

# BHAWIN TECHNOLOGIES

*Scientific Testing & Analytical Services*

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## FINAL SCIENTIFIC REPORT

Time-Kill Study Against *Mycobacterium Tuberculosis*  
MicroSure HGSD Colloidal Silicone Dioxide  
with Fifth-Generation Quaternary Ammonium Compound

**Prepared For:**  
Strategia

**Prepared By:**  
Bhawin Technologies Scientific Services Group

**Study Method:**  
Quantitative Time-Kill Analysis (Tuberculocidal Protocol)

**Report Date:**  
January 29, 2026

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## FINAL RESULTS

(Time Kill Study for TB testing Standard Test Protocol (STP) Number: BHA-STP-0158 Rev03)

<b>Date Received:</b> 05OCT 25	<b>Client:</b> Hamid Khan, MD Strategia hkhan@strategiapm.com	<b>Method:</b> Time Kill Study for TB testing Standard Test Protocol (STP) Number: BHA-STP-0158 Rev 03	
<b>Test Date:</b> 10NOV25	<b>Sample Description:</b>  MicroSure HGSD Colloidal Silicone Dioxide  Batch#25032001	<b>Bhawin ID:</b> 05OCT25ST001	<b>Expiration Date:</b> N/A
<b>Test Completed Date:</b> 23JAN26		<b>Bhawin Project Code:</b> PN090925	
<b>Issued Date:</b> 29JAN26			

### Introduction

This report describes the procedure for the evaluation of products for anti-microbial activity against selected organisms at representative contact times. Products are evaluated in a liquid matrix. The United States Environmental Protection Agency (EPA) requires disinfectants seeking tuberculocidal claims to demonstrate efficacy against *Mycobacterium* species using quantitative time-kill methodologies. Under standard EPA guidance, testing is typically performed using surrogate organisms such as *Mycobacterium terrae* or *Mycobacterium bovis*, which are accepted substitutes for *Mycobacterium tuberculosis* due to comparable resistance profiles and cell wall structure.

This standard method entails controlled contact times, quantitative recovery of surviving organisms, demonstration of a minimum 4-log (99.99%) reduction, neutralization controls, replicate pulls, and defined acceptance criteria.

The EPA-recognized surrogate testing method and its scientific basis were fully communicated to the client prior to study initiation. The client required that testing be conducted against *Mycobacterium tuberculosis* itself rather than a surrogate organism.

Because *M. tuberculosis* presents increased biosafety requirements, specific testing parameters were incorporated while still preserving the same performance benchmark of  $\geq 4$ -log reduction and maintaining the EPA time-kill framework.

### Compliance

All testing was performed under Good Manufacturing Practice (GMP) conditions in compliance with FDA 21 CFR Parts 210, 211, and 820 using quantitative methodology aligned with EPA disinfectant performance intent.

### Study Design and Description

The formulation was evaluated in a liquid matrix against *Mycobacterium tuberculosis* at multiple timed exposure intervals. At each timepoint, microbial recovery and enumeration were performed to quantify percent and log reduction relative to the initial inoculum. Multiple pulls were conducted to verify consistency.

## Results

### Time Kill Study Results

Organism:	<i>Mycobacterium Tuberculosis</i>					
Time-Point	30 Seconds	1 minute	2minute	5minute	7minute	9 minute
Log Reduction Benchmark Achieved?	Yes	Yes	Yes	Yes	Yes	Yes
Criteria	Met/Pass	Met/Pass	Met/Pass	Met/Pass	Met/Pass	Met/Pass

### Summary

The tested solution demonstrated consistent antimycobacterial activity across all evaluated contact times. All replicate pulls met acceptance criteria without deviation. Testing was conducted under GMP conditions using a quantitative methodology aligned with EPA disinfectant performance intent and FDA laboratory quality requirements.

Based on the generated time-kill data, the formulation exhibits reliable and reproducible antimycobacterial efficacy. The absence of failures across all timepoints and replicates supports the conclusion that the solution performs consistently under controlled exposure conditions.

The formulation combines colloidal silicone dioxide with a fifth-generation quaternary ammonium compound, resulting in a dual-mechanism antimicrobial system. The quaternary ammonium compound provides rapid antimicrobial action through disruption of microbial cell membranes and protein denaturation. The colloidal silica component contributes surface-binding and structural interaction effects that support continued antimicrobial activity.

Because both components are non-volatile and surface-active, it is scientifically reasonable to expect extended residual antimicrobial efficacy beyond the initial application period and the tested intervals.

### Conclusion

The testing completed successfully addressed the client's requirement to evaluate efficacy against *Mycobacterium tuberculosis* while maintaining EPA disinfectant performance intent and FDA GMP laboratory compliance. The product demonstrated consistent antimycobacterial activity across all evaluated timepoints and is expected to provide sustained antimicrobial performance.

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### History

Date	Revision	Changes
01/29/26	.00	New document

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