Session:
Delivery technologies in cosmetics and consumer products

Lipid nanocarriers: from lab to clinical evaluation

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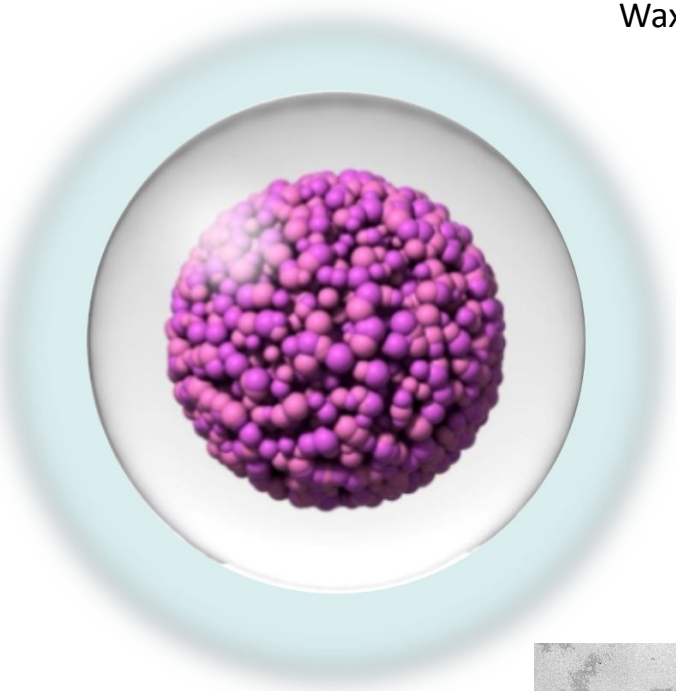
CONTROLLED RELEASE SOCIETY
CRS 2023 ANNUAL MEETING & EXPOSITION
JULY 24-28, 2023 Paris Hotel » Las Vegas, NV, USA
THE FUTURE OF DELIVERY SCIENCE

Lipid Nanocarriers

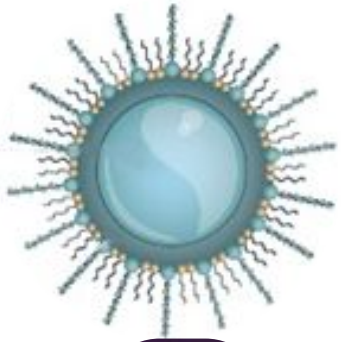
Wax/butter shell



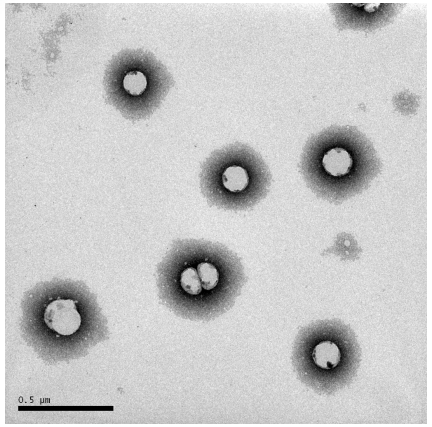
Lipophilic particles

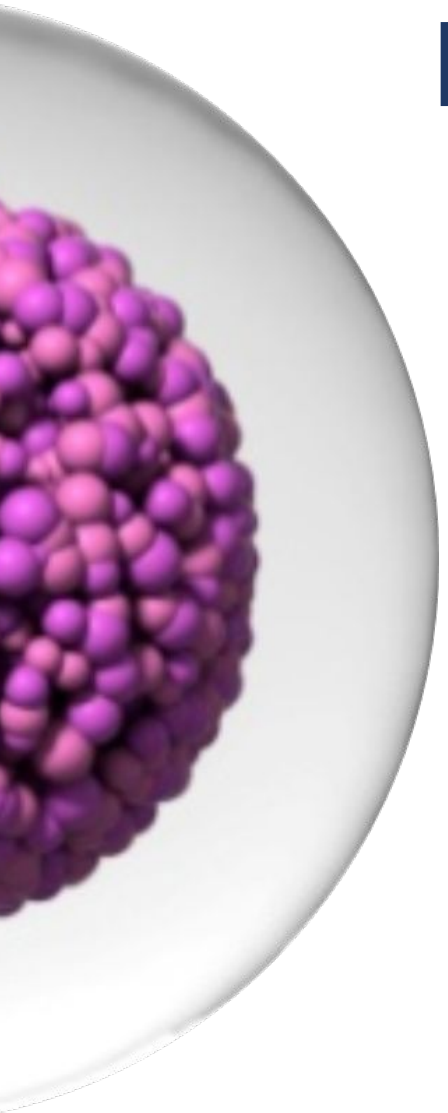
Liposomes

Microemulsion



Nanoemulsions



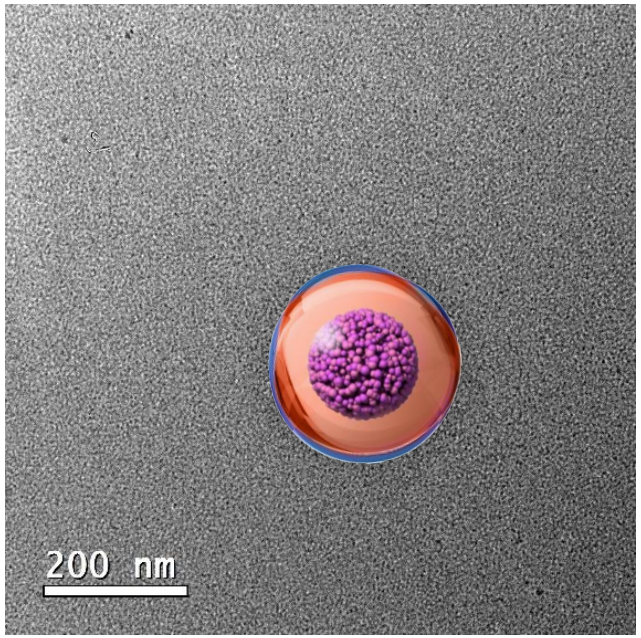


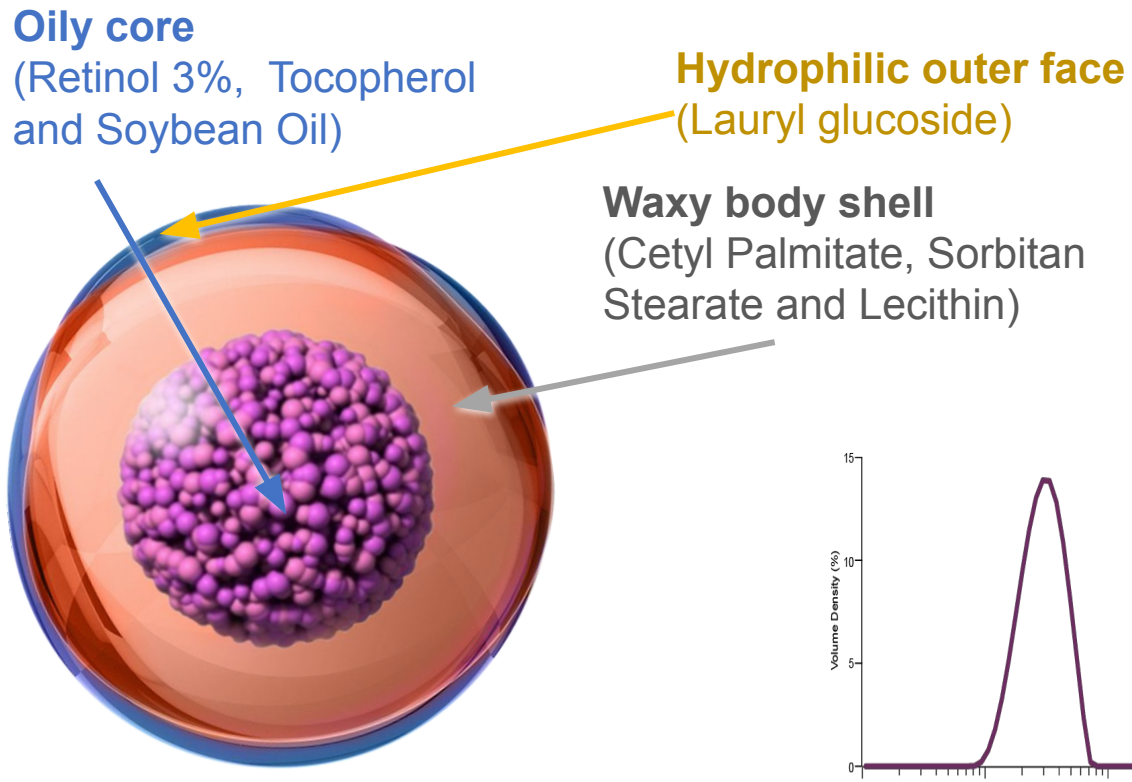
Defining the project

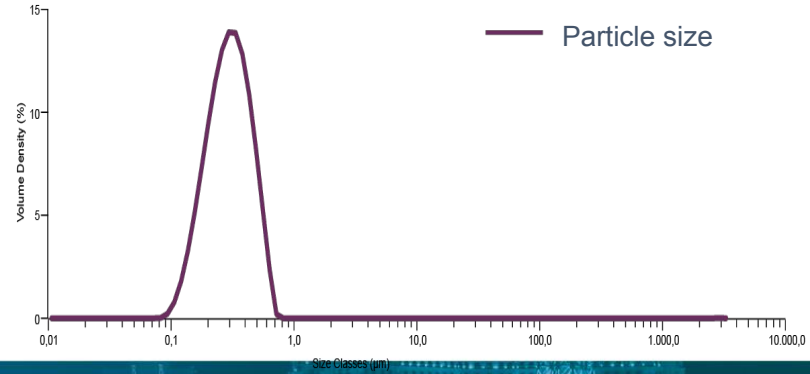
- Encapsulation of actives can lead product to multiple benefits
- Selecting the “target” benefits is crucial for technology selection
- Technology selection
  - Purpose (target benefit)
  - Active characteristics as solubility, stability, compatibility
  - Expected active concentration
  - Easiness to scale up or availability to scale up
  - Difficulty to prove the benefits
  - Characterization methods availability and cost

Retinol

Due to its chemical structure, retinol as well as other retinoids, are highly subject to various chemical changes depending on environmental conditions (light, temperature, oxygen, pH, solvents…).



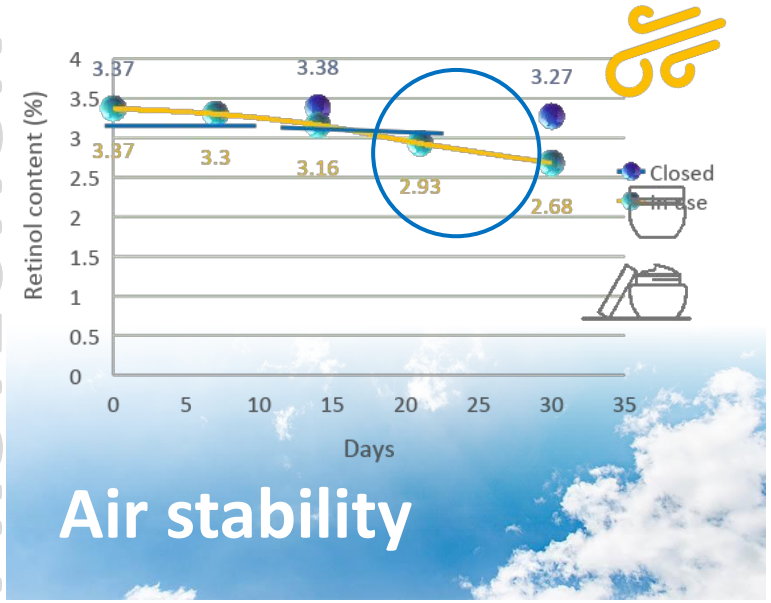


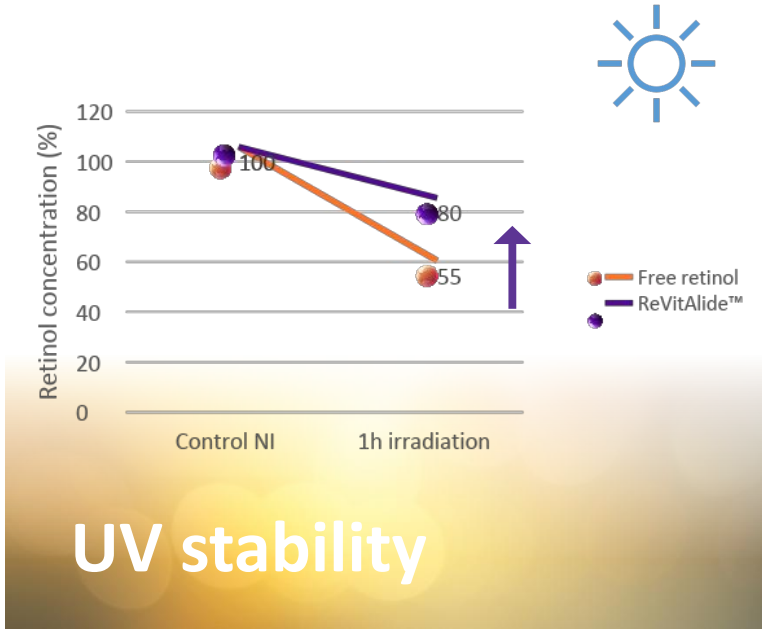


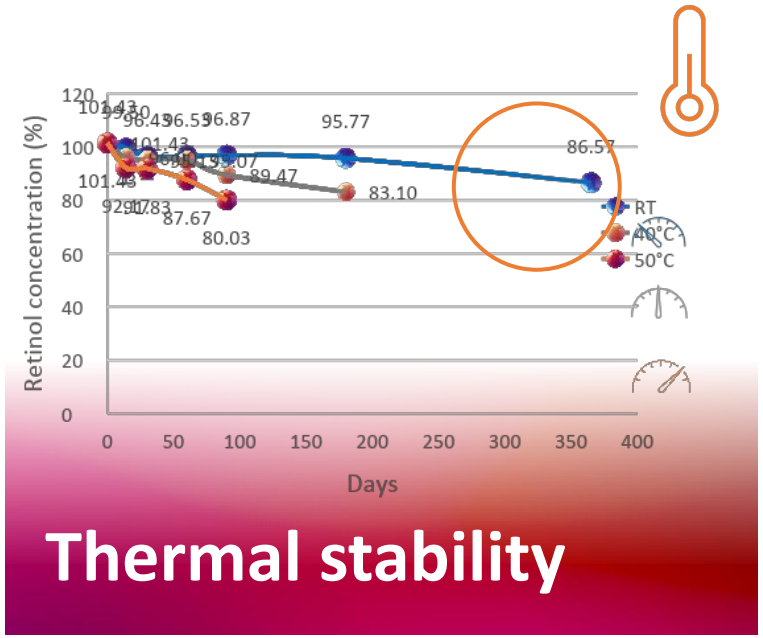
Retinol's stability within the capsules

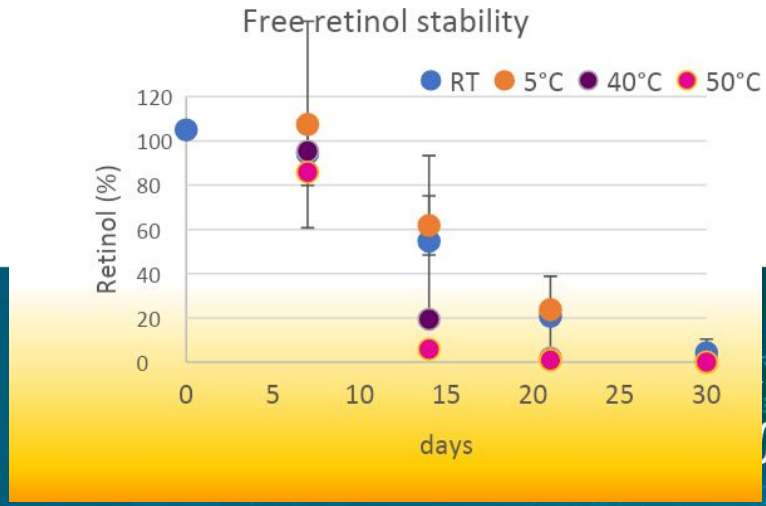
Measured retinol content over time after exposure to light, air, or heat

PROTECTION









Not Always Easy...

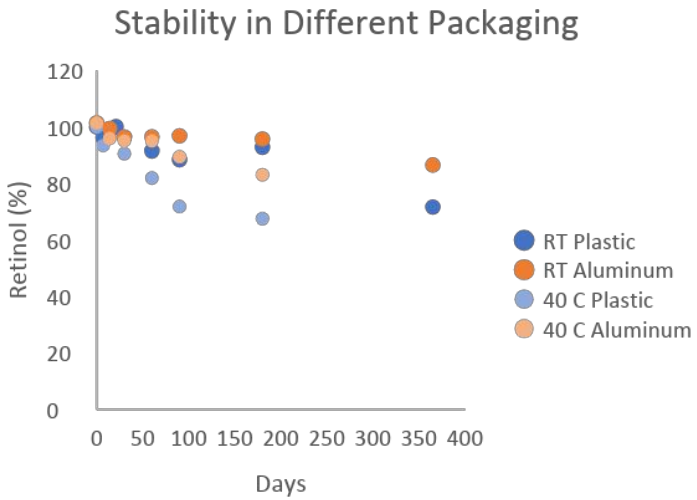
1

Confirmation of dosage from HPLC UV with LC MS/MS

Intensity of color is not proportional do degradation

2

Plastic Interaction



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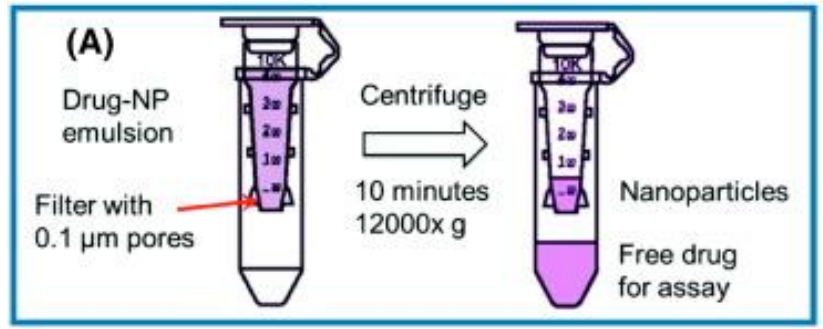


NO retinol detected – even in solution

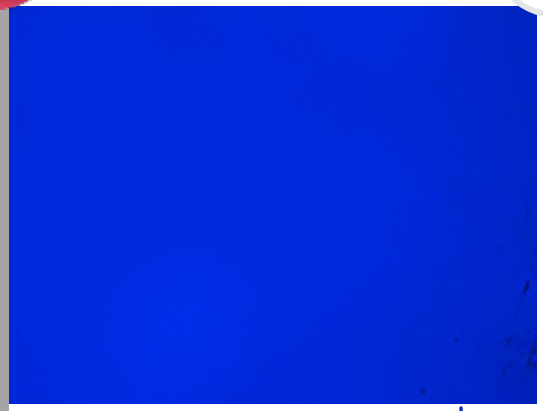
Need to develop a new way to "show" encapsulation beside the stability data

Proof of encapsulation - fluorescence

PROTECTION

Fluorescence

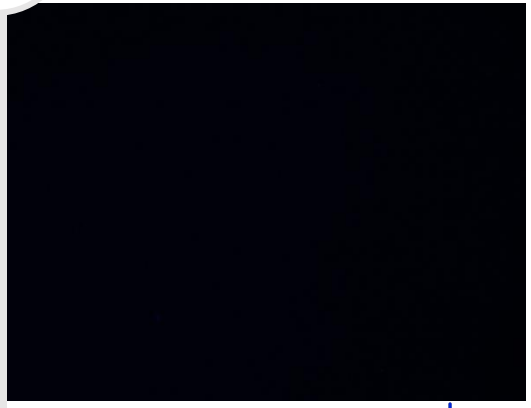
Free retinol



Non encapsulated Retinol is fluorescent → appears **blue**

1

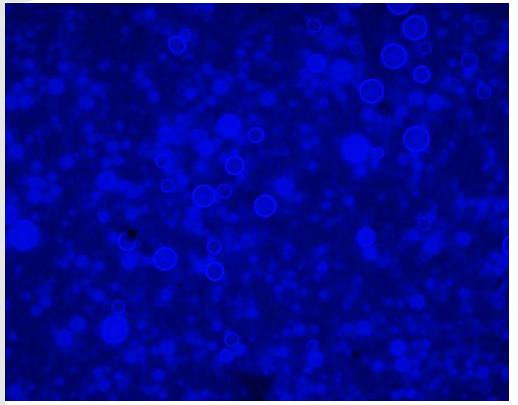
Placebo (empty capsules)



Empty capsules without retinol do not fluoresce → appear **black**

2

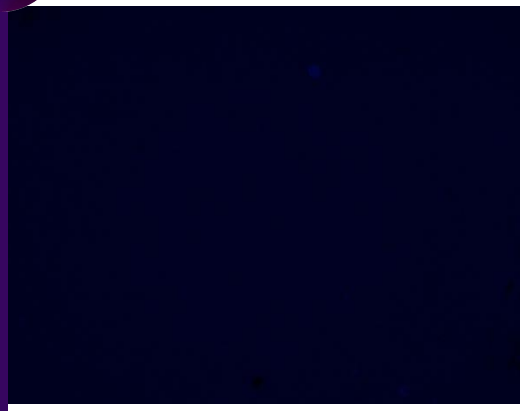
Free retinol + Placebo



Non encapsulated Retinol → droplets appear **blue** outside & around the empty capsules

3

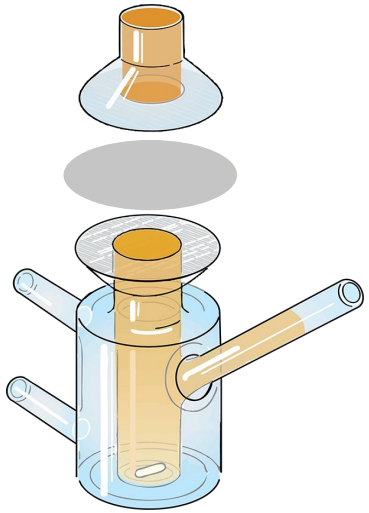
Encapsulated retinol



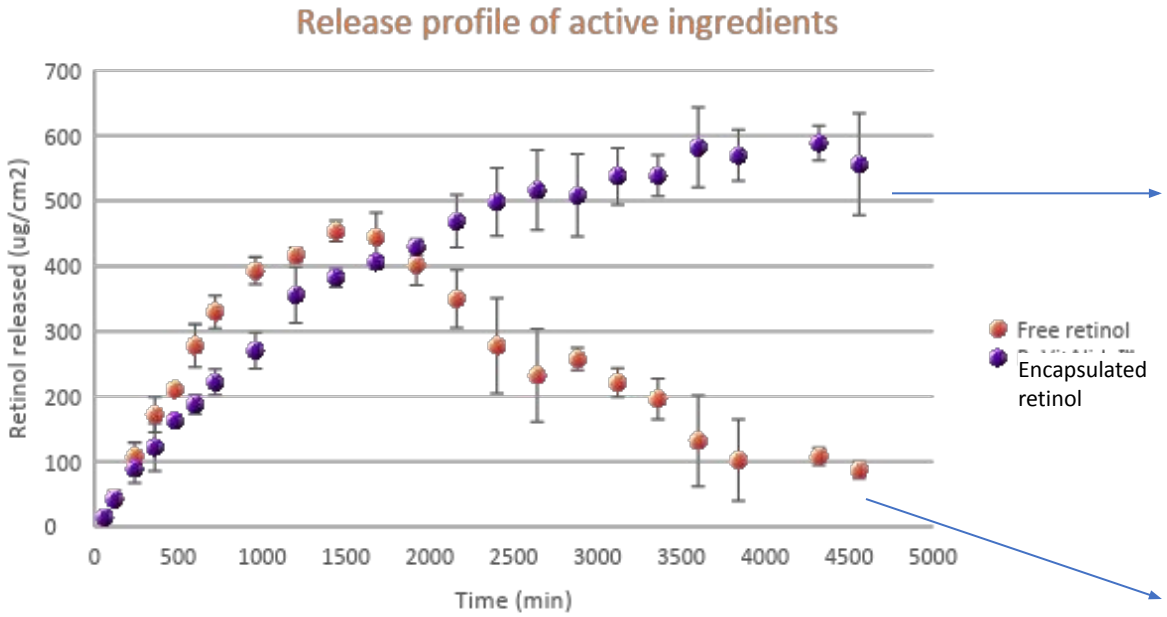
Retinol is inside the capsule (fluorescence is hidden) → appears **black**

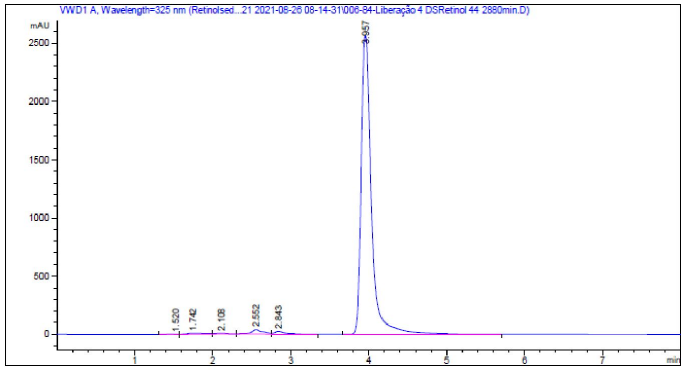
4

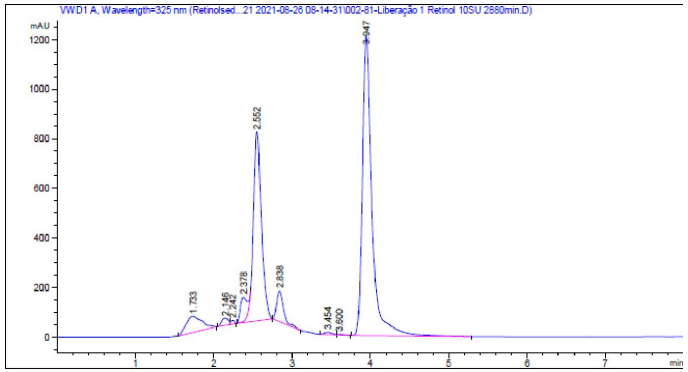
In vitro release profile



Franz diffusion cell





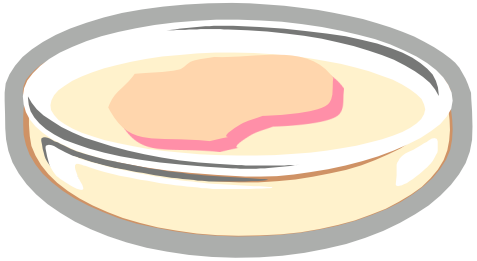


Skin penetration evaluation

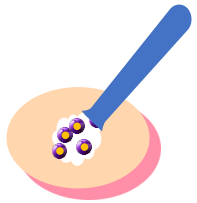
ex vivo

Via Raman spectroscopy

Studies performed by BIO-EC (France) on skin explants (abdoplasties from a 46 and 40-year old female donors)



Skin explants kept alive under physiological conditions

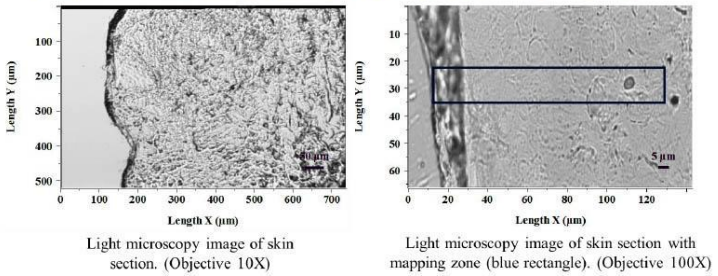


Topical application of a cream containing Encapsulated or free retinol

8 and 24 hours later

Evaluation of the penetration kinetic and tissue distribution of **Retinol** using **Raman spectroscopy** after tissue fixation

Example of Raman image acquisition on a cross section of skin explant:



Light microscopy image of skin section. (Objective 10X)

Light microscopy image of skin section with mapping zone (blue rectangle). (Objective 100X)

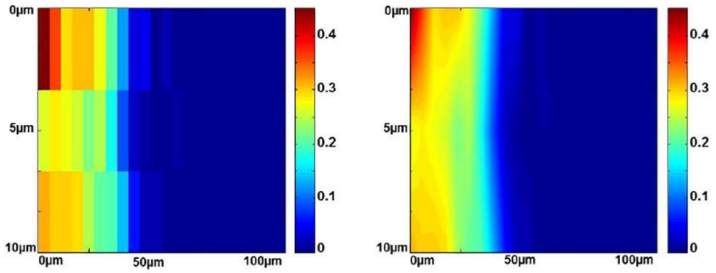


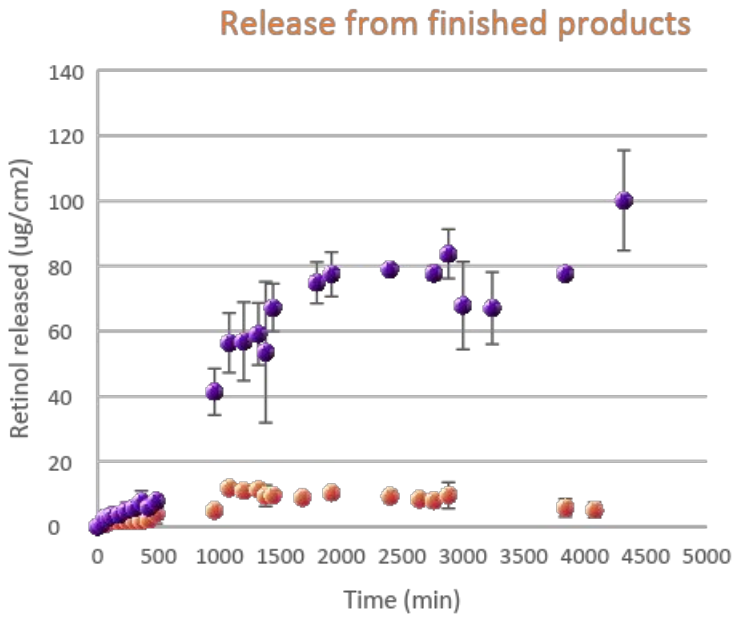
Image analysis process:

- Elimination aberrant spectra
- Baseline correction
- Smoothing & normalisation)

Skin penetration kinetic

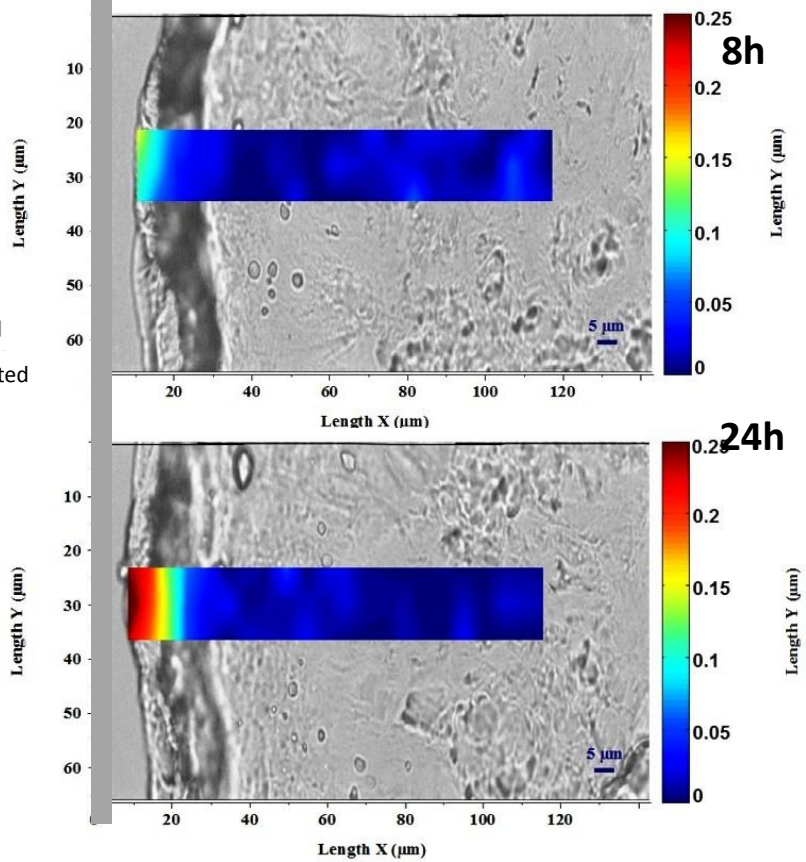
ex vivo

TARGETING



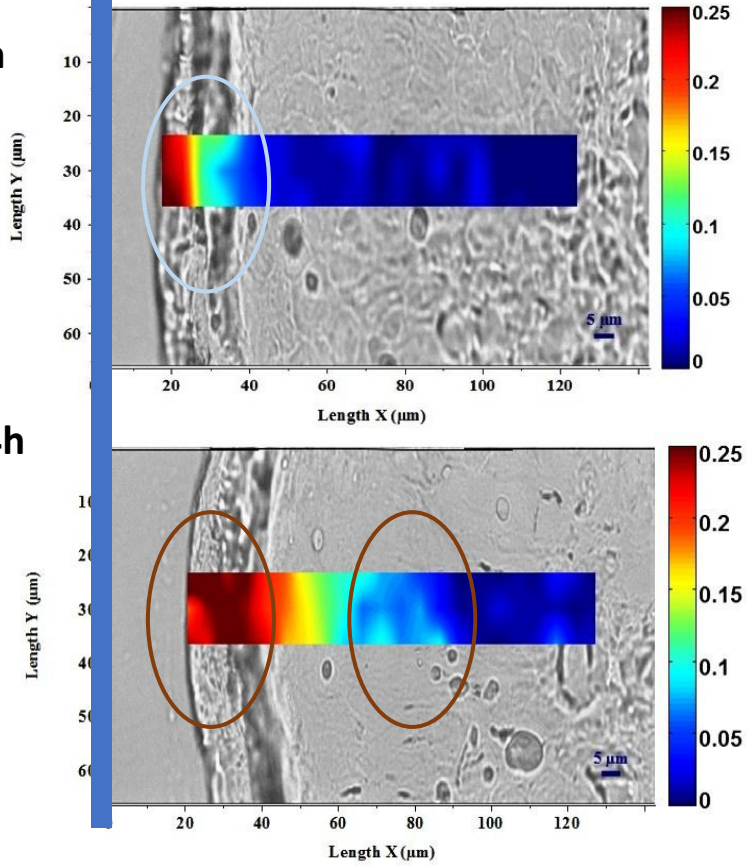
In vitro Franz cells

Free retinol



Encapsulated retinol 9 %*

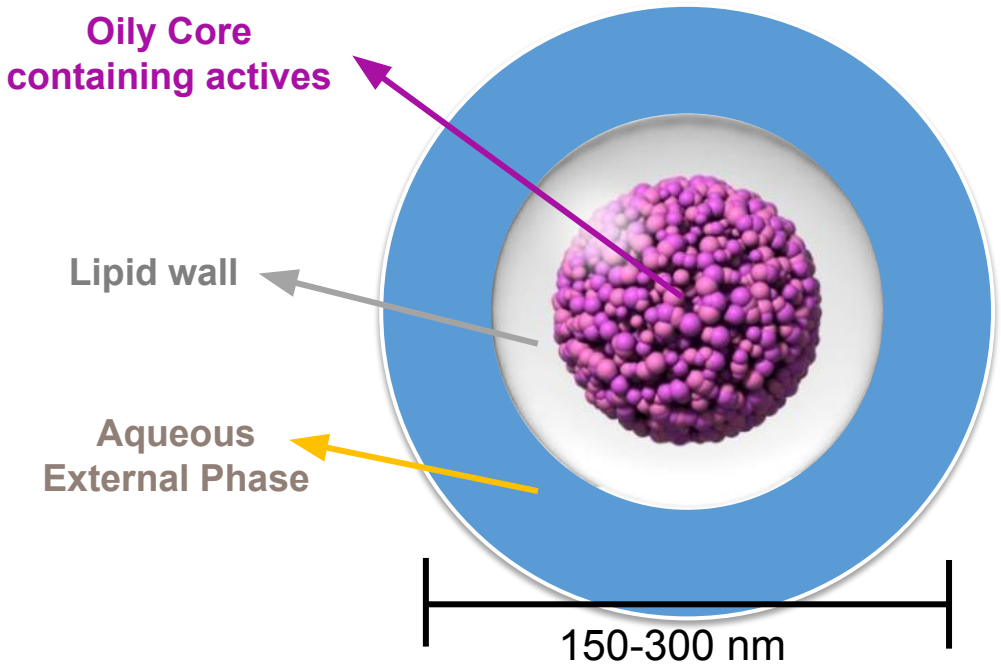
(*): 0.27 % active retinol



Improving delivery and efficacy

DELIVERY

Essential in maintaining ***homeostasis*** of the scalp and hair, ***reducing*** excessive ***sebum*** production and ***preserving*** the integrity of the ***skin barrier***



APPLICATIONS

- → Shampoos
- → Conditioners – Leave-on
- → Conditioners – Rinse-off
- → Hair Treatments
- → Hair Styling
- → Low-Poo/No-Poo Systems

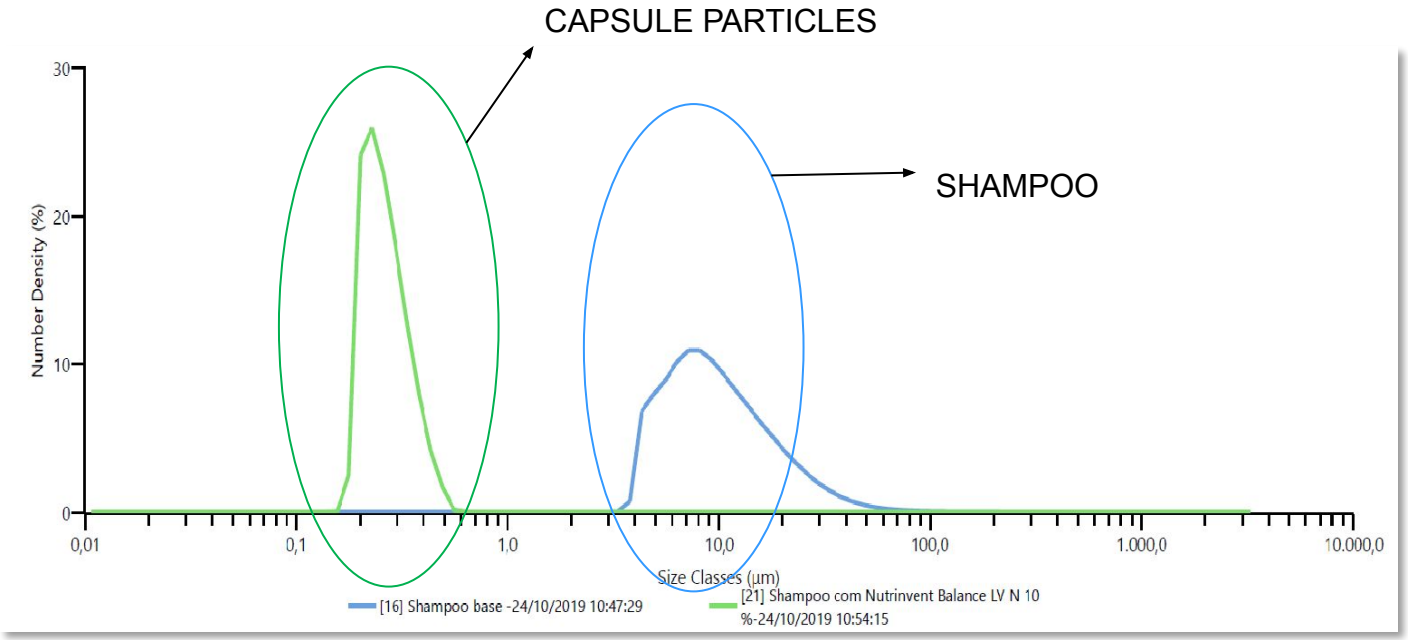
TEA TREE OIL

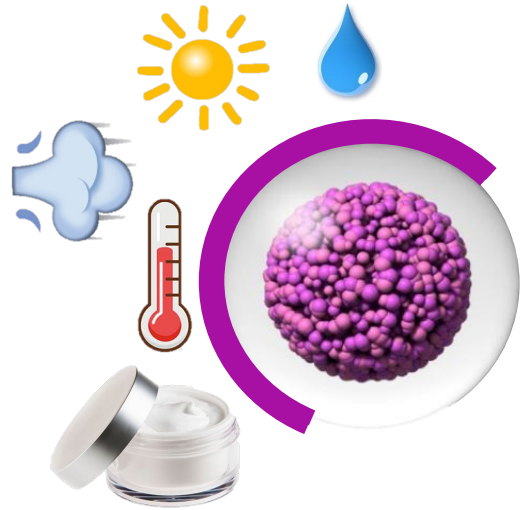
SUNFLOWER OIL

ROSEMARY EXTRACT

PUMPKIN SEED EXTRACT

Formulation and Active Stability



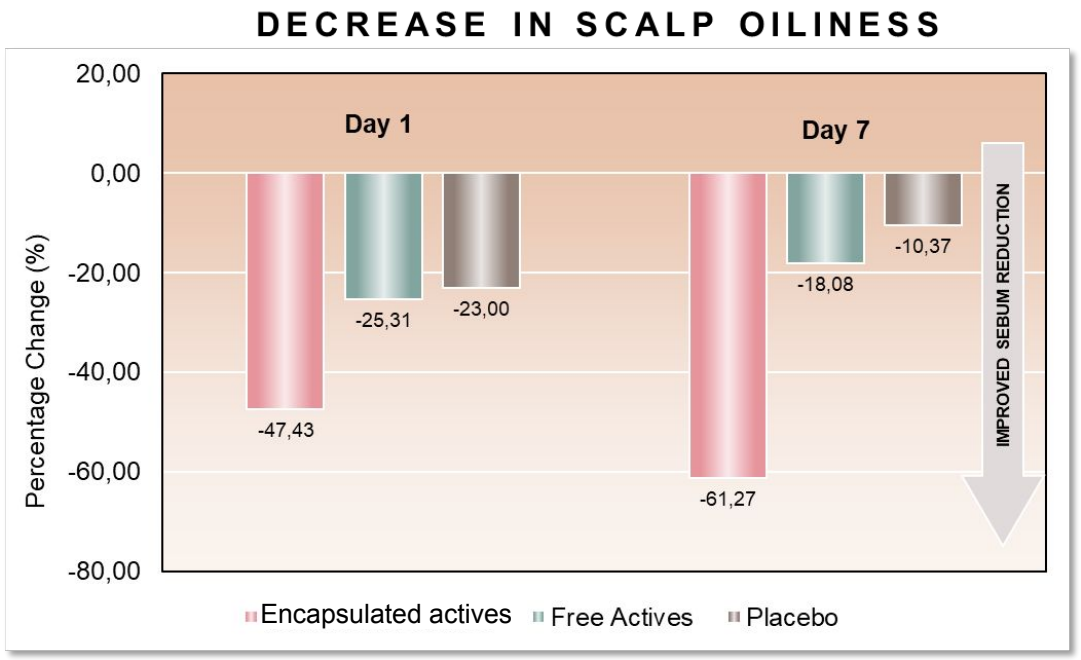


Encapsulation enhances formulation stability and compatibility

→ Capsule particles can easily be distinguished from shampoo base, showing they do not degrade within formulation

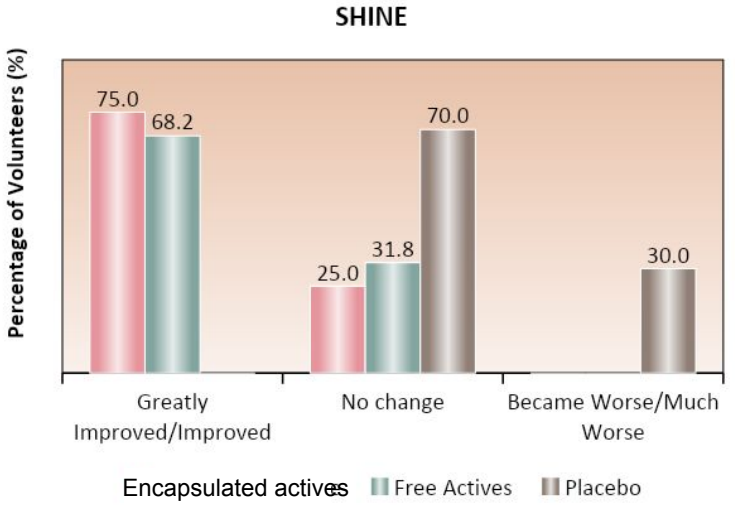
Clinical tests

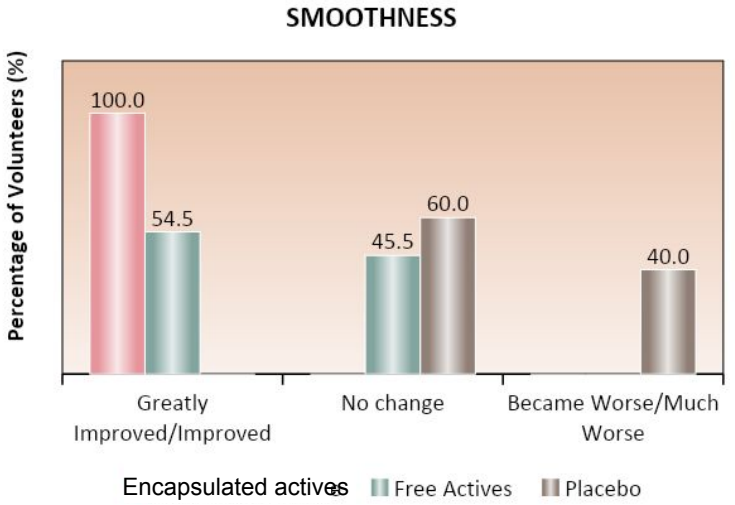
Objective analysis - Sebumeter



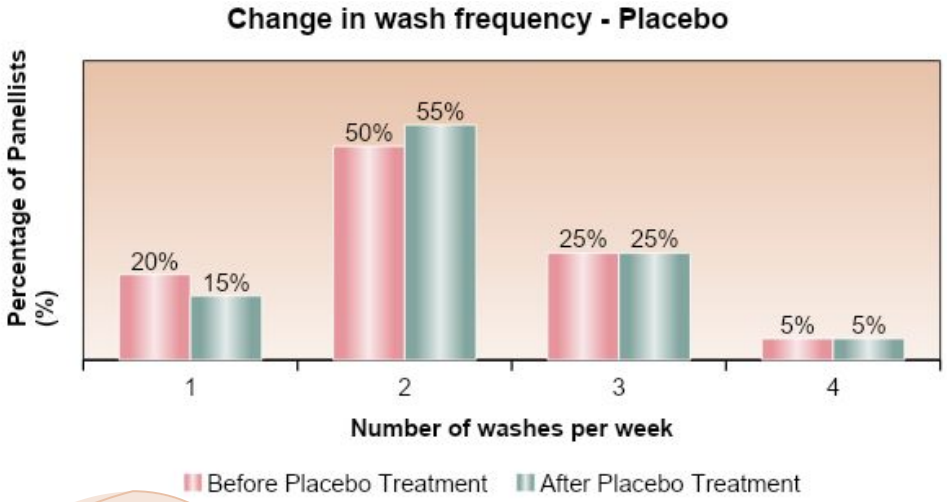
Shampoo and conditioner at 1% of the encapsulated actives

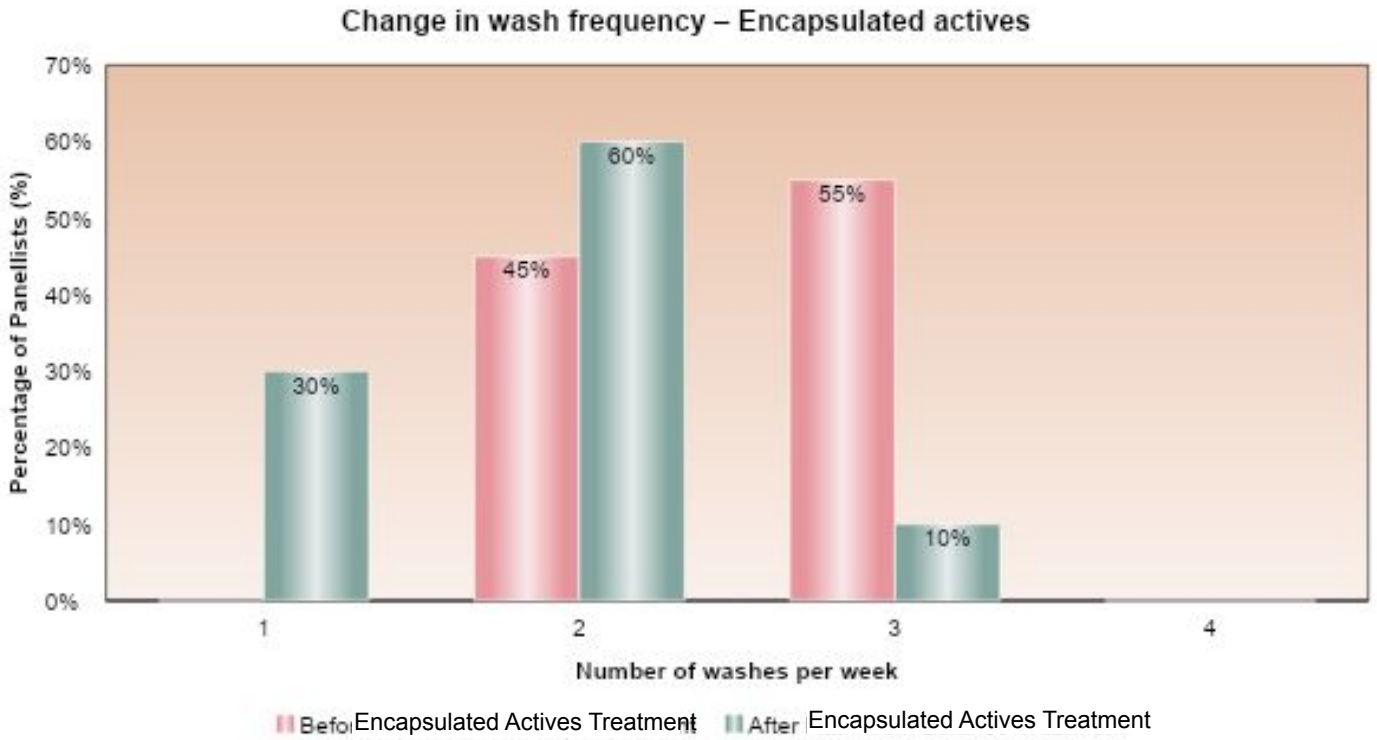
Subjective evaluation





Original Claims – Offering new solutions to consumers





Placebo demonstrated a 2.2% increase in wash cycles

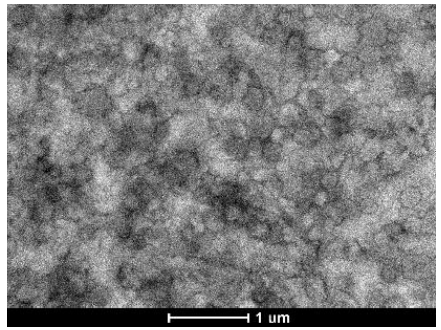
Encapsulated actives offered an average reduction in wash cycles of 29.4%

Compared to the placebo regime that remained largely unchanged

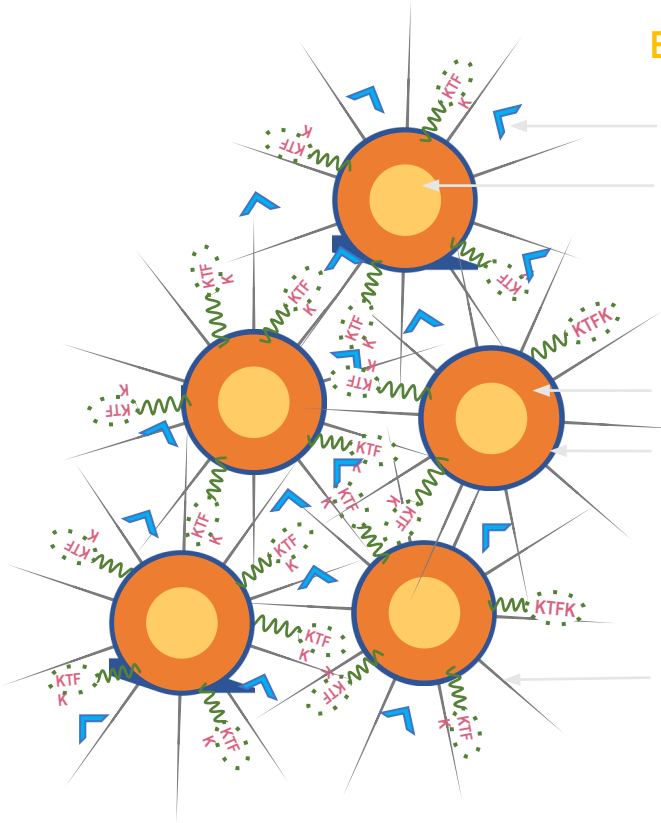
Vectorisation

By being amphiphilic, the palmitoylated peptide mainly sets at the interface of the oil soluble and water soluble phases, trapped by the waxy structure.
When formulated, the progressive melting and degradation of cetyl palmitate will slowly release the peptide.

0 % free form, 100 % portage



Transmission electron microscopy visualisation after drying sample (diluted 100x) in a copper grid and stained with uranile acetate solution (1%) for 1 minute.



External phase: Water

Internal oil soluble phase:
Caprilic/capric triglyceride + sorbitan stearate

Inner shell: Cetyl palmitate

Outer shell:
Hydrogenated lecithin

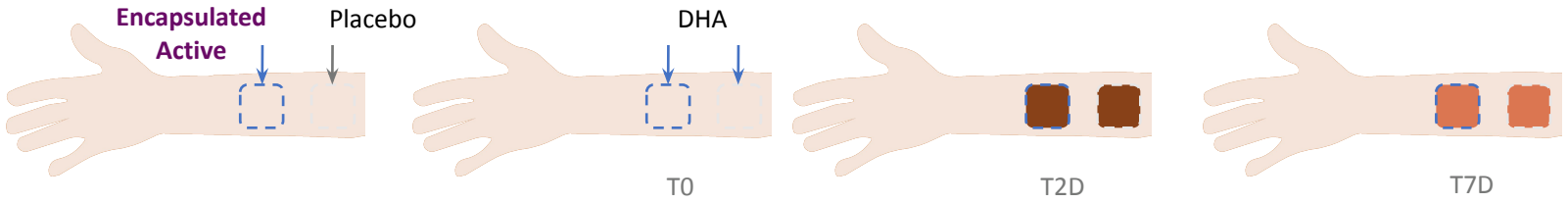
Stabilisation in the water soluble phase:
Polysorbate 80

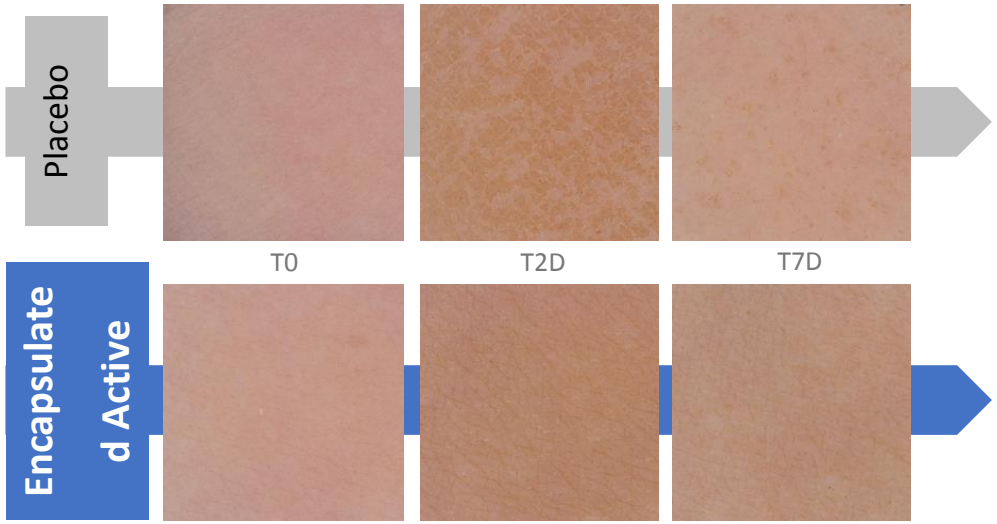
Protocol evaluation

in vivo

First test

Evaluation of the soft-polish effect by colour camera on 20 Caucasian volunteers on the forearm. 5 expert judges. Cream with 3 % **Encapsulated active**.





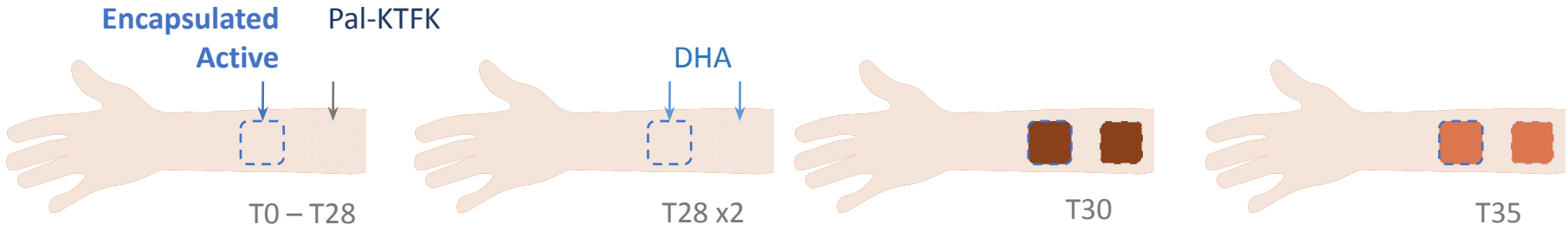
The soft-polish effect of **the active**

- enables the regular elimination of accumulated pigments in the epidermis
- restores the skin surface for a radiant appearance.

Second test - Benefits of the vectorisation

in vivo

Evaluation of the lipopeptide spreadability by assessment of the skin colour homogeneity, by C-Cube dermatoscope and 7 trained assessors. Twice-daily application on the forearm of 18 volunteers (mean age: 39.8) for 28 days of a cream with 3 % **Encapsulated Active** against a cream with 3 % pal-KTFK. Skin colouring with DHA.



- The skin **colour** is more **homogenous** after treatment with **Encapsulated Active**
- The skin **desquamation** process is then more **harmonious** after treatment with **Encapsulated Active**
- Thanks to the vectorisation, the lipopeptide can **spread more homogenously** on the skin surface.

Conclusions

- Each product development is unique, and the purpose will guide the Project design
- Similar Technologies can be applied to different products and exhibit unique benefits
- Consumer acceptance is fundamental
- Once launched, it can always be amended new tests to prove the product benefits

Session:
Delivery technologies in cosmetics and consumer products

Thank you

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