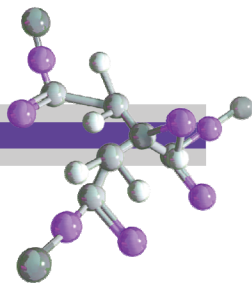


SILVÉRIION²⁴₀₀



Technical Data Sheet



A Versatile Antimicrobial for Personal Care Applications

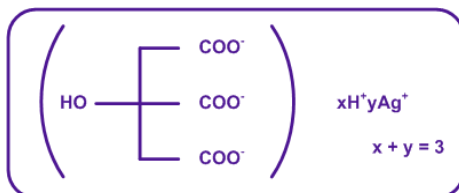


Characterization

SILVÉRIION® 2400 is a patented antimicrobial based on a stabilized silver ion complex produced by a unique electrochemical process with silver and citric acid.

Chemical Nature

Water soluble silver salt of citric acid

Structure**INCI Name**

Citric acid (and) silver citrate

Product Form

Colorless, low viscous liquid

Shelf Life

3 years

Features/Benefits

SILVÉRIION 2400 provides a broad spectrum antimicrobial activity and is effective against unwanted skin bacteria and pathogenic microorganisms. Its fast killing activity makes SILVÉRIION 2400 an effective antimicrobial for personal care products.

Deodorant active for Personal Care products
Antimicrobial active for Personal Care products

Applications

Due to different national regulations for antimicrobials, biocides and preservatives, the local registration status has to be considered.

Guidelines for Use

Personal care products 0.1 – 0.3%
SILVÉRIION 2400 shows good compatibility in most formulations at pH <7 with anionic and non-ionic surfactants, emulsifiers and with amphoteric surfactants. SILVÉRIION 2400 is compatible with many other antimicrobial actives and most preservatives. Combinations of SILVÉRIION 2400 with cationic ingredients and incorporation in formulations with pH above 7 should be avoided. Exposure of SILVÉRIION 2400 or SILVÉRIION 2400 containing formulations to light should be avoided and storage in containers that provide protection against light is preferable. Final formulations should be tested on light stability in case they are sold in transparent packaging.

Instructions for Incorporation

SILVÉRIION 2400 is highly water soluble and easy to incorporate into the aqueous phase of gels, surfactants and emulsions made by a cold process. In the manufacturing of emulsions produced by hot processes, the antimicrobial active should preferably be added to the final formulation after emulsion has cooled down. For formulations sensitive to acids, SILVÉRIION 2400 can be pre-neutralized prior to addition to the product. Exposure of SILVÉRIION 2400 to pH values higher than 7 and temperatures above 50°C should be avoided in order to achieve optimal formulation stability. High salt concentrations can reduce the bactericidal activity whereas anionic surfactants in a concentration of 0.03% to 1% increase the biocidal efficacy of SILVÉRIION 2400.

Broad Spectrum Efficacy

Minimum Inhibitory Concentration of SILVÉRIION 2400

Microorganism	MIC of SILVÉRIION 2400 (%)
Gram-positive Bacteria	
<i>Corynebacterium minutissimum</i> ATCC 23348	0.12
<i>Corynebacterium xerosis</i> ATCC 373	0.12
<i>Micrococcus luteus</i> ATCC 10240	0.08
<i>Staphylococcus aureus</i> ATCC 6538	0.16
<i>Bacillus subtilis</i> ATCC 6633	0.16
Gram-negative Bacteria	
<i>Escherichia coli</i> ATCC 10536	0.08
<i>Enterobacter gergoviae</i> ATCC 33028	0.16
<i>Klebsiella pneumoniae</i> ATCC 4352	0.16
<i>Proteus mirabilis</i> ATCC 14153	0.16
Yeasts & Molds	
<i>Aspergillus niger</i> ATCC 16404	0.50
<i>Candida albicans</i> ATCC 10231	0.12
<i>Malassezia furfur</i> DSM 6171	0.25
<i>Tricophyton mentagrophytes</i> ATCC 9533	0.50

Deodorant Active

Strong Reduction of bacteria involved in body malodor formation

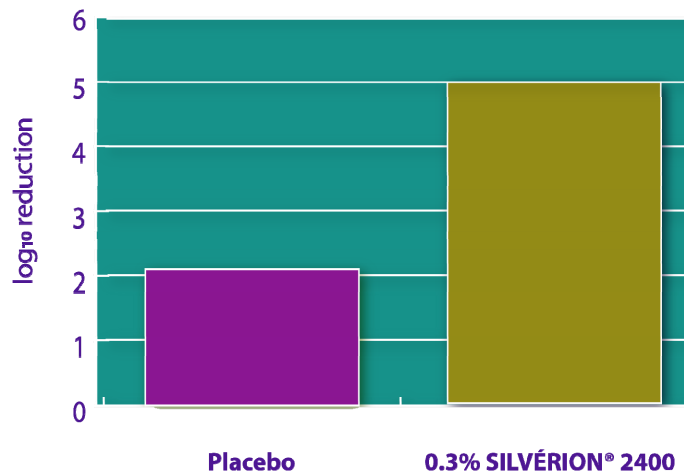
SILVÉRIION 2400 prevents the formation of body malodor by fast reduction of bacteria which metabolize human sweat. A study with a roll-on emulsion containing 0.3% SILVÉRIION 2400 showed a 99.999% reduction (i.e. 5 log) of *Corynebacterium minutissimum* within 5 minutes.

Test bacteria: *Corynebacterium minutissimum* ATCC 23348.

Formulation: Deodorant roll-on containing 0.3% SILVÉRIION 2400.

Placebo: Deodorant roll-on without SILVÉRIION 2400.

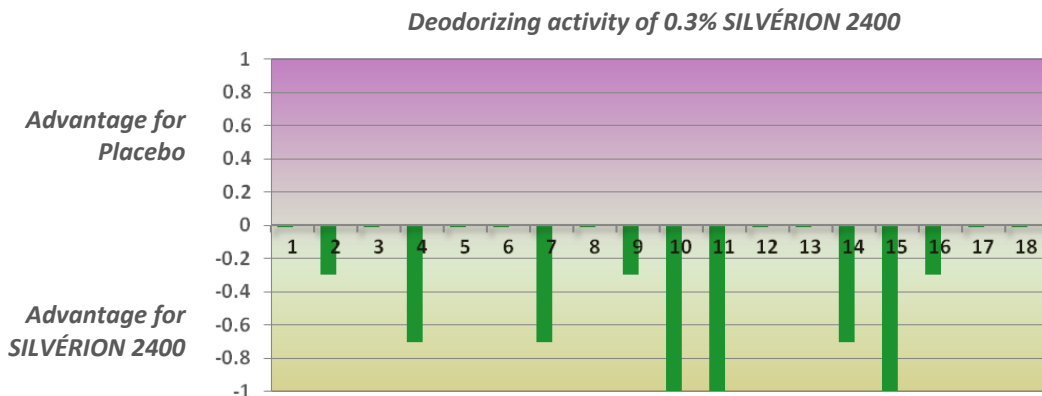
Protocol: EN1040 (5 minute contact time; 90% test product concentration).



**Deodorant -
User trial**

The **deodorizing activity** of a formulation containing 0.3% SILVÉRIION 2400 was proven under in-vivo test conditions on 18 volunteers.

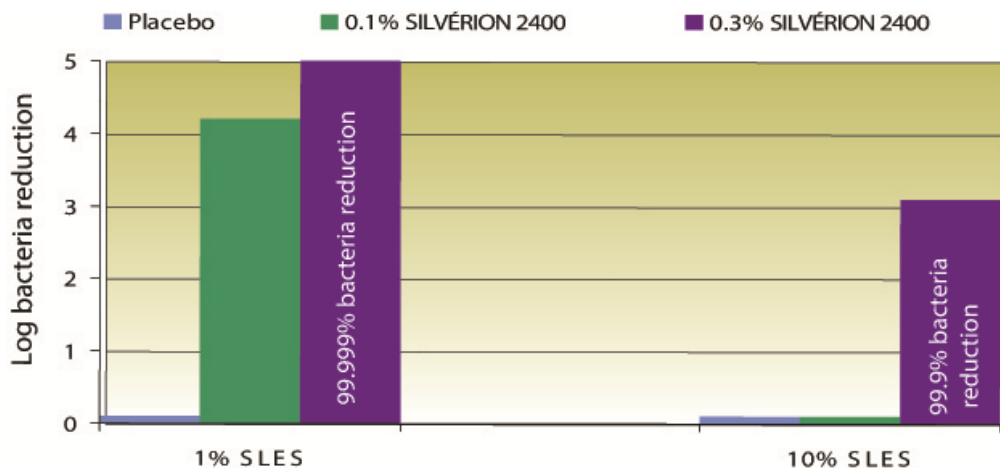
A 5 day in-use study was performed with volunteers using a deodorant spray with 0.3% SILVÉRIION 2400 and the same formulation without active. 24 hours after the last application, volunteers gave their ratings on preference. 50% preferred the formulation with 0.3% SILVÉRIION™ 2400. No volunteer preferred the placebo.



**Effective
antimicrobial
active**

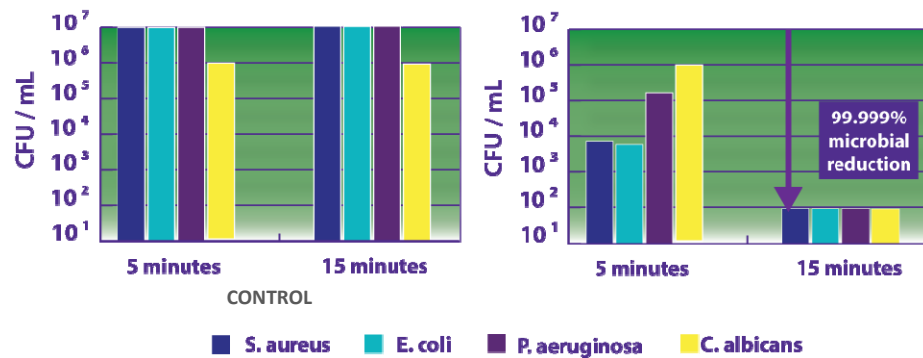
With its strong antibacterial effect, SILVÉRIION 2400 is perfectly suitable for skin cleansing products like liquid soaps, body showers, shampoos, wipes and baths as well as skin care products such as creams, lotions and gels.

A suspension test according to EN1040 was performed to demonstrate the strong antibacterial effect of liquid hand soap formulations containing 0.1% and 0.3% SILVÉRIION 2400 and 1% and 10% surfactant (SLES). The strain *Staphylococcus aureus* ATCC 6538 was exposed for 5 minutes contact time to the formulation (90% concentration).



Activity of SILVÉRIION 2400 in wet wipe formulation

A suspension test according to EN1040 was performed with a wet wipe liquid with 15 minutes contact time at 80% test product concentration. The test product contained 0.3% SILVÉRIION 2400. Test organisms used were *Staphylococcus aureus* ATCC 6538, *Pseudomonas aeruginosa* ATCC 15442, *Escherichia coli* ATCC 10536 and *Candida albicans* ATCC 10231.



Allergens

None of the allergens listed below are added to SILVÉRIION 2400 during manufacturing. Based on our manufacturing processes and evaluation of raw materials, we do not believe these allergens to be present in SILVÉRIION 2400.

Contact Allergens

- | | |
|--|--|
| Amyl cinnamal | d-Limonene |
| Amylcinnamyl alcohol | Eugenol |
| Anisyl alcohol | Farnesol |
| Benzyl alcohol | Geraniol |
| Benzyl benzoate | Hexyl cinnamaldehyde |
| Benzyl cinnamate | Hydroxy-citronellal |
| Benzyl salicylate | Hydroxymethylpentylcyclohexenecarboxaldehyde |
| 2-(4-tert-Butylbenzyl) propionaldehyde | Isoeugenol |
| Cetone Alpha | Latex |
| Cinnamal | Linalool |
| Cinnamyl alcohol | Methylheptin carbonate |
| Citral | Oak Moss |
| Citronellol | Tree Moss |
| Coumarin | |

Food Allergens

SILVÉRIION 2400 has been evaluated for the source of the raw materials used in production. There are no raw materials, including additives, used that have origin in peanuts, soybeans, milk, eggs, fish, shellfish, tree nuts and/or wheat or gluten. Based on this examination of the ingredients and their sources, SILVÉRIION 2400 is free of the specified known allergy stimulating food substances.

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