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VERSION 1.0



GreenGard™

Next Generation
Multifunctional
Preservation

PRESERVATIVES are integral to maintaining the quality of cosmetic products



Preservatives are integral to maintaining the quality of cosmetic products during consumer use. Organic acids can play a pivotal role in stabilizing cosmetics by inhibiting the growth of bacteria, yeast, and fungi. Their antimicrobial action occurs through membrane penetration, disturbing the cell's pH and ultimately causing microbial death. Depending on the organic acid form, these systems can offer additional skin benefits to formulations.

The combination of levulinic acid with arginine has been shown to deliver skin benefits such as reducing TEWL and enhancing collagen production. It also contributes to preservation, especially when combined with anisic acid and benzoic acid, which offer broad-spectrum preservation. This patent-pending, next-generation technology demonstrates the unique ability of arginine to remain ionized under various conditions, including different pH levels, and may have multifunctional and synergistic interactions with various organic acids.



Multifunctional Benefits of Arginine and Levulinic Acid

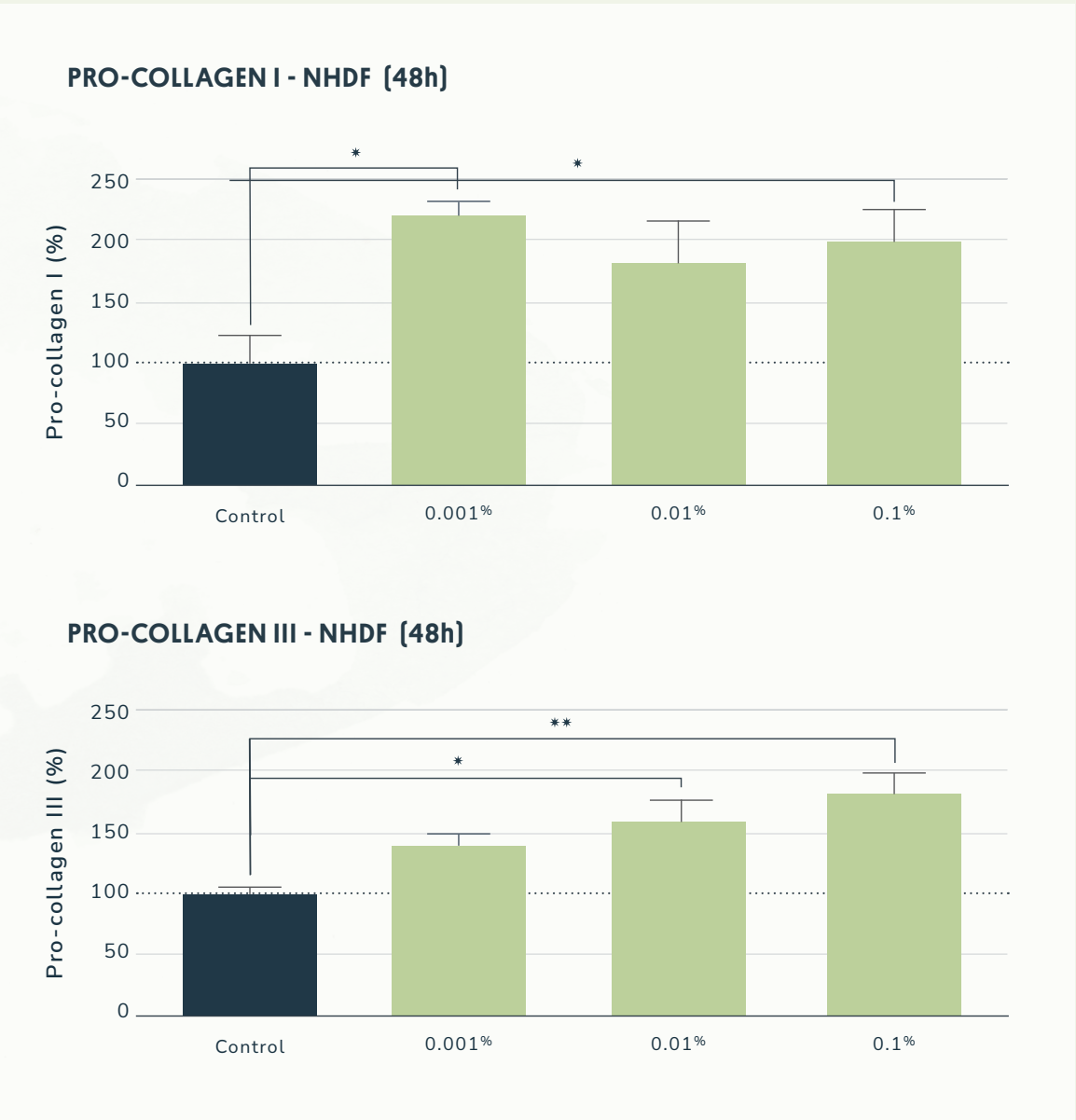


FIGURE 1: Green Line conducted an in vitro study that treated Dermal Fibroblasts with GreenGard L. Results found that the cells treated with GreenGard L displayed antiaging and firming effects substantiated by a significant increase of collagen type III levels compared to an untreated control.



SKIN PROTECTION OF A HYDROGEL WITH GREENGARD L

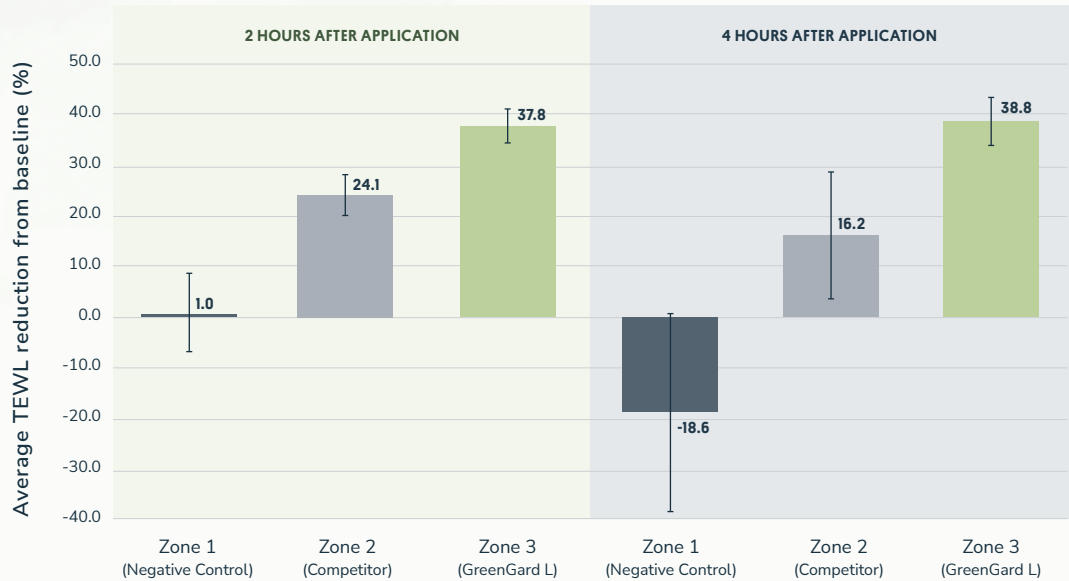


FIGURE 2: The hydrogel with GreenGard L showed consistent reductions of TEWL at both the 2- and 4-hour marks and reductions higher than those compared to a hydrogel containing Sodium Levulinate. The hydrogel with GreenGard L was shown to reduce TEWL greater than 35%.

GREENGARD™ LA (2.00% IN O/W EMULSION, pH 5.03) PCPC PRESERVATIVE ADEQUACY TEST

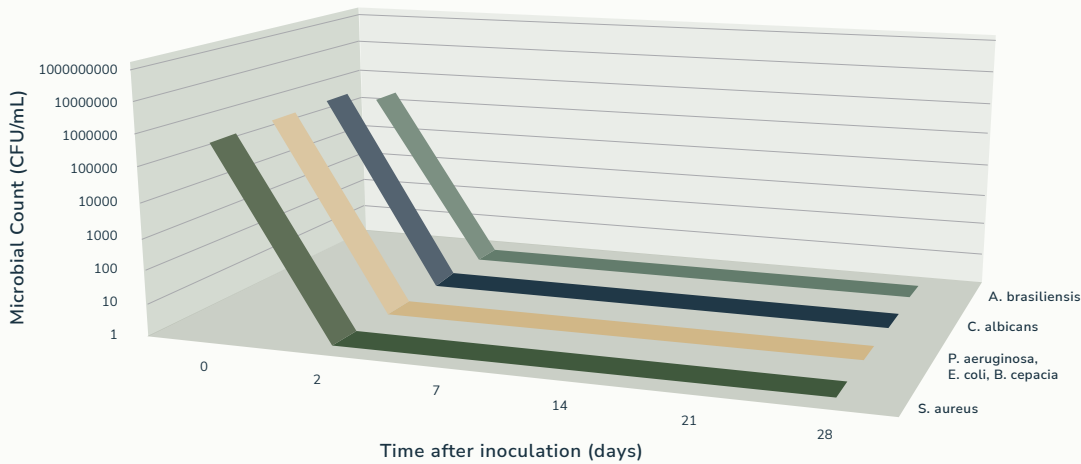


FIGURE 3: GreenGard LA was tested in a O/W emulsion. A 28-day PET (Preservative Efficacy Test) was performed and found that the formula showed a total kill within 2 days of inoculation for bacteria, yeast, and mold.

Very good | Sufficient | Insufficient

GreenGard™ L Use Level 1.5-2.5%

INCI: Water, Arginine, Levulinic Acid

Description: 100% biobased, multifunctional ingredient. Strong activity against gram (+) and gram (-) bacteria, works best when paired with an anti-fungal agent. In-vitro testing confirms additional skin benefits including a reduction of TEWL and upregulation of collagen I. Most effective between pH 4.5 and 5.5.

Efficacy spectrum: gram+ gram- yeast mold

GreenGard™ LA Use Level 2.0-3.5%

INCI: Water, Arginine, Levulinic Acid, P-Anisic Acid

Description: 100% biobased broad-spectrum antimicrobial for use in all formulations. Most effective between pH 4.5 and 5.5.

Efficacy spectrum: gram+ gram- yeast mold

GreenGard™ LB Use Level 2.0-3.0%

INCI: Water, Arginine, Levulinic Acid, Benzoic Acid

Description: 100% biobased broad-spectrum antimicrobial for use in all formulations. Most effective between pH 4.5 and 5.5.

Efficacy spectrum: gram+ gram- yeast mold

GreenGard™ A bio Use Level 0.7-1.5%

INCI: Water, Arginine, P-Anisic Acid

Description: Provides skin care benefits with strong fungicidal effects for all formulations. Derives its power from Thai basil, ensuring a 100% biobased, minimally processed form of p-anisic acid.

Efficacy spectrum: gram+ gram- yeast mold