Testing Protocol V 4.1* (November, 2021). A product specific test plan was developed based on these WHO technology protocols, the WHO *Harmonized Testing Protocol: Technology Non-Specific Version 4.0* (August, 2021) and the manufacturer’s use instructions. Testing was conducted at a WHO-designated laboratory, NSF International, in the United States.

**Test organisms:** Evaluation of Germisep 0.5g investigated its performance in inactivating bacteria and viruses. The test organisms were *Escherichia coli* (*E. coli*), representing bacteria, and coliphages MS2 and PhiX174, representing viruses.

**Test waters:** The product was tested in two waters: general test water (GTW), simulating high quality groundwater, and challenge test water (CTW), simulating surface water. Refer to the WHO *Harmonized Testing Protocol: Technology Non-Specific Version 4.0* (August, 2021); and the *Chlorine Disinfection Technology Testing Protocol V 4.1* (November, 2021) for details on physicochemical characteristics of the test waters.

**Test procedure:** The manufacturer provided tablets from two production lots (as 0.5 g × 30 tablets) of the Germisep 0.5g for the test. Tablets from each production lot were tested in triplicate in GTW and CTW, resulting in a total of 12 sample points for each test organism. A single tablet of the product was dosed into six individual 80 L volumes of GTW, and six individual 15 L volumes CTW (Fig. 1). After addition, the tablet was allowed to effervesce for a 10-minute hold time prior to sampling. The manufacturer’s instructions were followed for utilizing the provided dosing calculator, hold time, and test water volumes.
The manufacturer’s instructions were to drop the tablet into test waters to achieve a target ppm based on the type of water being treated. An initial dose of 4 mg/L was recommended by the manufacturer for the GTW which equated to one tablet in 80 L of test water, and falls between the 2.5-5 mg/L “maintenance dose” in the instructions. A target dose of 20 mg/L was utilized for the CTW which equated to one tablet in 15 L of test water and corresponds to the recommended dose for contaminated drinking water treatment. Recommendations for stirring were not provided by the manufacturer.

Subsampling was performed on each test volume. Measurement of disinfectant concentration was performed for each lot and neutralizer effectiveness was determined for both GTW and CTW. Pretreatment and post-treatment water grab samples were analysed using the methods identified in the WHO Chlorine Disinfection Technology Testing Protocol V4.1.

Post treatment free residual and total chlorine samples were collected and analysed. According to the Guidelines for Drinking-water Quality (WHO, 2017), the concentrations of chlorine should not exceed the health-based guideline value of 5 mg/L.

3. Results

Figure 1 presents the results of the microbial testing in GTW and CTW. All test water characteristics were within specifications.

Fig. 1. Performance across the two microbial groups¹

CTW: challenge test water; *E. coli*: Escherichia coli; GTW: general test water; MS2 Coliphage; PhiX174 Coliphage.

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, these pretreatment concentrations may be above what is sufficient, which may lead to reductions that far exceed the performance targets. However, the emphasis is on whether the performance target is met and not the extent by which the target is exceeded.
Germisep 0.5g achieved mean \( \log_{10} \) reduction values of 3.29 (range 1.12 – 8.48) for \textit{E. coli}, 2.22 (range 0.85 – 5.08) for MS-2, and 2.78 (range 0.82 – 4.25) for Phi X174. For \textit{E. coli} 41% of samples were below the performance target. For MS-2 and Phi X174 coliphage 50% of samples fell below the performance target. High variability in disinfection efficacy was observed in both test waters between replicates and may be attributable to the absence of manufacturer recommendation for stirring.

Free residual chlorine concentrations in GTW ranged from 0.03 to 0.4 mg/L (mean 0.10 mg/L). Free residual chlorine concentrations in CTW ranged from 0.44 to 3.32 mg/L (mean 1.95 mg/L).

4. 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 \textit{comprehensive protection} against all three microbial groups. One-star products meet performance targets for only two of the three microbial groups, providing \textit{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 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 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.

Performance classification

Germisep 0.5g did not fully meet the minimum performance targets for bacteria and viruses. It is therefore classified as providing little or no protection.

\(^2\) These cut-off values were determined using QMRA modelling and selecting ranges that still result in appreciable health gains within a specific performance tier.
References


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