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Mycofuse® Protect

COMPLEX ACTIVES



VEGAN



COSMOS



EX VIVO



CHINA



ISO 16128



THE FEATURES.

Mycofuse® Protect offers a water-soluble ingredient developed by Active Concepts to provide nourishing and revitalizing benefits to cosmetic and personal care formulations. This unique combination of water, *Lentinus edodes* mycelium extract, and *Lactobacillus* ferment provides protective properties to hair follicles. Mycelium technology provides a protective shield, forming a barrier against external aggressors such as pollution and thermal damage while enhancing the visual aesthetic of the overall hair.

Water & Lentinus Edodes Mycelium Extract & Lactobacillus Ferment

Actions

Pollution Protection
Thermal Protection
Barrier Protection
Moisturizing
Nourishing

TECHNICAL DATA SHEET.

THE REGULATION.

INCI. Water & Lentinus Edodes Mycelium Extract & Lactobacillus Ferment
CAS. 7732-18-5 & 999999-99-4 & 68333-16-4 (or) 1686112-36-6
EINECS. 231-791-2 & 310-127-6 & N/A (or) N/A
EUROPE. Compliant
USA. Compliant
CHINA. Compliant

THE SPECIFICATION.

Origin. Botanical & Bacteria
Natural Antimicrobial. Lactobacillus Ferment
Preservatives. None
Solvents Used. Water
Soluble/Miscible. Water Soluble
Appearance. Slightly Hazy to Hazy Viscous Gel, Colorless to Yellow
Use Level. 1 - 10 %



THE STORY.

Fungi are at the forefront of an environmental and medicinal movement, making them essential for the future of the planet, as well as health and innate immunity. Growing awareness of health-boosting superfoods has contributed to research in mycology, or the study of fungi. Consumers are typically familiar with mushrooms, or the fruiting body of fungi, due to their popularity throughout the nutritional realm. Hailed as healthy for the planet, mushrooms maintain a low carbon footprint and a sustainable life cycle for more than just the beauty industry. Advances in science and technology pave the way for innovative biotechnology such as the use of fungal mycelium.

Mycelium, the root structure of mushrooms, co-exist in nature's complex communities forming symbiotic relationships with various botanicals and ecosystems. Mycelium is forming an influential network in architecture, agriculture, food, fashion, and medical technology. The emergence of nature's sustainable infrastructure, mycelium-harnessed technology is achieving scaffolding for skin substitutes, as well as ecosystem engineering, and alternatives to synthetic foams and plastics^{1,2}. From plant-based meats to reliable building materials, mycelium could curb our reliance on plastics, fuel, and excessive energy use. With minimal waste and energy cost, mycelium offers an answer to sustainability concerns. Harnessing the innovative potential of mycelium, Mycofuse® Protect is the beginning of a fungi revolution for the beauty industry. Mycofuse® Protect optimizes sustainable mycelium technology to shield and strengthen hair. The renewable nature of mushrooms and mycelium prompt their incorporation into various beauty applications.

THE SCIENCE.

Mycelium is gaining momentum as a fungal biotechnology for advances in building materials, wound scaffolding, and alternatives to synthetic foams and plastics^{1,2}. Engineering advances utilize mycelium components for adhesive properties as this vegetative fungus tissue naturally binds together different components such as wood, soil, and other loose particles. Mycelium grow due to a symbiotic relationship with the materials that feed it, ultimately creating a network of branching fibers or filaments called hyphae. These networks extend for excessive lengths, such as the mycelium network in the Oregon Blue Mountains that occupies 10km³. The diet of mycelium influences the concentrations of polysaccharides, lipids, proteins, chitin, and enzymes present in the fibrous structures. As mycelium progresses through an environment, whether in nature or through a predetermined engineering design, enzymes are released to degrade food particles³. Food for mycelium can include plant components to toxic waste and pollutants. As materials are degraded, mycelium physically binds together leftover particles, creating stable forms and structures³. This ability is transforming the innovation of alternative building materials for wood, concrete, and plastic, as well as ecosystem engineering by preserving fungal carbon mineralization during drought⁴.

Mainly composed of natural polymers such as proteins, cellulose, chitin, and other polysaccharides (chitosan)^{2,3}, mycelium is a naturally fibrous material. Polysaccharides contribute to the fungi's adhesive capability and prompt the concept of nature's glue. Chitosan, specifically, possesses intrinsic antifungal, antibacterial, hemostatic, and muco-adhesive properties, having been used in the biomedical field for the treatment of burns and wounds¹. Harnessing commonalities of nature, Active Concepts employs mycelium technology to transform hair care. Mycofuse® Protect optimizes *Lentinus edodes* (shiitake) mycelium polysaccharides to shield hair strands from thermal damage, while masking visible damage from chemical processes such as bleach. The adhesive properties of mycelium encourage the ability of Mycofuse® Protect to attach or fuse to the hair strand and seal the cuticle. Raised hair cuticles result in loss of moisture and opportunities for additional damage to the hair strand. For hair protection, Mycofuse® Protect smooths the hair cuticles while improving physical and mechanical properties of the hair strand including strength and elasticity. Mycelium technology provides a protective shield, forming a barrier against external aggressors such as pollution and thermal damage while enhancing the visual aesthetic of the overall hair.

THE BENEFITS.

Hair

Pollution protection Hair Pollution Protection Assay Analysis



Tensile strength Tensile Strength Hair Swatch Study



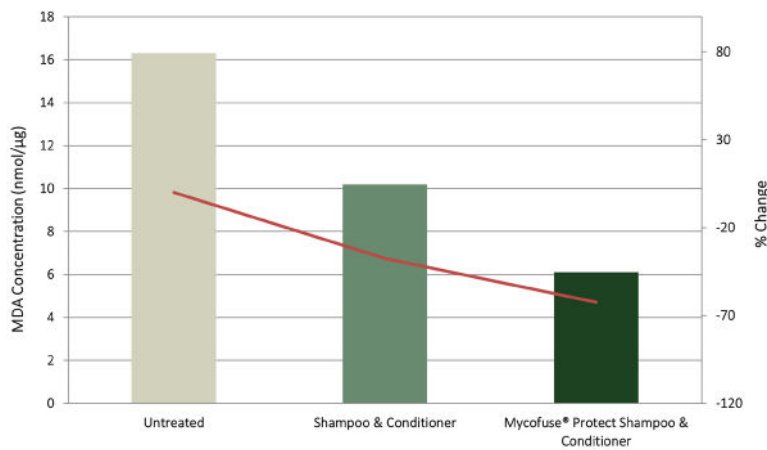
Cuticle protection Scanning Electron Microscopy Assay



THE EFFICACY.

Hair Pollution Protection Assay.

An *ex vivo* hair pollution protection assay was conducted to assess the ability of Mycofuse® Protect to protect the hair from the oxidative effects of air pollution. Testing was performed on three total hair swatches: untreated, shampoo/conditioner, and treated shampoo/conditioner. The swatches were treated and exposed to cigarette smoke, and peroxidation of hair lipids was assessed using a Malonaldehyde (MDA) Assay. MDA is frequently used as a biomarker for oxidative stress and, in this case, lipid peroxidation due to environmental stress. Results indicate that, at normal use concentrations, Mycofuse® Protect can be used as an effective hair pollution protection ingredient.



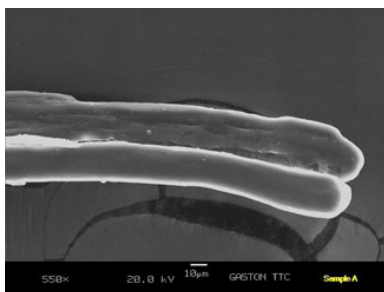
Treated hair samples showed a 62.5% reduction in MDA levels compared to untreated hair samples (tested at 5%)

Pollution protection.

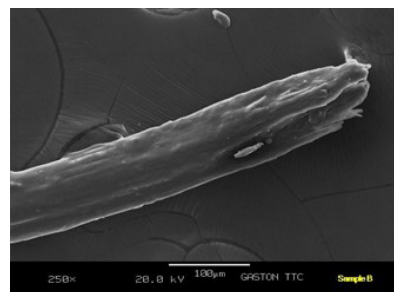
Minimizes oxidative stress

Scanning Electron Microscopy Assay.

This *ex vivo* study was conducted to determine if Mycofuse® Protect is capable of protecting the hair when thermal styling stress is applied. This study was conducted by salon professionals using 100% unprocessed Brazilian virgin human hair. Test swatches were treated and submitted for testing. Results indicate that Mycofuse® Protect is an ideal addition to everyday treatment to repair and protect against thermal styling stressors and chemical treatments. The SEM imagery results of the Straightened, Untreated Hair sample depicts an extensively damaged, split cuticle while the Straightened sample treated with 5% Mycofuse® Protect has a significant decrease in damage in both the cuticle and the cortex.



Untreated, straightened hair



Treated, straightened hair with 5.0% Mycofuse® Protect

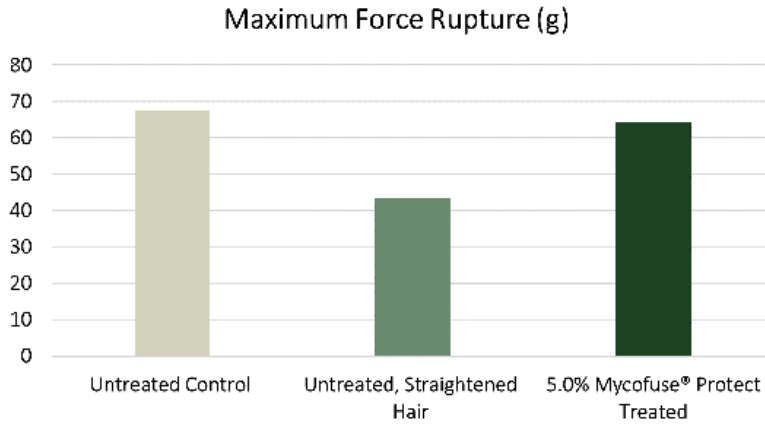
Creation of a *de novo* cuticle on damaged cuticle (tested at 5%)

Cuticle protection.

Heat + barrier protection & Moisturization

Tensile Strength Hair Swatch Study.

An *ex vivo* study was conducted to measure the tensile strength of hair when treated with Mycofuse® Protect. This study was conducted using 100% unprocessed Brazilian virgin human hair. Two hair swatches were collected: one was sprayed with 5.0% Mycofuse® Protect in a water solution and left to dry, while the other was untreated. Both hair swatches were passed through a flat iron 25 times at 232°C (450°F). A third hair swatch was set aside as a control. The Force to Rupture was then measured, which is defined as the measured force in gram-force (g) necessary to rupture the hair. Results indicate that Mycofuse® Protect offers significant thermal protection to hair.



Increased force to rupture by 9.7% compared to untreated, straightened control (tested at 5%)

Tensile strength.

Stronger, healthier hair

References:

1. Suarato, Giulia, Rosalia Bertorelli, and Athanassia Athanassiou. "Borrowing from Nature: biopolymers and biocomposites as smart wound care materials." *Frontiers in bioengineering and biotechnology* 6 (2018): 137.
2. Jones, Mitchell, et al. "Engineered mycelium composite construction materials from fungal biorefineries: A critical review." *Materials & Design* 187 (2020): 108397.
3. Haneef, M. et al. *Advanced Materials From Fungal Mycelium: Fabrication and Tuning of Physical Properties*. *Sci. Rep.* 7, 41292; doi: 10.1038/srep41292 (2017).
4. Worrlich, Anja, et al. "Mycelium-mediated transfer of water and nutrients stimulates bacterial activity in dry and oligotrophic environments." *Nature communications* 8.1 (2017): 1-9.

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