INNOVATION IN UV PROTECTION.
WHEN IT BECOMES A DAILY MUST HAVE

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1 INTRODUCTION

Optimizing the efficiency of solar filtration formulations is a constant objective of the cosmetics industry. In particular, it takes into account a better distribution of the filters with the lowest possible concentration of the latter, the resistance of the formula to the surface of the skin, a reduced release in the environmental and an optimal sensoriality for increased consumer observance. For this purposes, we co-developed with raw materials suppliers a unique technology based on amphiphilic acrylate copolymer INCI C12-22 alkyl acrylate/hydroxyethylacrylate (AAHAcp). AAHAcp is a copolymer which structures the lipophilic phase and leads alone to oil-in-water emulsion [1]

2 MATERIALS & METHODS

FORMULA CHARACTERIZATION

Solar formula structure were observed using Confocal Laser Scanning Microscope (CLSM). Phases staining: 1 g [sample] + 5 µL [Propylen glycol + Fluorescein]. Bulk was observed between 2 microscopy cover slips separated with 250 µm-thickness double tape. Deposit is prepared on a cover slip at 25-µm thickness with a drawdown bar. Sample dried at Room Temperature during 1 hour before image acquisition

FORMULA DEPOSITION

Optical Coherence Tomography (OCT) was used to visualize formula distribution at the skin surface in vivo. Solar products were applied on forearm, on surfaces of 2mg/cm2 with a drying time of 15 minutes.

RESISTANCE TO MIGRATION

An in vitro study using polymethyl methacrylate plates (PMMA) allowed visualizing migration properties of emulsions. After standardized deposition of suncare formulas on PMMA plates, the plates were stored at 35°C for 3 hours.

PHOTOPROTECTION EFFICACY

The Sun Protection Factor of various formulations containing or not the unique AAHAcp Technology was evaluated, the following the ISO/EN24444 Cosmetics Sun Protection Test-in-vivo determination of the Sun Protection Factor (SPF) (2010).

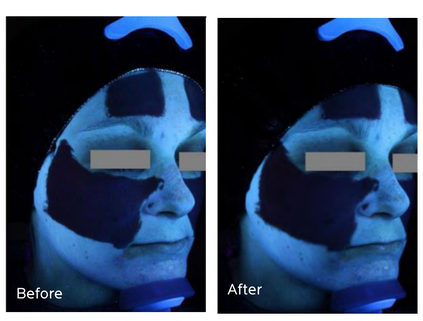
SAUNA MIGRATION TEST

The resistance of formulas to sweat and heat was evaluated in-vivo. A standardized quantity (500 µL) of formula was applied on half-face with a slight massage. The volunteers were submitted to a sauna for 2 hours (temperature between 35°C and 45 °C and relative humidity between 50% and 70%).

The visualization of the formula at the skin surface was performed before and after the sauna, using the VISIA® from CANFIELD® imaging systems. The control of the repositioning takes place directly on data-processing screen using an overlay visualization of the images at each time of acquisition. A series of photos taken under multi-spectral imaging and analysis (white light, UV or polarized light – parallel or crossed) allow to capture visual information affecting complexion health and appearance.

SENSORIALITY

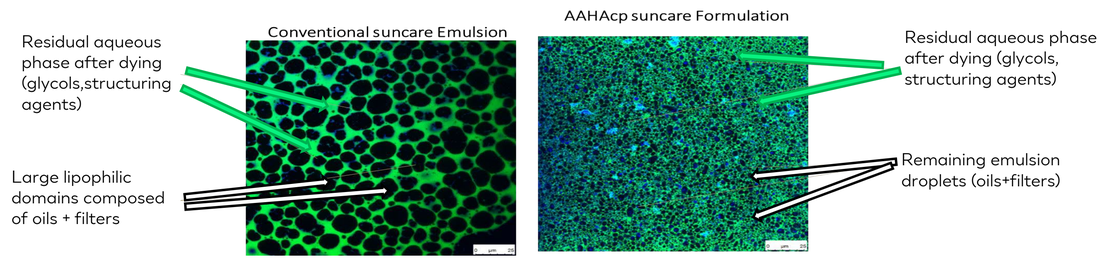
A consumer test was realized in FRANCE on 130 women aged 20 to 60. All types of skin (face and body). Users of SPF50/50+ for body or face and body, in milk and/or cream formats. Pure monadic quantitative blind use test. Products were applied under normal conditions of use during the panelist's vacations.



3 RESULTS & DISCUSSION

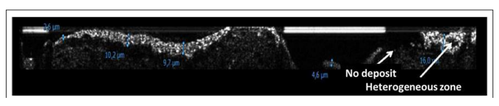
FORMULA CHARACTERIZATION

As visualized by CLSM, the new AAHAcp formulation forms finer and more regular droplets (entrapping UV filters) compared to conventional emulsions.

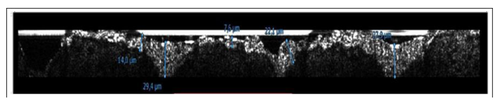


FORMULA DEPOSITION

OCT analysis shows that the film containing AAHAcp is particularly covering and has a consequent thickness (*versus* the solar references tested), whatever the microrelief of the skin



Conventional suncare emulsion

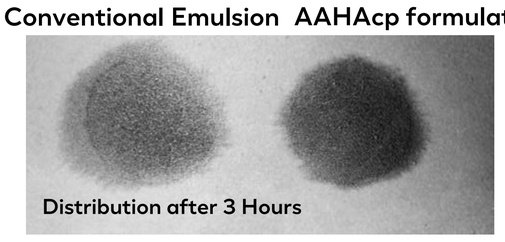


AAHAcp suncare Formulation

RESISTANCE TO MIGRATION

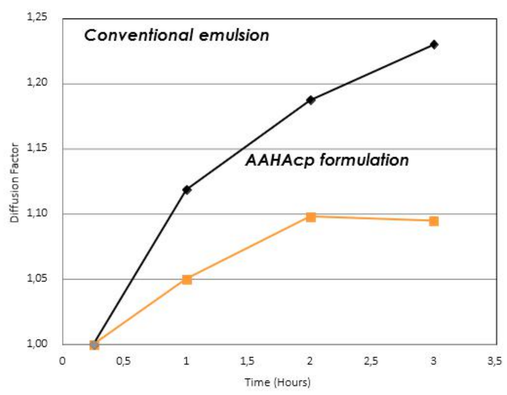
The PMMA plates test shows that the diffusion factor of the AAHAcp formula is reduced, even in hot summer conditions.

Conventional Emulsion AAHAcp formulation



2MG/CM² - /4.4 CM²
2 IR LAMPS 40°C - 50CM AMBIENT TEMPERATURE 35°C

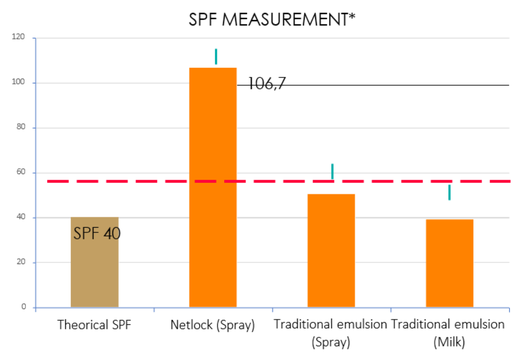
$$\text{FACT. DIFF.} = \frac{(\text{SURFACE } t)}{(\text{SURFACE 15 MIN.})}$$



LITTLE MIGRATION OF THE FORMULA OVER TIME IN HOT SUMMER CONDITIONS

PHOTOPROTECTION EFFICACY

The SPF-enhancing properties of this technology is illustrated by the comparison of three oil-in-water emulsions (sprays and lotion) containing the same association of UV filters. The AAHAcp formula yielded an SPF twice as high as the emulsions based on conventional technologies [4]

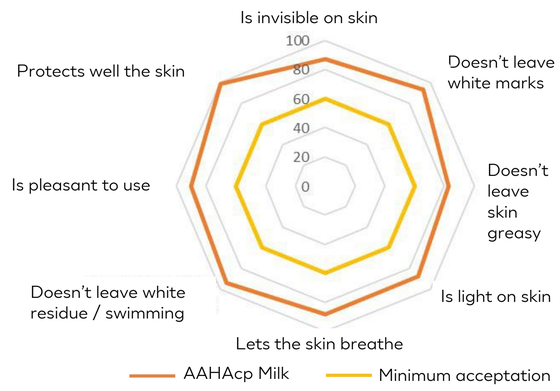


RESISTANCE TO SAUNA CONDITIONS

As shown by the dark blue zones (product visualization), even after 2 hours of sauna condition, we observe no migration of the solar formula.

SENSORIALITY

Panelists report that the product has a very light texture, with bare skin feeling, non greasy, and letting the skin breathe. It leaves an invisible skin finish, with no white residue, even while swimming.



4 CONCLUSIONS

For the first time, thanks to a new specific polymer creating a new type of emulsion, we succeed in reconcile in a single sun care maximal SPF efficacy, resistance to numerous stresses and optimal sensoriality.

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REFERENCES

1. *Personal care compositions containing functionalized polymers. European Pat., 2407148 (2018).*
2. *Solar protection composition, containing a semicrystalline polymer, for skin and hair. European Pat., 1331000 (2003).*
3. *In vivo determination of the sun protection factor<(SPF). https://www.iso.org/obp/ui/#iso:std:iso:24444:ed-1:v1:en (2010).*
4. *Moyal D., Passeron T., Josso M., Douezan S., Delvigne V. and Seité S. Formulation of sunscreens for optimal efficacy. J. Cosmet. Sci. 71, 199-206 (July/August 2020).*