

PhytoCide Lichen

Technical Data Sheet

BACKGROUND

Innovations in naturally derived antimicrobials have continued to advance as consumers push for alternatives to synthetic preservatives. The use of natural alternatives to prevent microbial growth is not as simple as an ingredient substitution. Natural preservation requires special attention to formula details such as optimal pH, temperature, and charge. Current alternatives offer effective microbial protection under mild conditions of pH and temperature. Limited natural options are available for anionic systems. Lichens are a complex life form that is a symbiotic partnership of two separate organisms, a fungus and an alga. In symbiosis, we explore the antimicrobial ability of a lichen extract on anionic formulations for the cosmetic and personal care market.

Code Number: M16008
INCI Nomenclature:
2,3-Butanediol & Cladonia Rangiferina Extract
INCI Status: Conforms
REACH Status: Compliant
CAS Number: 513-85-9 & 92346-91-3
EINECS Number: 208-173-6 & 296-176-3
Origin: Botanical
Processing:
GMO Free
No Ethoxylation
No Irradiation
No Sulphonation
No Ethylene Oxide treatment
No Hydrogenation
Additives: None
Preservatives: None
Antioxidants: None
Other additives: None
Solvents used: Water & 2,3-butanediol
Appearance: Clear to Slightly Hazy Liquid Light Yellow to Amber
Soluble/Miscible: Water Soluble
Suggested Use Levels: 1.0 - 2.0%
Suggested Applications:
Antioxidant, Antimicrobial

SCIENCE

Lichens are among nature's most remarkable symbiotic organisms, thriving in some of the world's harshest climates. These resilient organisms produce a vast array of bioactive secondary metabolites ; more than a thousand identified to date. Among them, the reindeer lichen (*Cladonia rangiferina*), a pale fruticose species that carpets boreal forests and serves as nourishment for reindeer and caribou, stands out for its adaptive strength[1]. It thrives in extreme climates[2], developing powerful natural defenses that now inspire research into lichen-derived actives for skin protection and product preservation. Several of metabolites, including usnic acid, have been widely studied for their antimicrobial and antioxidant properties[3]. Historically, lichen extracts were used to support respiratory and joint health, and in more recent decades, countries such as Germany have integrated lichen-derived substances into pharmaceutical antiseptic formulations[4]. Today, this long tradition of protection and resilience inspired us for innovative cosmetic applications harnessing the natural bioactivity of lichens. Their unique compounds bridge ancestral knowledge and modern skincare science.



Active Micro Technologies, LLC - www.activemicrotechnologies.com - info@activemicrotechnologies.com
107 Technology Drive - Lincolnton, NC 28092 - USA - Phone (704) 276-7100 - Fax (704) 276-7101

Version 3 - 10-27-25

Information contained in this technical literature is believed to be accurate and is offered in good faith for the benefit of the customer. The company, however, cannot assume any liability or risk involved in the use of its chemical products since the conditions of use are beyond our control. Statements concerning the possible use of our products are not intended as recommendations to use our products in the infringement of any patent. We make no warranty of any kind, expressed or implied, other than that the material conforms to the applicable standard specification. Freedom from patent infringement is not implied. All information is for investigative purposes only.

PhytoCide Lichen

BENEFITS

By using our specific extraction technique, Active Micro Technologies was able to create Phytocide Lichen, a lichen-derived active designed to deliver broad-spectrum antimicrobial protection and antioxidant support for cosmetic formulations. Inspired by the natural defense mechanisms of lichens, this ingredient helps preserve both product integrity and skin balance, with excellent compatibility in anionic systems.

PhytoCide Lichen was evaluated for its antioxidant capacity. This assay quantitatively measures its ability to quench free radicals that have the potential to react with and damage cellular components. The results indicate that **PhytoCide Lichen** exhibited greater antioxidant activity than 200µM Trolox®. Therefore, we can assume that products incorporating **PhytoCide Lichen** are capable of providing antioxidant properties and aids in the anti-aging process through protection at the cellular level.

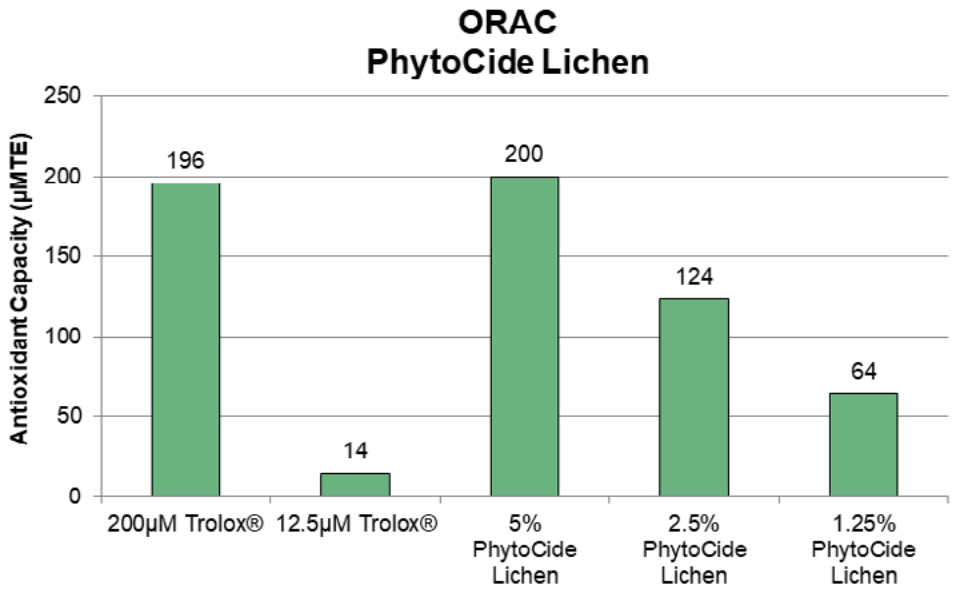


Figure 1. Antioxidant results for 2.0% **PhytoCide Lichen**

A ROS Scavenging Assay was conducted to assess the in vitro effect of **PhytoCide Lichen** to scavenge unnecessary oxidative stress in dermal fibroblasts. Attenuating excessive ROS preserves cellular homeostasis and blunts intrinsic and extrinsic age-related declines in skin cell function. The data obtained from this study met criteria for a valid assay and the positive control performed as anticipated. Compared to untreated fibroblasts, Antimycin A (AntA) 200 pM increased ROS levels. Fibroblasts treated with **PhytoCide Lichen** at 0.01%, 0.1%, and 1.0% exhibited a reduction in oxidative stress levels compared to fibroblasts exposed to AntA.

Active Micro Technologies, LLC - www.activemicrotechnologies.com - info@activemicrotechnologies.com
107 Technology Drive - Lincolnton, NC 28092 - USA - Phone (704) 276-7100 - Fax (704) 276-7101

Version 3 - 10-27-25

Information contained in this technical literature is believed to be accurate and is offered in good faith for the benefit of the customer. The company, however, cannot assume any liability or risk involved in the use of its chemical products since the conditions of use are beyond our control. Statements concerning the possible use of our products are not intended as recommendations to use our products in the infringement of any patent. We make no warranty of any kind, expressed or implied, other than that the material conforms to the applicable standard specification. Freedom from patent infringement is not implied. All information is for investigative purposes only.

PhytoCide Lichen

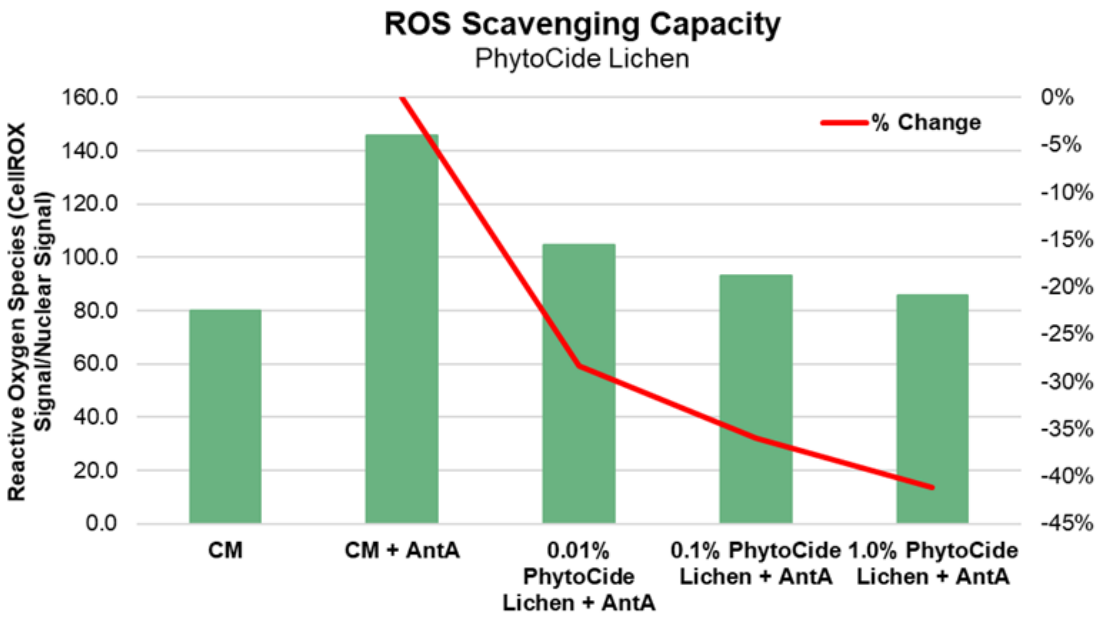


Figure 2. The effect of **PhytoCide Lichen** on ROS scavenging.

One of the first steps in the development of this product was to determine the peptide's potential ability to inhibit the growth of a variety of bacteria and fungi. Using standard serial dilution protocols in growth media, the Minimum Inhibitory Concentrations (MICs) for **PhytoCide Lichen** were determined for a variety of both bacterial and fungal organisms. The results of these tests are shown in Figure 3.

Microorganism Tested	MIC (%)
E. coli	0.25
P. aeruginosa	0.12
S. aureus	0.25
C. albicans	0.12
A. brasiliensis	0.12

Figure 3. MIC Data for **PhytoCide Lichen**.

The positive MIC screening results warranted further testing to confirm its ability to provide product preservation. A Double Challenge Test was completed using 1.0% **PhytoCide Lichen** in a generic cream base formulation. Samples were inoculated with *E. coli, P. aeruginosa*, *S. aureus*, *C. albicans*, and *A. brasiliensis*. During the first 28-day incubation period, samples were periodically collected and tested for the presence of these microorganisms. Following this initial 28 days of incubation, the cream samples were then re-inoculated with the microbial cultures and sampled over an additional 28-day period. Figure 4 shows the positive preservation results for 1.0% **PhytoCide Lichen**.

Active Micro Technologies, LLC - www.activemicrotechnologies.com - info@activemicrotechnologies.com
107 Technology Drive - Lincolnton, NC 28092 - USA - Phone (704) 276-7100 - Fax (704) 276-7101

Version 3 - 10-27-25

Information contained in this technical literature is believed to be accurate and is offered in good faith for the benefit of the customer. The company, however, cannot assume any liability or risk involved in the use of its chemical products since the conditions of use are beyond our control. Statements concerning the possible use of our products are not intended as recommendations to use our products in the infringement of any patent. We make no warranty of any kind, expressed or implied, other than that the material conforms to the applicable standard specification. Freedom from patent infringement is not implied. All information is for investigative purposes only.

PhytoCide Lichen

1.0% Phytocide Lichen in Cream Formula
Challenge Test - pH 7

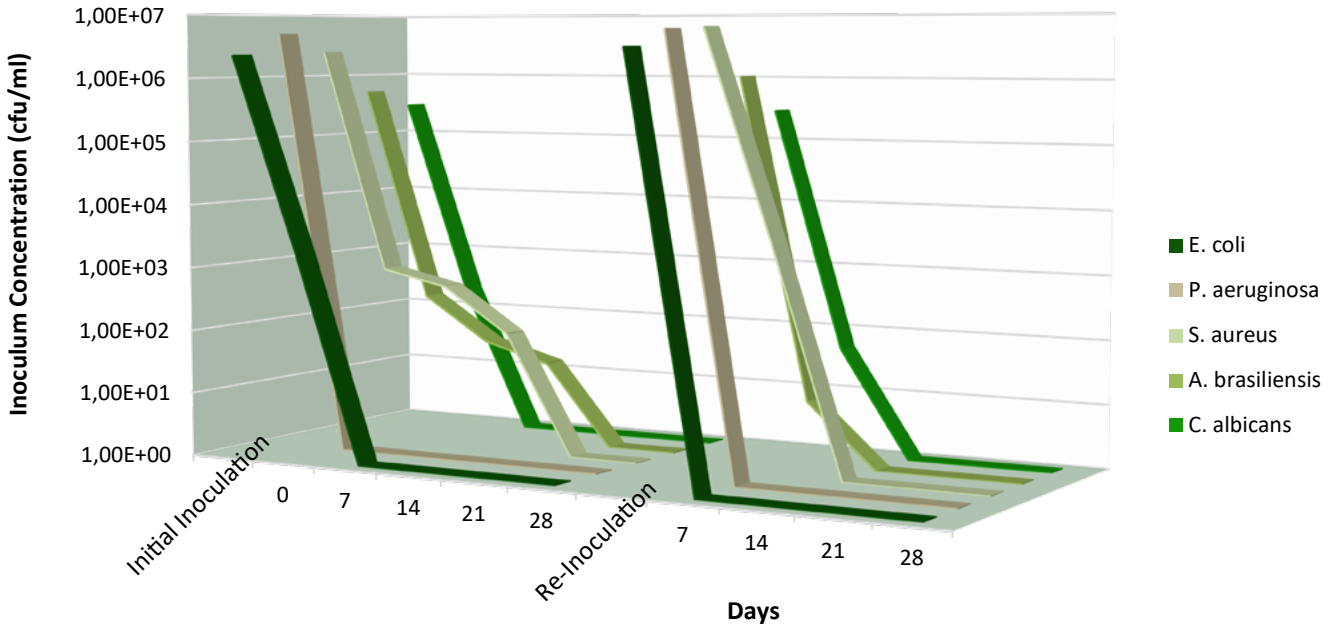


Figure 4. Challenge Test results for Generic Cream Formula with 1.0% **PhytoCide Lichen** inoculated on Day 0 and re-inoculated on Day 28. Results show log reduction in viable organisms.

USE RECOMMENDATIONS

PhytoCide Lichen is non-ionic and water soluble and may therefore be added to aqueous systems, as well as the aqueous phase of emulsions. When using **PhytoCide Lichen** it is recommended to maintain the formulation pH between 3 and 8. We also suggest incorporating the product at temperatures of 25°C or below. When handling this product please prevent exposure to temperatures above 25°C and prolonged exposure to UV. Exposure to temperatures above 25°C and direct UV may cause darkening.

REFERENCES

1-Britannica, The Editors of Encyclopaedia. "reindeer lichen". Encyclopedia Britannica, 3 May. 2021, https://www.britannica.com/science/reindeer-lichen. Accessed 14 June 2022.

2-Department of Botany, Faculty of Science, Institute of Biology and Ecology, P. J. Šafárik University, Mánesova 23, 041 54 Košice, Slovakia

3-Nybakken, Line & Julkunen-Tiitto, Riitta. (2006). UV-B induces usnic acid in reindeer lichens. The Lichenologist. 38. 477 - 485. 10.1017/S0024282906005883.

4-Vasudeo P. Zambare & Lew P. Christopher (2012) Biopharmaceutical potential of lichens, Pharmaceutical Biology, 50:6, 778-98, DOI: 10.3109/13880209.2011.633089

Active Micro Technologies, LLC - www.activemicrotechnologies.com - info@activemicrotechnologies.com
107 Technology Drive - Lincolnton, NC 28092 - USA - Phone (704) 276-7100 - Fax (704) 276-7101

Version 3 - 10-27-25

Information contained in this technical literature is believed to be accurate and is offered in good faith for the benefit of the customer. The company, however, cannot assume any liability or risk involved in the use of its chemical products since the conditions of use are beyond our control. Statements concerning the possible use of our products are not intended as recommendations to use our products in the infringement of any patent. We make no warranty of any kind, expressed or implied, other than that the material conforms to the applicable standard specification. Freedom from patent infringement is not implied. All information is for investigative purposes only.