

C&E Advanced

Superior active delivery into the skin

Introduction

For a skincare product to be effective, it must combine proven levels of actives and efficient delivery into the skin for optimal results. **PCA SKIN®'s C&E Advanced** combines four key antioxidants, 20% L-ascorbic acid (vitamin C), 5% tocopherol (vitamin E), 1% hexylresorcinol, and 1% silymarin with a proprietary anhydrous delivery system to nourish skin with the highest doses of clinically proven ingredients. Quantitative and qualitative studies reveal that **C&E Advanced** has superior levels of vitamin C and vitamin E penetration into the skin over a leading competitor.

Objective

Compare the skin penetration of vitamin C and vitamin E from **C&E Advanced** versus a leading competitor which has 15% vitamin C and 1% vitamin E in an aqueous base.

Experimental Design

1. Quantitative Analysis

To measure vitamin C penetration, a measured amount of product was added to porcine skin and rubbed on for 30 seconds. The skin samples were then incubated for 96 hours; every 24 hours, excess product was removed and fresh product was reapplied. At the conclusion of the study, excess product was removed from the skin surface. Tape stripping was conducted on skin 20 times, which approximately corresponds to removal of the outermost stratum corneum layer. Active from the tapes was extracted off and the concentration of vitamin C was determined quantitatively via high-performance liquid chromatography (HPLC) analysis.

To measure vitamin E penetration, a measured amount of product was added to porcine skin and rubbed on for 30 seconds. The skin samples were then placed on Franz cells for a 24-hour diffusion study. At the conclusion of the study, excess product was removed from the skin surface. The epidermis and dermis of the skin was split and each layer was homogenized to extract any penetrated active. The concentration of vitamin E in each layer was determined quantitatively via HPLC analysis.

2. Qualitative Analysis

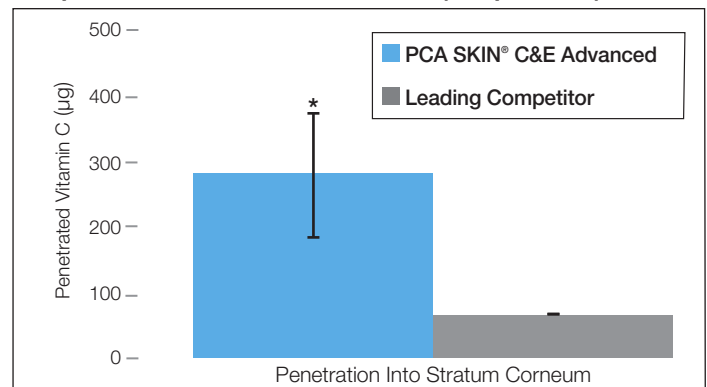
Active penetration was qualitatively analyzed using confocal Raman spectroscopy, a powerful and non-destructive method to image the extent of active penetration into skin samples by targeting a unique chemical signal of each individual active of interest. Skin samples were treated with product and placed on Franz cells for the duration of the diffusion experiment. Following the diffusion experiment, samples were immediately analyzed via confocal Raman spectroscopy without any further workup.

Results

Not all formulations can integrate high levels of both vitamin C and vitamin E. Thanks to the unique anhydrous backbone of **C&E Advanced**, 20% vitamin C and 5% vitamin E can both be stably incorporated into a topical formulation. Quantitative analysis of vitamin C penetration confirmed that over four times more vitamin C penetrated the stratum corneum from **C&E Advanced** versus a leading competitor (Graph 1). Quantitative

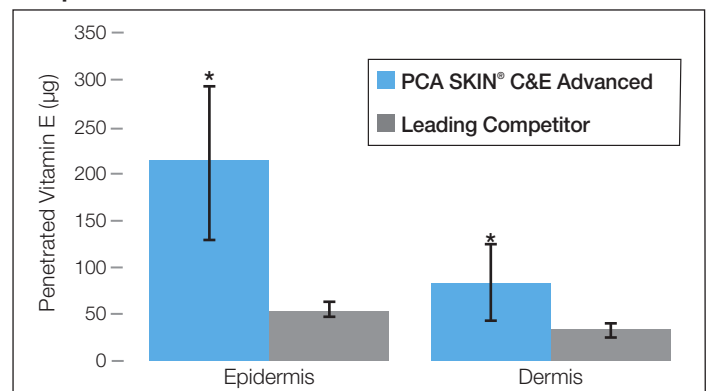
analysis of vitamin E penetration confirmed higher levels of active penetration into the skin from **C&E Advanced** versus a leading competitor. In both layers of the skin, **C&E Advanced** had about three and a half times more penetrated vitamin E than a leading competitor (Graph 2).

Graph 1: Vitamin C Penetration (Strips 2-20)



N=3 of porcine skin. Multidose application over 96 hours.
* p<0.10 (tape strip one omitted)

Graph 2: Vitamin E Skin Penetration



N=4 of porcine skin. Single dose application over 24 hours.
* p<0.10

C&E Advanced

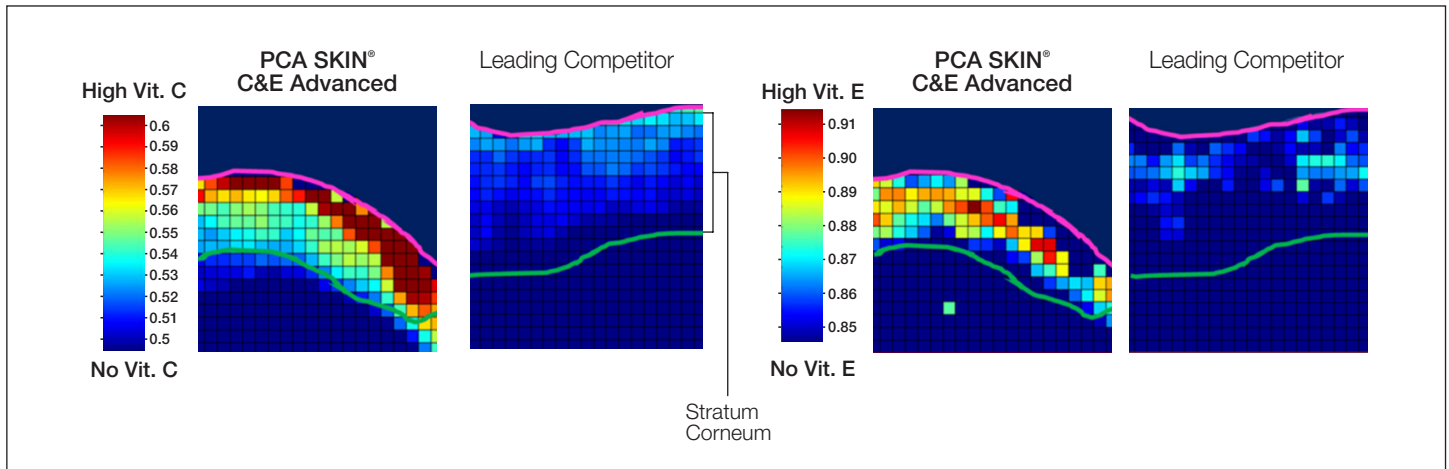
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Results (con't)

Imaging vitamin C and vitamin E penetration using confocal Raman spectroscopy confirmed the trends observed with the quantitative analysis. Skin treated with **C&E Advanced** had strong chemical signals for both vitamin C and vitamin E in the stratum corneum layer, indicative of significant levels

of active penetration. In contrast, skin treated with a leading competitor had extremely weak chemical signals for both of these actives, indicative of low levels of active penetration (Figure 1).

Figure 1: Confocal Raman Spectroscopy Analysis



Confocal Raman courtesy of TRI Princeton

Conclusion

C&E Advanced has superior levels of vitamin C and vitamin E delivery into the skin versus a leading competitor. In particular, quantitative analysis performed via HPLC revealed that over four times more vitamin C penetrated into the stratum corneum layer, while three and a half times more vitamin E penetrated into the epidermis and dermis layers of the skin. The trends were confirmed qualitatively with confocal Raman spectroscopy, which revealed much stronger chemical signals for vitamin C and vitamin E in skin samples treated with **C&E Advanced** versus skin samples treated with a leading competitor.