



## ElfaMoist® AC Humectant

Non-tacky, high-performance humectant for deep, instant and long-lasting moisturization, even after one application.

INCI: Acetamidoethoxyethanol

Our latest innovative skincare ingredient provides the personal care industry with the ability to meet consumers demand for long-lasting and high-performance products without the negative sensory impact of other humectants. ElfaMoist AC humectant is an effective new active that easily penetrates inside the skin (stratum corneum), delivers and increases hydration keeping skin moisturized for over 30 hours, even after one application. Equally important, ElfaMoist AC humectant performs exceptionally without showing disruption to the skin barrier, making it safe and gentle on the skin.

With ElfaMoist AC humectant, formulators can create the finest skin care products in a wide variety of leave-on as well as rinse-off products.

### Key benefits for formulators

- High moisturizing efficacy (instant and over 30 hours)
- Effective penetration and deposition properties
- Non-sticky, easily spreadable aesthetics
- pH and hydrolytic stability
- 100% active (as supplied)
- Easy to formulate, liquid form
- Synergistic effect with other humectants
- Compatible with most commonly used ingredients
- Does not impact the color of your formulation
- Can be used in higher concentrations for deeper skin hydration without sticky feel
- Preservative free
- Nitrosamine free

### Key benefits for consumers:

#### During Application

- Great absorbance
- Lubricity in skin feel
- Excellent spreadability

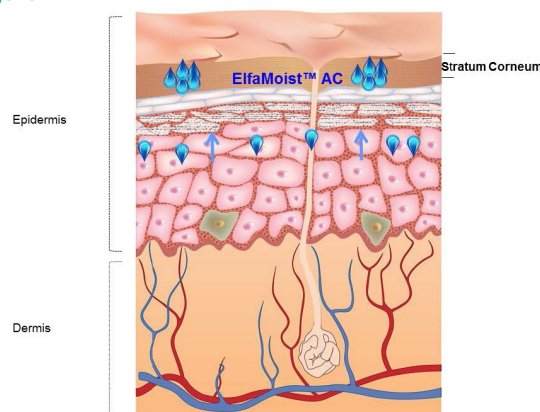
#### After Application

- Lack of stickiness/tackiness
- Highly effective skin hydration
- Instant and long-lasting moisturization (over 30 hours)

### How does ElfaMoist AC humectant work?

Designed by Nouryon scientists, ElfaMoist AC humectant interacts with water and keratin (skin protein) to keep the water molecules tightly bound in the stratum corneum. This binding mechanism ensures that ElfaMoist AC humectant continues to improve hydration initially as well as over 30 hours. In-vitro and in-vivo tests indicate the binding mechanism of ElfaMoist AC humectant and its high-performance capabilities.

Figure 1::



## Performance properties

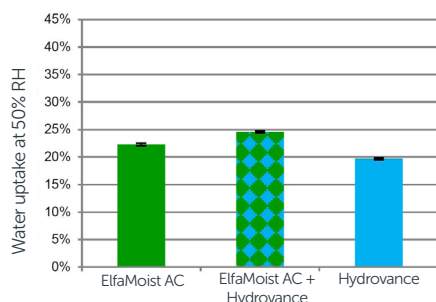
### Hydrophilicity measured by dynamic vapor sorption (DVS)

An important attribute of a humectant is its ability to attract and retain moisture via water absorption. Dynamic Vapor Sorption (DVS), which is a gravimetric technique, was used to measure water absorption capability of ElfaMoist AC as well as its synergism with other humectants.

#### Results:

In-vitro DVS study shows that ElfaMoist AC humectant binds water molecules and can be considered as hydrophilic as benchmarks in the industry (figure 2). The study also demonstrates the unique moisture absorption properties of ElfaMoist AC humectant when used in combination with other humectants. ElfaMoist AC humectant's unique synergy behavior allows cosmetic chemists to formulate highly efficacious products.

Figure 2: Dynamic vapor sorption (DVS) study at 50% relative humidity (used as 50% humectant in water solution) and synergistic boost effect using 50:50 wt% blend



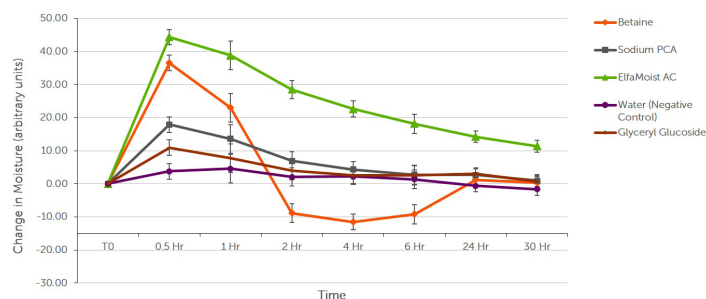
### Moisturization efficacy measured by corneometer

In-vivo moisturizing efficacy is measured by the ingredient's ability to increase the water content in the skin (stratum corneum). The measuring principle of the Corneometer is based on the dielectric constant in the medium and water has the greatest impact on the dielectric constant of the skin. Therefore, any increase in water content on skin can be determined by corneometer measurements.

#### Results:

ElfaMoist AC humectant shows in-vivo skin moisturization efficacy better than or equivalent to other moisturizing agents in the marketplace (figure 3). In the case of the most premium moisturizing agents, ElfaMoist AC humectant performed significantly better over the 30 hours of study.

Figure 3: In-vivo Corneometer measurements - 30 hour study



Note: Gels with 10% active level of either ElfaMoist AC humectant, a control with water, as well as various commercial benchmarks were applied in a 4 cm diameter circle on the volar forearm of panelists. Moisture levels of the stratum corneum were measured prior to application of the gel and 30 minutes, 1, 2, 4, 6, 24, and 30 hours after application.

#### Formulation used in the study:

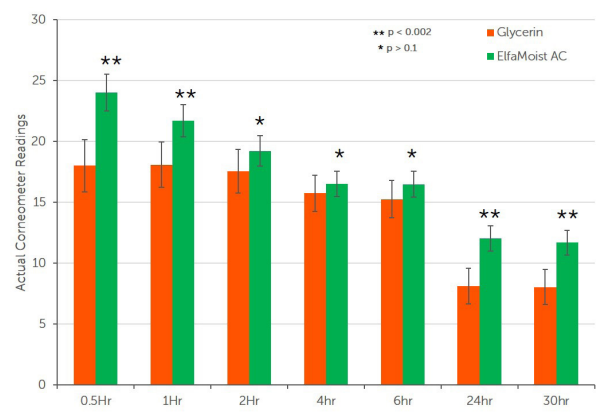
Ingredients	Weight %
Deionized water	88.5
Compound (humectant)	10.0
DMDM Hydantoin (and) Iodopropynyl Butylcarbamate	0.5
Carbomer	0.5
TEA	0.5

ElfaMoist AC humectant compared with glycerin. Furthermore, ElfaMoist AC was evaluated using corneometer vs glycerin at 5% active over 30 hours.

#### Results:

ElfaMoist AC humectant shows in-vivo skin moisturization efficacy better than Glycerin -- the benchmark for moisturization in the industry -- at 5% active levels (figure 4). Therefore, when compared directly with Glycerin, ElfaMoist AC humectant has demonstrated better performance instantly as well as over 30 hours.

Figure 4: In vivo t-test corneometer (5% active in 0.5% carbopol 940 gel)



Note: Gels with 5% active level of ElfaMoist AC humectant and Glycerin, were applied in a 4cm diameter circle on the volar forearm of panelists. Moisture levels of the stratum corneum were measured prior to application of the gel and 30 minutes, 1, 2, 4, 6, 24, and 30 hours after application.

### Instant and long-lasting moisturization

The in-vivo corneometer study demonstrated that ElfaMoist AC humectant is capable of delivering outstanding instant (figure 5) and long-lasting moisturization benefit (figure 6) by increasing hydration in the stratum corneum and effectively retaining water over 30 hours.

### Results:

Through Corneometer testing, it has been confirmed that ElfaMoist AC humectant instantly increases the water content of the stratum corneum and effectively retains the water over 30 hours. ElfaMoist AC humectant performs better than other humectants initially and at 30 hours

Figure 5: In vivo corneometer study vs benchmarks and water (1 hour)

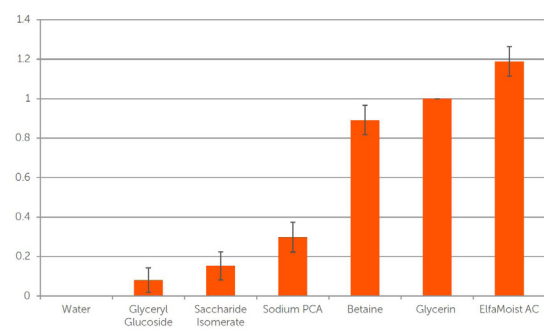
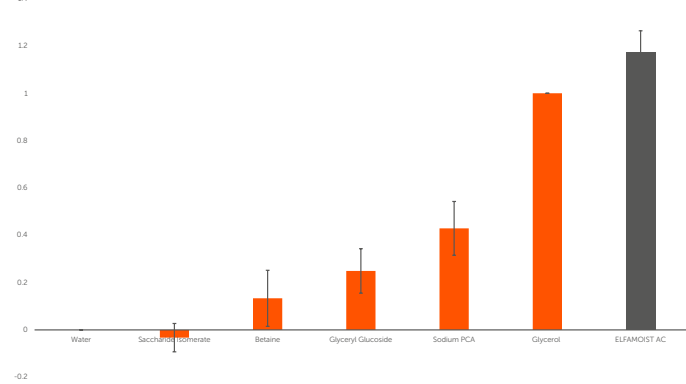


Figure 6: In vivo corneometer study vs benchmarks and water (30 hours)



Note: Corneometer Measurements 30 hour study (using 10% active competitor polymers in 0.5% Carbopol 940 Gel).



## Evaluation of moisturizing ingredient - delivery and hydration via ATR-FTIR imaging

In a study conducted by TRI Princeton, the efficacy of ElfaMoist AC humectant was measured and compared with Glycerin. Attenuated total reflectance (ATR) Fourier Transform Infrared (FTIR) imaging spectroscopy was used to analyze and visualize the deposition and penetration of these actives in the skin (stratum corneum).

ATR-FTIR imaging spectra were collected at the skin surface before treatment (control), on the skin surface after treatment (deposition) and then after sequential tape strips (penetration).

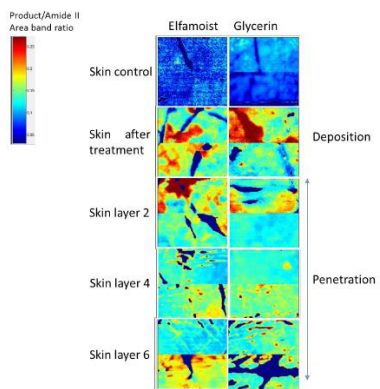
### Deposition and penetration

The deposition of both ElfaMoist AC humectant and Glycerin on the human skin can be observed after 30 min treatment (skin after treatment).

#### Results:

Through Corneometer testing, it has been confirmed that ElfaMoist AC humectant instantly increases the water content of the stratum corneum and effectively retains the water over 30 hours. ElfaMoist AC humectant performs better than other humectants initially and at 30 hours.

Figure 7: Deposition and penetration efficacy by ATR-FTIR imaging



Note: The ATR-FTIR image shows the 1090-1000 cm<sup>-1</sup> to 1580-1480 cm<sup>-1</sup> band area ratio which normalizes the product peaks (1090-1000 cm<sup>-1</sup>) to the Amide II peaks (1580-1480 cm<sup>-1</sup>). In the ATR-FTIR images presented in this section, the higher the ratio, the redder is the image and the higher is the actives concentration. Figure 7 shows results recorded with 5% aqueous solution - 0.25mL of solution per square centimeter (12.5mg/skin cm).

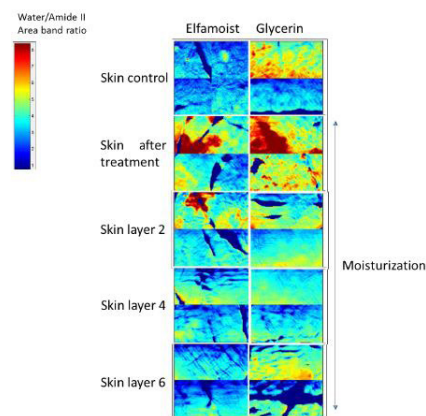
## Skin hydration

Figure 8 shows new ATR-FTIR images generated by TRI/Princeton to identify potential skin moisturizing effect from ElfaMoist AC humectant and Glycerin.

#### Results:

The study shows that a moisturizing effect can be seen inside the skin after treatment with both products. This effect can be detected down to the lowest layer 6 that was analyzed for the study (figure 8).

Figure 8: Skin hydration efficacy by ATR-FTIR imaging



Note: The ATR-FTIR image shows the water to Amide II band area ratio. In the ATR-FTIR image presented in this section, the higher the ratio, the redder is the image and the higher is the moisturization.



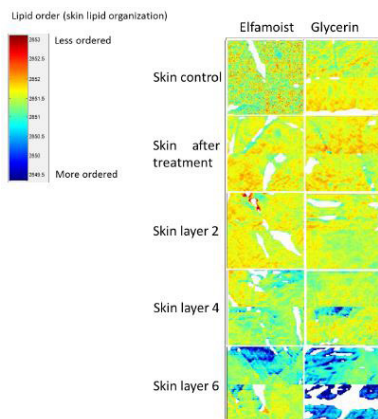
## Skin barrier

To better understand the effects of the product application on the skin, TRI/Princeton also verified if both active penetrations disturbed the skin barrier. To assess this parameter, TRI/Princeton observed the CH<sub>2</sub> peak position from the lipid. The increase of a few cm<sup>-1</sup> in the high frequencies of the CH<sub>2</sub> bands reflects a modification of the acyl chain packing. The CH<sub>2</sub> peak position is a relevant marker to analyze the lipid organization in the stratum corneum.

### Results:

No significant differences were observed in the lipid order indicating that ElfaMoist AC humectant and Glycerin do not disturb the skin barrier function and are gentle the skin. ElfaMoist AC humectant is effective at depositing, penetrating and delivering hydration to the stratum corneum without disturbing the skin barrier (figure 9).

Figure 9: The ATR-FTIR image showing CH<sub>2</sub> peak position



Note: In the ATR-FTIR image presented in this section, higher is the value (red) higher is lipid disorder.

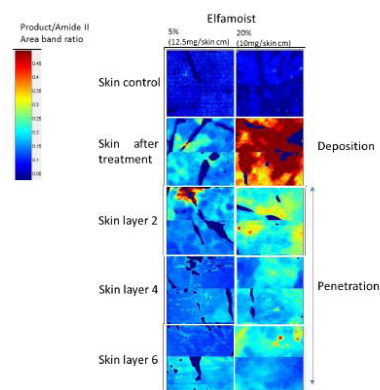
## Impact of formulation on delivery of ElfaMoist AC humectant

The deposition and the penetration of ElfaMoist AC humectant inside the skin were compared between two formulations using different concentrations (5% and 20%) by generating ATR-FTIR images.

### Results:

While the total amount of actives deposited on the skin is similar, the deposition and the penetration of ElfaMoist AC humectant can be influenced by levels of active and the type of formulation used (figure 10).

Figure 10: The ATR-FTIR image – Deposition and penetration using ElfaMoist AC at 5% and 20%



Note: The ATR-FTIR image shows the 1090-1000 cm<sup>-1</sup> to 1580-1480 cm<sup>-1</sup> band area ratio which normalizes the product peaks (1090-1000 cm<sup>-1</sup>) to the Amide II peaks (1580-1480 cm<sup>-1</sup>). In the ATR-FTIR images presented in this section, the higher the ratio, the redder is the image and the higher is the actives concentration.



## External sensory evaluation

Sensory Evaluation involves the detection and description of a product's sensory characteristics. Sensory testing was done by Sensory Spectrum to determine skin-feel properties among skincare formulation samples using ElfaMoist AC humectant and Glycerin. Both were evaluated by expert panelists trained in Skinfeel Descriptive Analysis methodology. Gels using 10% active were used in this study.

### Results:

ElfaMoist AC demonstrated statistically less tack/stickiness as well as better spreadability than Glycerin (table 1).

**Table 1: 10% active gels evaluated by Sensory Spectrum**

	Pick-up attribute stickiness	Rub-out attribute spreadability
Glycerin	-	-
ElfaMoist AC humectant	+	+

+ statistically different at a 95% confidence level

## In-house sensory evaluation (100% active raw material)

Furthermore, the results generated from Sensory Spectrum (table 1) validated internal subjective testing (table 2) which evaluated tack and spreadability during the rubout phase as well as after feel tack/stickiness.

### Results:

Internal sensory testing concluded that ElfaMoist AC humectant demonstrated better tack and spreadability than Glycerin during rub out as well as during the after feel (table 2).

**Table 2: Subjective evaluation of 100% active raw material**

	Pick-up attribute stickiness	Rub-out attribute spreadability	After feel attribute tack/stickiness
Glycerin	-	-	-
ElfaMoist AC humectant	+	+	+

+ statistically different at a 95% confidence level

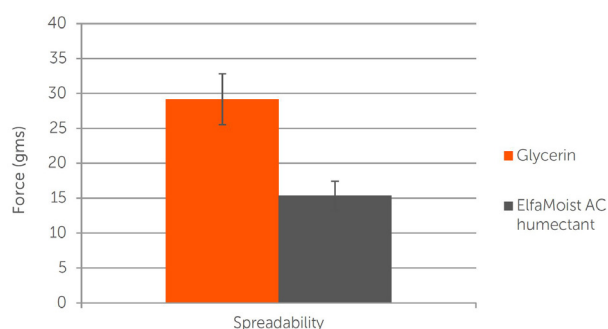
## Texture analyzer evaluation for spreadability

This method measures the force required to spread a sample in order to investigate textural attributes of personal care products such as lotions, creams, gels for the purpose of texture mapping and sensory correlation. The texture analyzer assesses textural properties by comparing force, distance, and time data. The texture analyzer was used to evaluate the force required to spread both ElfaMoist AC humectant and Glycerin.

### Results:

This texture analyzer study on the neat raw material (100% active) demonstrates ElfaMoist AC humectant requires statistically less force to spread the samples compared to Glycerin. This objective evaluation technique demonstrates good agreement with the subjective evaluation results from Sensory Spectrum and those carried out in-house (figure 13).

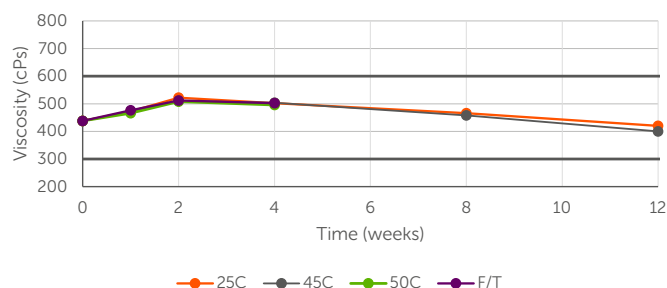
**Figure 13: Spreadability evaluated by texture analyzer**



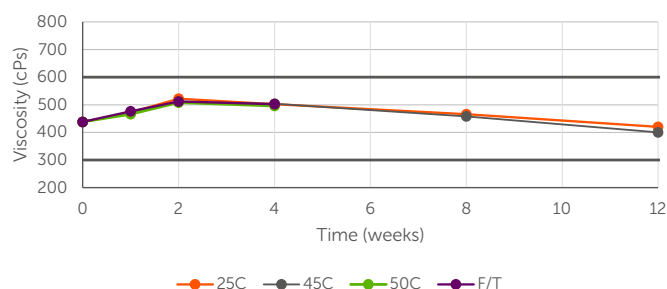
## pH and viscosity stability

ElfaMoist AC humectant has shown excellent pH & viscosity stability at 25°C, 45°C and 50°C and freeze/thaw cycles over a period of eight weeks, after adjusting the pH to the desired range for skincare formulations.

Figure 14: ElfaMoist AC humectant stability data



Viscosity Stability – Neat ElfaMoist AC (RV#3 at 50rpm)



ElfaMoist AC pH Stability prepared at 10% aqueous and pH adjusted to 5.50

## Recommended applications

ElfaMoist AC humectant has demonstrated very good compatibility with a broad range of raw materials and as such it offers an excellent moisturizing benefit in a wide variety of leave-on emulsion systems such as creams, lotions, antiperspirant/deodorant, masks, eye-cream, baby lotions, BB creams, and facial mask sheets. ElfaMoist AC humectant also finds great utility in rinse-off products such as shower gels, moisturizing hand liquid soap, and body washes.

## Formulation guidelines

ElfaMoist AC humectant is readily water soluble and is easily incorporated into water or into the water phase of an emulsion at ambient or elevated temperature conditions. ElfaMoist AC humectant can also be post added to a formulation during cool down.

Suggested pH range of final formulations: 4-8.

### Suggested use levels, as supplied

Ingredients	Weight %
Leave-on moisturizing products (creams, lotions, gels)	1-10
Sun care (pre and post sun care products)	1-10
Rinse-off products (shower gels, body wash, hand liquid soap, and skin cleansing systems)	1-20
Color cosmetics (Foundations, BB creams, blushes)	1-7.5

### Storage and handling

ElfaMoist AC humectant can be stored under ambient conditions without undergoing decomposition or degradation. When not in use, the container should be kept covered to prevent dirt, dust, and moisture pick-up. Store in a cool, dry area. This product is freeze thaw stable.

### Health and safety

Information on ElfaMoist AC humectant relating to the EU Cosmetics Directive 76/768/EEC is available on request.

The suitability of the final formulations should be confirmed in all respect by appropriate evaluation. The marketer is advised to evaluate the final formulation with regard to performance and health and safety.

For more information and sample formulations contact us at [PersonalCare.Marketing@nouryon.com](mailto:PersonalCare.Marketing@nouryon.com).

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We are a global specialty chemicals leader. Markets worldwide rely on our essential chemistry in the manufacture of everyday products such as paper, plastics, building materials, food, pharmaceuticals, and personal care items. Building on our nearly 400-year history, the dedication of our 10,000 employees, and our shared commitment to business growth, strong financial performance, safety, sustainability, and innovation, we have established a world-class business and built strong partnerships with our customers. We operate in over 80 countries around the world and our portfolio of industry-leading brands includes Eka, Dissolvine, Trigonox, and Berol.

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