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Wettability: A Reliable Method to Measure the Surface Energy of Cosmetic Products

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INTRODUCTION

The stratum corneum regulates water loss and protects the skin. While corneometry and TEWL assess internal hydration, they don't reflect surface properties. Wettability, measured via the contact angle (θ) of a liquid droplet, offers a non-invasive way to assess if the skin surface is hydrophobic or Hydrophilic:

Low θ → hydrated/ Lipid-rich (hydrophilic) skin

High θ → dry or lipid-poor (hydrophobic) skin

This study measures this contact angle as a reliable, surface-specific method to evaluate the cosmetic product efficacy.

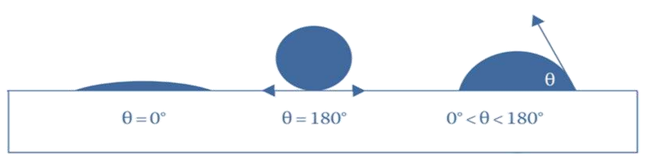


Figure 1. Contact angle illustration :
θ = 0° (complete wettability) → θ = 180° (no wettability)

MATERIALS & METHODS

CLINICAL TRIAL DESIGN

This Randomized, monocentric study enrolled 19 healthy volunteers (aged 19–68 years; mean age 57.4 years).
On each forearm, **two areas were defined** (treated vs. untreated), allowing intra-individual comparison.
The tested formulations were applied by the subjects at home for **7 consecutive days**.
Measurements were performed at **baseline (Day 0), 2h and 6 h after application, and on Day 3 and Day 7**.

TESTED FORMULATIONS

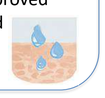
Two cosmetic formulations tested :
HAB5 : HA + Provitamins B5
HAB3 : HA + Vitamin B3
2 times per day → 7 days

EVALUATION METHODS

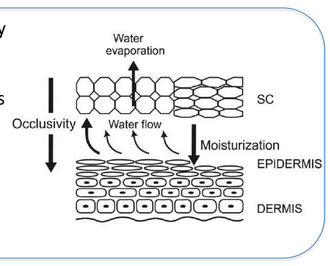
Drop Angle Meter®

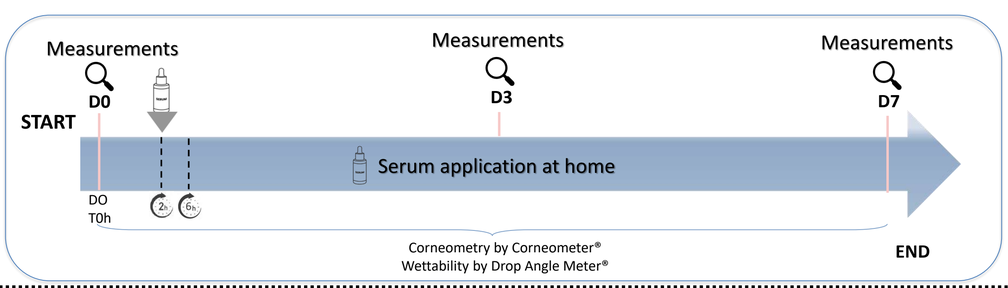
Corneometer®

A lower contact angle indicates better wettability, reflecting improved hydration and spreading properties



Water balance in the skin is regulated by two main mechanisms:
•**Moisturization**, which ensures water supply from the dermis to the epidermis and stratum corneum (SC), maintaining skin softness and elasticity.
•**Occlusivity**, which reduces transepidermal water loss (TEWL) by forming a barrier on the skin surface, limiting evaporation.

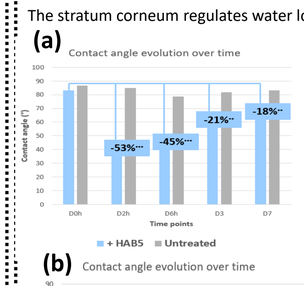




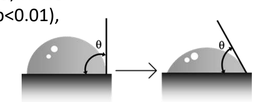
RESULTS

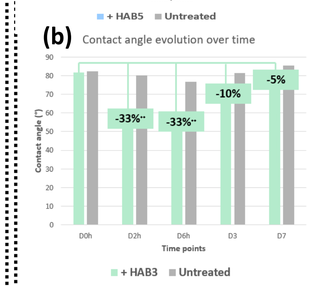
SKIN WETTABILITY BY Contact Angle

The stratum corneum regulates water loss and protects the skin. While corneometry and TEWL assess internal hydration, they don't reflect surface properties.



Immediate results (2h & 6h)HAB5 (HA + Provitamin B5):A single application of HAB5 induced a very strong and significant decrease of the contact angle (–53 % at 2h, –45 % at 6h, p<0.0001), showing a rapid and marked improvement of skin wettability.HAB3 (HA + Vitamin B3):HAB3 application led to a significant reduction of the contact angle (–33 % at 2h and 6h, p<0.01), confirming an improvement in skin wettability immediately after application.





Long-term results (D3 & D7)HAB5 (HA + Provitamin B5):After repeated applications for 7 days, HAB5 maintained a significant reduction of the contact angle (–21 % at D3, –18 % at D7, p<0.05), indicating a sustained moisturizing effect, whereas untreated skin remained unchanged.HAB3 (HA + Vitamin B3):At D3 and D7, HAB3 induced only a modest decrease of the contact angle (–10 % and –5 %), which was not statistically significant, suggesting that the effect tends to diminish with repeated applications.

Figure 2. Evolution of contact angle over time for HAB5 (a) and HAB3 (b)

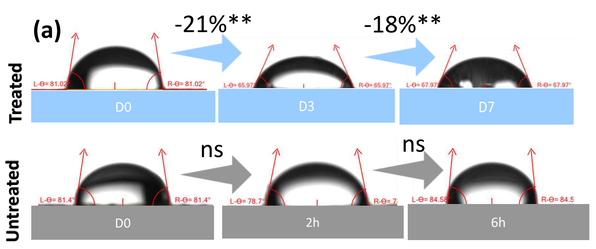


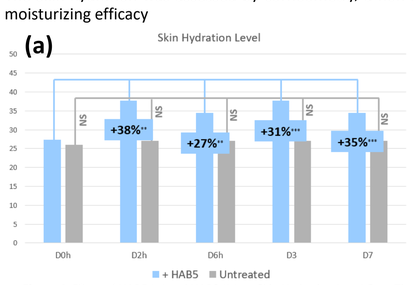
Figure 3. Representative Contact Angle Measurements for HAB5 (a) and HAB3 (b)

A smaller contact angle indicates higher wettability and thus better surface hydration.HAB3 (HA + Vitamin B3) induced a rapid and significant reduction of the contact angle (–33 % at 2h and 6h, p<0.01), highlighting an immediate improvement in skin wettability.

HAB5 (HA + Provitamin B5) showed a progressive and sustained effect, with significant decreases at Day 3 (–21 %) and Day 7 (–18 %, p<0.05), confirming a cumulative moisturizing action upon repeated applications.In contrast, the untreated areas did not show significant changes

SKIN WETTABILITY BY Contact Angle

The Skin hydration was assessed by corneometry, a non-invasive method that quantifies the water content of the stratum corneum, providing a reliable evaluation of moisturizing efficacy

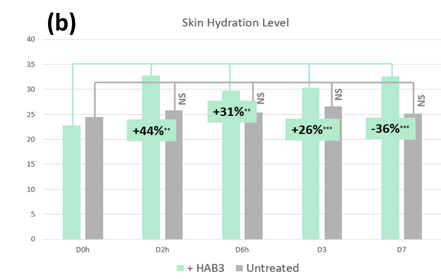


Both formulations significantly increased skin hydration compared to baseline. HAB3 induced a rapid improvement (+44% at 2h, +31% at 6h, p<0.01), which was maintained at Day 3 (+26%) but decreased by Day 7. HAB5 showed a strong and sustained moisturizing effect (+38% at 2h, +27% at 6h, +31% at Day 3 and +35% at Day 7, all p<0.01), while untreated areas did not change significantly.

Figure 4. Effect of HAB5 (a) and HAB3 (b) on Skin Hydration Level Over Time

	T2h	T6h	D3	D7
HAB5	**(HI)** +38% **(θ)** :–53%	**(HI)** +27% **(θ)** :–45%	**(HI)** +31% **(θ)** :–21%	**(HI)** +35% **(θ)** :–18%
HAB3	**(HI)** +44% **(θ)** :–33%	**(HI)** +31% **(θ)** :–33%	**(HI)** +26% **(θ)** :–10%	**(HI)** +36% **(θ)** :–5%

Table 1. Time-Course Evaluation of Skin Hydration (HI) and Wettability (θ) Using Contact Angle and Corneometry



CONCLUSION

- Contact angle measurement is a simple, fast, reliable and non-invasive method to assess skin surface energy which could regroup the skin hydration level, skin hydrophobicity/ hydrophilicity and SC lipidic layer
- The technique is sensitive and reproducible, detecting the small evolutions after even a single application
- It allows tracking of dynamics evolutions over time (short- and long-term effects)
- The preliminary results show that Vitamin B5 has better effect on skin wettability than Vitamin B3, to be validated by further bigger studies

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