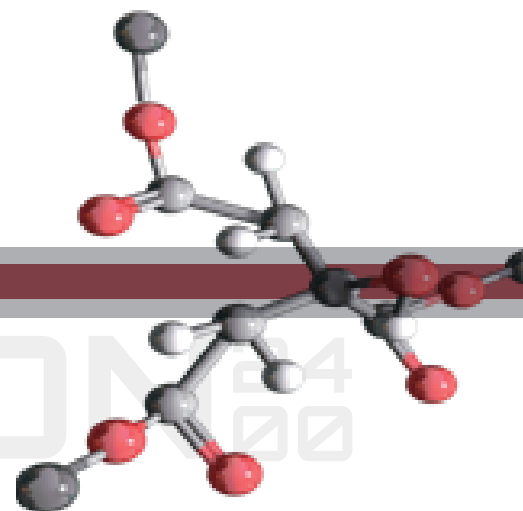

Technical data sheet
2011

SILVÉRION²⁴₀₀



SILVÉRION²⁴₀₀

pure
BIOSCIENCE

Characterization	SILVÉRION™ 2400 is a patented antimicrobial based on 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	$\left(\begin{array}{c} \text{COO}^- \\ \text{HO} - \text{C} - \text{COO}^- \\ \text{COO}^- \end{array} \right) x\text{H}^+ y\text{AG}^+$ <p style="text-align: right; margin-right: 100px;">$x + y = 3$</p>
INCI Name	Citric acid (and) silver citrate
Product form	Colorless, low viscous liquid
Shelf Life	2 years
Features/benefits	SILVÉRION™ 2400 provides a broad spectrum antimicrobial activity and is effective against unwanted skin bacteria and pathogenic microorganisms. Its fast killing activity makes SILVÉRION™ 2400 an effective antimicrobial for personal care products.
Applications	Deodorant active for Personal Care products Antimicrobial active for Personal Care products
	Due to different national regulations for antimicrobials, biocides and preservatives, the local registration status has to be considered.
Guidelines for use	<p>Personal care products 0.1 – 0.3%</p> <p>SILVÉRION™ 2400 shows good compatibility in most formulations at pH<7 with anionic and non-ionic surfactants, emulsifiers and with amphoteric surfactants. SILVÉRION™ 2400 is compatible with many other antimicrobial actives and most preservatives. SILVÉRION™ Combinations of SILVÉRION™ 2400 with cationic ingredients and incorporation in formulations with pH above 7 should be avoided. Exposure of SILVÉRION™ 2400 or SILVÉRION™ 2400 containing formulations to light should be avoided and the product preferably be stored in container that provide protection against light. Final formulations should be tested on light stability in case they are sold in transparent packaging.</p>
Instructions for Incorporation	<p>SILVÉRION™ 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, SILVÉRION™ 2400 can be pre-neutralized prior to addition to the product.</p> <p>Exposure of SILVÉRION™ 2400 to pH values higher than 7 and temperatures above 50 °C should be avoided in order to achieve optimal formulation stability.</p> <p>High salt concentrations can reduce the bactericidal activity whereas anionic surfactants in a concentration of 0.03% to 1% increase the biocidal efficacy of SILVÉRION™ 2400.</p>

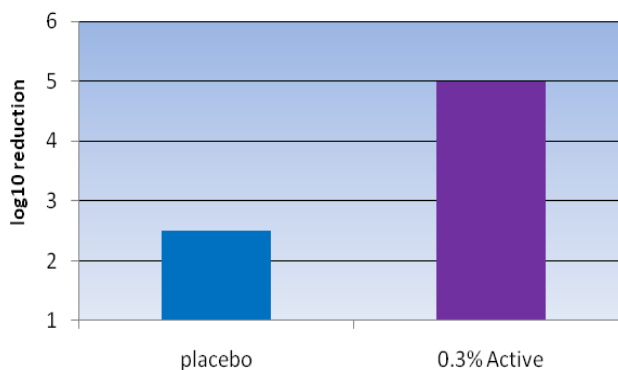
**Broad Spectrum Efficacy
Minimum Inhibitory
Concentration (MIC) of
SILVÉRIION™ 2400**

Microorganism	MIC of SILVÉRIION™ 2400(%)
Gram-positive Bacteria	
Corynebacterium minutissimum ATCC 23348	0.12
Corynebacterium xerosis ATCC 373	0.12
Micrococcus luteus ATCC 10240	0.08
Staphylococcus aureus ATCC 6538	0.16
Bacillus subtilis ATCC 6633	0.16
Gram-negative Bacteria	
Escherichia coli ATCC 10536	0.08
Enterobacter gergoviae ATCC 33028	0.16
Klebsiella pneumoniae ATCC 4352	0.16
Proteus mirabilis ATCC 14153	0.16
Pseudomonas aeruginosa ATCC 15442	0.16
Pseudomonas fluorescens ATCC 17826	0.16
Yeasts & Molds	
Aspergillus niger ATCC 16404	0.50
Candida albicans ATCC 10231	0.12
Malassezia furfur DSM 6171	0.25
Trichophyton mentagrophytes ATCC 9533	0.50

**Strong Reduction of
Bacteria Involved in
Body Malodor
Formation by
SILVÉRIION™ 2400**

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).

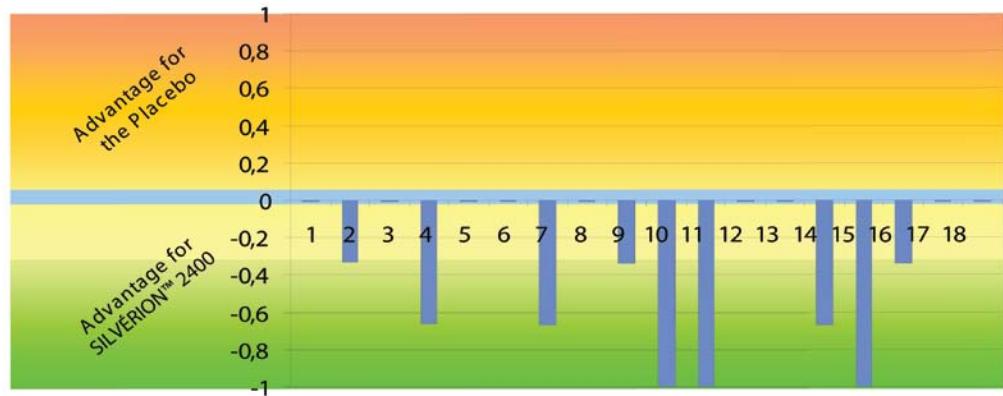


Bactericidal activity of 0.3% SILVÉRIION™ 2400

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 SILVÉRIION™ 2400 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 0.03% SILVÉRIION™ 2400. No volunteer preferred the placebo.

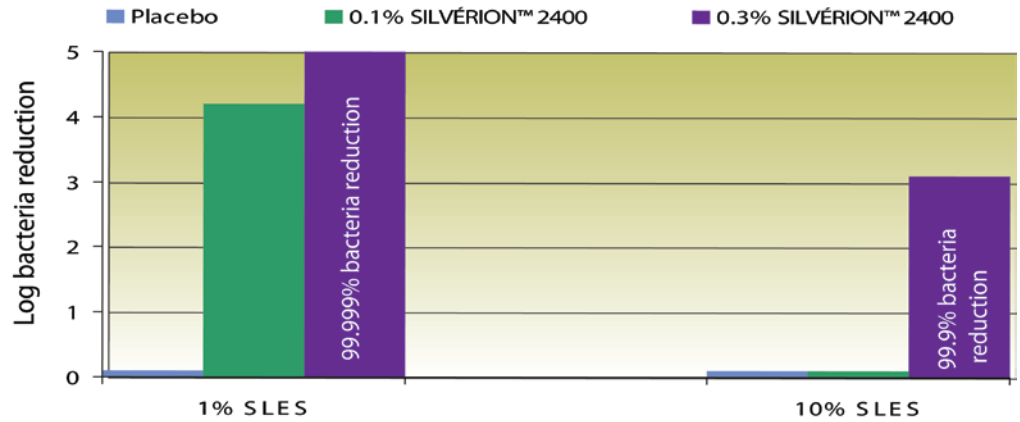
Deodorizing activity of 0.3% SILVÉRIION™ 2400



SILVÉRIION™ 2400 is an effective antimicrobial active

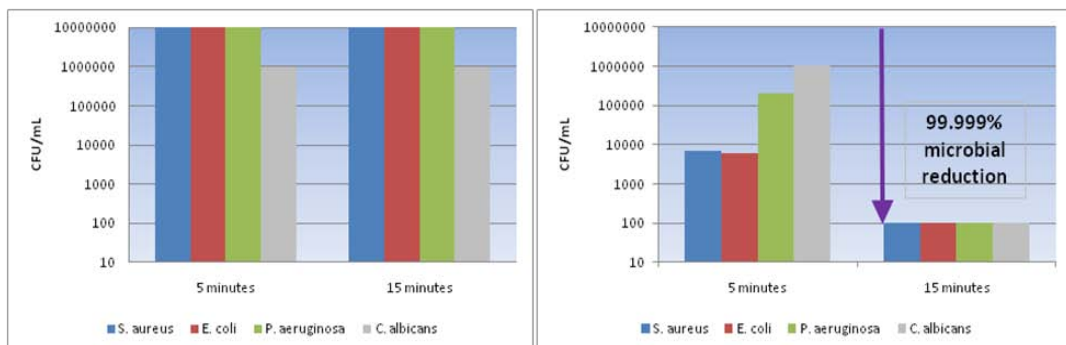
With its strong antibacterial effect, SILVÉRIION™ 2400 is perfectly suitable for skin cleansing products like liquid soaps, body showers, shampoos, wipes and baths as well as skin care products such as creams, lotions and gels.

A suspension test according to EN1040 was performed to demonstrate the strong antibacterial effect of a liquid hand soap formulation containing 0.1% and 0.3% SILVÉRIION™ 2400. 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.



Safety & Registration

Information on product safety and registration status is available on request.

Cosmetic Registration Status of SILVÉRIION™ 2400 for antimicrobial applications:

Country	Use as Preservative in cosmetic products	Deodorants	Cosmetic products with antimicrobial claims
Europe	Allowed Scientific Opinion granted SCCP/1274/09, 13 October 2009	Allowed Scientific Opinion granted SCCP/1274/09, 13 October 2009	Allowed Scientific Opinion granted SCCP/1274/09, 13 October 2009
USA	Allowed ¹⁾	Allowed ¹⁾	Not Allowed
Japan	Not Allowed	Not Allowed	Use restrictions applies depending on claims
Australia	Allowed under Low Volume Exemption Category op to 5t/year	Allowed under Low Volume Exemption Category op to 5t/year	Not allowed
South Korea	Not allowed	Allowed ¹⁾	Allowed ¹⁾
Thailand	Allowed ²⁾	Allowed ²⁾	Allowed ²⁾
China	Not allowed	Allowed ¹⁾	Allowed only in soaps
Hong Kong	Allowed ¹⁾	Allowed ¹⁾	Not allowed. End product with antimicrobial claims will have to be registered. Data on foreign usage may be helpful.
Taiwan	Allowed (but no preservative claim)	Allowed for claims like anti-odor claim, freshness. Not allowed	Not allowed ²⁾

		in antiperspirants	
Indonesia	Allowed ²⁾	Allowed ²⁾	Allowed ²⁾
Philippines	Not allowed	Allowed ¹⁾	Allowed ¹⁾
Malaysia	Not allowed	Allowed ¹⁾	Allowed ¹⁾
Vietnam	Not allowed	Not allowed	Not allowed
Brazil	Not allowed	Allowed ¹⁾	Allowed ¹⁾
Mexico	Allowed up to 0.3%	Allowed up to 0.3%	Allowed up to 0.3%
Canada	Allowed up to 4t/year Label to bear following warnings: Conditions of Use and Warnings Which Must be Printed on the Label: "This product contains silver and/or silver salts. Avoid contact with broken or abraded skin." 4t/ year import restriction based on Citric Acid (and) Silver Citrate	Allowed up to 4t/year Label to bear following warnings: Conditions of Use and Warnings Which Must be Printed on the Label: "This product contains silver and/or silver salts. Avoid contact with broken or abraded skin." 4t/ year import restriction based on Citric Acid (and) Silver Citrate	Allowed up to 4t/year Label to bear following warnings: Conditions of Use and Warnings Which Must be Printed on the Label: "This product contains silver and/or silver salts. Avoid contact with broken or abraded skin." 4t/ year import restriction based on Citric Acid (and) Silver Citrate
Chile	Not allowed	Product registration as cosmetics	Allowed as long as safety warranted
Andean Community (Columbia, Bolivia, Peru, Ecuador, Venezuela)	Registration for the final cosmetic product. Proof of safety of new ingredient (inclusion of data in the submission and "materias primas" (ingredients) to be registered too).	Registration for the final cosmetic product. Proof of safety of new ingredient (inclusion of data in the submission and "materias primas" (ingredients) to be registered too).	Registration for the final cosmetic product. Proof of safety of new ingredient (inclusion of data in the submission and "materias primas" (ingredients) to be registered too).
Argentina, Uruguay, Paraguay (Mercosur)	Not allowed	Allowed (cosmetic products to be registered by Health Authority)	Allowed (cosmetic products to be registered by Health Authority)

- 1) No volume restrictions
- 2) Registration / Certification of finished products and active ingredients required prior to marketing.

This document or any answers provided herein by PURE Bioscience does not constitute a legally binding obligation of PURE Bioscience. While the descriptions, designs, data and information contained herein are presented in good faith and believed to be accurate, it is provided for your guidance only. Because many factors may affect processing or application/use, we recommend that you make tests to determine the suitability of a product for your particular purpose prior to use. It does not relieve our customers from the obligation to perform a full inspection of the products upon delivery or any other obligation. NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE.