MicroSilver BG™
A natural and broad spectrum antimicrobial skin active consisting of highly porous and micro-sized particles of pure silver

Presented by: Stan Wojnicki on behalf of Karl Richter
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- How Does it Work
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- Selected Efficacy Studies
- Discussion on Skin Flora & Safety

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- Cosmetics, Skincare, Personal Care
- Medical & Wound Care
- Animal Care

Pure Elemental Silver

Agg0

Highly porous particle
- Surface area: up to 5m²/g
- Silver Porosity: 90-95%
- Average particle size: 10 µm
- No nano particles
- INCI Monograph ID: 2798
- CAS No.: 7440-22-4

Manufactured according to:
- ISO 13485 (medical devices)
- ISO 9001

Approvals / Certifications:
- Biocidal Product Directive (EU)
- REACH pre-registered
- EPA (USA)
- FDA Masterfile
- ECOCERT / COSMOS
- NPA
Silver Additives in cosmetics

Comparison to Silver Citrate / Zeolite

- **Silver Citrate / Silver Dihydrogen Citrate**
  - Silver Ions are masked/protected by citrate anion. Limited silver and works only with the citrate
  - Citrate is not an inert carrier and can complex other cations - the stability and protective effect of citrate is lost in complex environments. Very difficult release control.
  - Citrate remains diffusible and can be washed off
  - Limited lifetime – especially in complex environments. No sustainable effects on the skin.
  - Not ideal with alkaline conditions (pH>7). Formulations are often at low pH
  - Used primarily as a preservative in cosmetics or in simple formulations such as deodorants

- **Silver Zeolite**
  - Zeolite (molecular sieves) needed as carriers for silver ions.
  - Limited life time: The zeolite depot can be easily emptied or blocked so that antimicrobial life time is significantly more limited.
  - Blocking of the molecular sieve by other compounds. Silver ions as the depot form are more susceptible to inactivation by the surrounding milieu
  - Product behaviour is non-uniform and difficult to control.
  - Discolorations due to higher local and temporal fluctuations of silver ions.
  - More limitations in product performance and product safety
  - Not used in wound care. Not allowed in cosmetics world-wide
  - Chemical waste during production of silver zeolites
Silver Additives in cosmetics
Comparison to Nano / Colloidal Silver

- **Nanosilver or colloidal silver solutions**
  - Particles of metallic nanosilver suspended in a liquid solution such as mineral oil (5-30nm particles)
  - Typically produced via a chemical electrolysis process with numerous impurities
  - Nano particles will not stay on the surface of the skin
  - Whole nano controversy → Safety for humans and environment?
  - Primarily used in homeopathic remedies

- **MicroSilver BG™ (INCI: Silver)**
  - Pure elemental dry silver powder consisting of highly porous & micro-sized particles of pure silver.
  - Produced by physical process using highly refined medical grade pure silver (99.99%).
  - No chemical waste in production. No chemical carriers or ion exchange systems.
  - Pure silver deposit that provides a continuous and lasting generation of silver ions over time even in complex environments (sweat, blood, wound drainage fluid, urine)
  - Provides sustainable antimicrobial action on the surface of the skin against unwanted germs and without harming the resident skin flora (good resident bacteria)
  - Helps provide product preservation.
  - High product safety due to large micro-sized particles that do not penetrate skin or mucosa tissue. (average particle size of 10 microns = 10,000 nm)
  - Natural: NPA (USA), ECOCERT / COSMOS (EU) certified for use in natural cosmetic products
  - Used in cosmetics, skincare, oral & personal care, wound care, bone cement, dental fillers (Good market experience since 2005. 100+ customers. Not that many in USA)
MicroSilver BG™ – How is it Made?

*Pure elemental silver powder additive*

MicroSilver BG™ is produced in a specially developed manufacturing plant using a physical production process that uses pure metallic silver with no ionic impurities.

**pure silver in - pure MicroSilver out → no chemicals used! no waste products!**

- Surface area: up to 5m²/g
- Average particle size: 10 µm

Manufactured according to:
- ISO 13485 (medical devices)
- ISO 9001
Highly porous particle:
- Surface area: up to 5m$^2$/g
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- CAS No.: 7440-22-4

Manufactured according to:
- ISO 13485 (medical devices)
- ISO 9001

Approvals / Certifications:
- Biocidal Product Directive (EU)
- REACH pre-registered
- FDA Masterfile
- EPA (USA)
- ECOCERT
- COSMOS
- NPA
- Patented

- Pure silver powder additive
- Surface area: up to 5m$^2$/g
- Average particle size: 10µm

Pulver:0697-kF-ATP 3200-3+4

EHT = 5.00 kV  Signal A = InLens  Signal = 1.000
WD = 3 mm       Signal B = InLens  Photo No. = 314
MicroSilver BG™ – How does it Work?

MicroSilver BG™
pure elemental silver

Ag⁰

Highly porous micro particles
- Surface area: up to 5m²/g
- Average particle size: 10 µm

Extremely High Surface Area

Ag⁺ + e⁻

H₂O

Salts
Polar Groups (e.g. proteins)
Temperature

Bacteria are killed by silver ions (Ag⁺) that are released from the MicroSilver BG depot.

Unique pure silver powder additive with large micro-sized particles provides effective and lasting broad-spectrum (gram +ve / -ve) action that is natural, skin-friendly and safe.

Unique porous structure provides efficient silver ion generation at low usage levels & helps the particles to physically “cling” to the surface of the skin. No skin or mucosa tissue penetration.

Result: natural, skin-friendly, long-lasting antimicrobial action on the surface of the skin
MicroSilver BG™ – Benefits in skincare

- **A large number of skin problems result from harmful external bacteria**

- **MicroSilver** provides an excellent and stable depot for generating silver ions resulting in **controlled, long-term and sustainable effects on top of the skin**

- **Particles remain on the surface of the skin** and help inhibit bacteria and fungus growth and **promote / strengthen the skin’s natural healing process**

- A pure silver additive that is **NPA/ECOCERT/COSMOS certified** that allows you to **eliminate harmful preservatives** and create a more **Natural and Skin friendly product**.

- For: **supportive daily care** as a face cream, hand cream, foot cream, body lotion, shampoo, wash, deodorant, toothpaste, after shave product.

- For: **skin ailments** to help prevent and help **improve** stressed skin, contact dermatitis, neurodermatitis, dry scaly skin, sensitive skin prone to redness, blemishes and acne prone skin, body odor, wounds

- For: **post treatment skincare** for: epilation, waxing, shaving, laser therapy, microdermabrasion, chemical peels, waxing, tattoos,
MicroSilver BG™ – Cosmetic Claims

MicroSilver is listed in the cosmetics handbook by tradename and with the following functions

1. Colorant
2. Deodorant
3. Skin conditioning agent
   - This is a key function.
   - Allows you to draw attention to MicroSilver on the label as a skin condition agent to help improve the appearance of skin.
   - E.g. Help calm sensitive and irritated skin
   - More direct skin condition claims could be:
     - Enhance the appearance of dry or damaged skin
     - Help soothe and nurture dry skin
     - Reducing flaking and restoring suppleness
     - Help to keep skin healthy looking and well-conditioned
     - Helps protect and prevent chafed, chapped and cracked skin
     - Maintain natural skin quality

If desired, MicroSilver can be combined with other actives to make non-cosmetic claims:

Example: MicroSilver + Salicylic Acid = OTC acne claim
          MicroSilver + Zinc pyrithione = OTC anti-dandruff claim
          MicroSilver + Anti-fungal agent = OTC fungal toenail / foot care product

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MicroSilver BG™ – Anti-Aging Concept

Healthy Skin is a Pre-requisite!

- **Anti-aging and Skin Rejuvenation Starts with Healthy Skin!**
  - Everyone is aware of the damaging effects of the **sun**…
  - …and negative environmental factors like – **pollution and stress**…
  - **BUT a vast majority of skin problems are due to bacteria**
  - Help improve and rejuvenate skin by eliminating burdensome and unwanted micro-organisms *WITHOUT* harming your good, natural skin flora
    - Help regulate the skin microbiome
    - Keep skin free of harmful bacteria that cause inflammation and reduce a major stress factor affecting skin
    - Reduce skin irritations and blemishes and help increase the anti-aging effect.

- **MicroSilver BG™** technology provides **lasting** broad spectrum **action on top of the skin**, helps to maintain a healthy skin flora, and boosts the skin’s natural defences **promoting healthy and blemish free skin**

- Help **support** and **maximize** the **benefits** of **anti-aging formulations** and regimens by incorporating the **synergistic effects of MicroSilver BG™ and improving overall skin complexion / skin fitness**
MicroSilver BG™ – Acne Article in EJA

Efficacy and tolerability of a novel topical agent in mild acne: results of a prospective multicenter study

Source: European Journal of Acne and Related Diseases, Volume 6 – Number 3 / 2015, pp 77-81
MicroSilver BG™ – Acne Article in Euro Cosmetics

Skin flora discussion: MicroSilver effective yet gentle with less influence on resident skin flora

Discussion on:

- MicroSilver is a unique, highly biocompatible and sustainable ingredient for improving acne-affected skin
- MicroSilver is gentle on the skin with less influence on the resident skin flora in comparison to other antimicrobials
MicroSilver BG™ – Rosacea Article in Euro Cosmetics

Designing a modern skincare product to address Rosacea by combining MicroSilver with extracts from ancient herbs

Discussion:

- Update on Rosacea, its causes and how to define a modern skincare product for improving this condition
- Improvements in skin condition by combining MicroSilver with extracts from ancient herbs.
MicroSilver BG™ – Skincare Cream Study
Published in Kosmetische Medizin Magazine 2008

- Evaluation of a 0.1% MicroSilver cream on patients suffering from **atopic dermatitis issues**
- Published independent 4 week clinical skincare study (performed at: IGSF - Institute for Health System Research, Kiel, Germany)
- A standard dermatological skincare scoring system (SCORAD index) was used

**RESULTS:**
- **57.5% improvement in the score!**
- **No patient experienced staphylococcus aureus colonisation during the 4 wks**
- **69% of patients rated the MicroSilver cream as “Very Good” or “Good”**

Example of the improvement in skin condition in patients using a 0.1% MicroSilver cream

![Day 1](image1)
![Day 14](image2)
![Day 28](image3)

*Abb. 3: Verbesserung des klinischen Bildes am rechten Arm bei Patient 13 (Tag 1, Tag 14, Tag 28)*
Post peeling treatment cream with 0.3% MicroSilver BG™

Anti-aging acid peeling treatment (Brazil)

MicroSilver BG™ Post Treatment Cream applied several times a day to improve healing / skin recovery

Progress 48 hours after phenol peeling regime

→ faster healing and less inflammation
Resident Skin Flora (good bacteria)

The body’s “good” bacteria, is primarily in deeper skin layers of the stratum corneum, especially in the hair follicle’s wax environment.

Micronized silver leaves the good resident skin flora mostly unaffected. Reason: The large micro particles do not penetrate the skin and the sebaceous wax in hair follicles is a less favourable environment for silver.

In contrast: Organic compounds (e.g. triclosan / other antimicrobials) can accumulate in the wax environment of the resident bacteria. The resident flora of “good” bacteria can be damaged.

Transient Skin Flora (unwanted germs)

The germs that come from outside when we touch something or someone. They are transient guests and reside in and on the top skin layer.

Transient germs are easily passed on by contact during the infection cycle (e.g. handshakes).

Many of these germs are infectious (pathogenic) microorganisms that need to be addressed.
Effects on Skin Flora

→ Normal skin flora present in the Stratum Corneum are not affected even when products are used continuously for longer periods of time
→ Unwanted bacteria on top of the Stratum Corneum are affected
→ The micronized silver particles stay in the skin folds after application

Renewal of „good“ bacteria on the top skin layers, by the resident flora found in the hair follicles and deeper in the skin
**MicroSilver BG™ – Effects on Skin Flora**

*Where does MicroSilver BG™ stay on the skin?*

**In vivo confocal microscopy**

(a) Healthy skin

(b, c) same skin directly after application of 0.5% MicroSilver cream.

(d, e) 2h after application, silver particles (see white arrows) were observed mainly in the skin folds.

No silver particles could be seen in the epidermis and upper epidermis.

Consistent findings were observed with horizontal and vertical mapping.

2hrs after application of body lotion (d, e)

Living Skin Photos, Charité Univ. Research Hospital Berlin
Prof. Dr. Daniels et al. Pharmazeutische Zeitung, 16/2009
MicroSilver BG™ – Effects on Skin Flora

Tape Stripping Tests showed MicroSilver remains on surface

Method to prove that MicroSilver remains in the stratum corneum

- Removing Stratum Corneum cell layers stepwise with adhesive cellophane tapes (tape stripping)
- Analyzing single or pooled tapes for (metallic) silver content.

Results:
Micronized silver particles resides in and on the Stratum Corneum which is ideal since it can give the most support to the skin against germs from the environment.

MicroSilver BG™ – Effects on Skin Flora

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Stratum Corneum (dead cell layers) – Epidermis – Dermis

unstripped stripped

Example how tape stripping removes the outer skin layers of the stratum corneum
MicroSilver BG™ – Effects on Skin Flora

Skin Flora Verification Test

- Independent study performed at: Institut Dr. Schrader Hautphysiologie, Germany
- 20 healthy test persons, 28 days, twice daily, application of ca. 2 mg/cm²
- 0.1% silver spray or body lotion, respectively
- Total microbial counting before start and after 4 weeks of application on forearm
- Germ differentiation before and after 4 weeks of application on forearm
- Test procedure: agar plate testing (standard procedure for this kind of testing)

**Conclusion:**
The relevant bacterial skin flora of 20 test persons remained intact even after prolonged use of micronized silver cosmetics.
MicroSilver BG™ – Safety

**In-vitro Penetration Tests Using Franz Cell Diffusion Model**

**No skin penetration by MicroSilver BG™ particles**

**Penetration of silver ions (Ag⁺) were at the analytical limit of the ICP-MS equipment**

<table>
<thead>
<tr>
<th>MicroSilver Concentrations</th>
<th>mean penetration during 0 - 24 h</th>
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<tbody>
<tr>
<td></td>
<td>(% of dose)</td>
</tr>
<tr>
<td></td>
<td>i.e. % of 1.5%</td>
</tr>
<tr>
<td>1.5% MicroSilver BG™</td>
<td>0.0007%</td>
</tr>
<tr>
<td>0.5% MicroSilver BG™</td>
<td>0.0014%</td>
</tr>
<tr>
<td>0.5% MicroSilver BG™ + 3%</td>
<td>0.0036%</td>
</tr>
<tr>
<td>Dexpanthenol</td>
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</tbody>
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**Detection:** ICP MS
- Perkin Elmer Sciex ELAN 6100
- Perkin Elmer AS90 Autosampler

The **analytical limit** of quantification:
- 0.03 µg Ag/L OR approx. 0.0028 µg/cm²
MicroSilver BG™ – Skincare & Personal Care

150+ customers; 35+ countries; on market since 2005
skincare, personal care, oral care, cosmetics

Customer Growth:

Many Customers throughout Europe
Opportunity to be among the first in USA / Canada

0 50 100 150 200

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MicroSilver BG™ – Medical & Wound Care

Numerous Efficacy Studies; Published Articles
(9 medical device class III CE approved topical wound care products)

- Wound rim ointment, gels
  - Wound Hydrogel USA – 2014
  - Wound care gel & ointment – Mexico 2014

- Wound care – dry spray - Fidia
  - Burn victims / lesions / ulcers
  - CE Medical Device Class III

- Root canal filling material
  - Sold in the USA & Europe since 2005

- Wound care – textiles
  - CE approved dressings
  - PU-Foam + Chitosan + MS
  - Resorbable dressing

- Bone cement hip implants
  - 20 person clinical trial with Excellent results
  - Launched in Vet market

- Silicon & other polymers / master-batches

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MicroSilver BG™ – Animal Care
Thank you for your time!