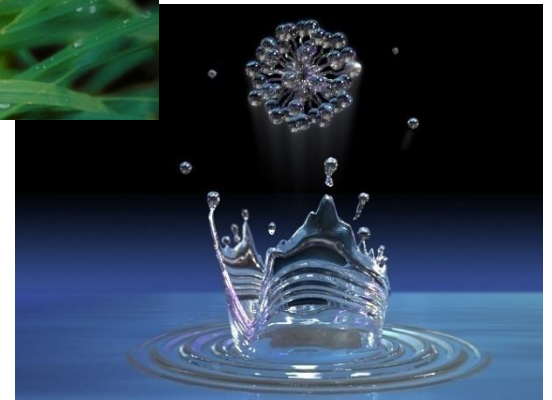
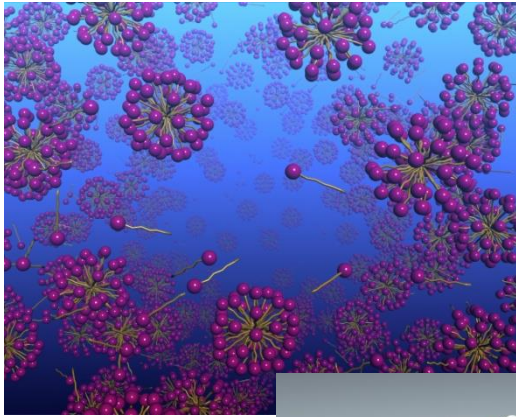




New formulation for oral care

Emile PEREZ

***co-leader of the SMODD team, laboratoire des
IMRCP, UMR5623 Toulouse, France***



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Numerous industrial collaborations

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- **Aeronautics and space (Airbus and Airbus DS)**
- **Cosmetic (Pierre Fabre, Affichem, Gattefossé)**
- **Food industry (Poult, Nataïs, AGIR)**



Pierre Fabre
Dermo-Cosmétique

- 2 products marketed with Pierre Fabre (Trixera+® et Triacneal®)
- Sunscreen oils formulation (PF)
- Whitening formulations (PF, CERPER)
- Analytical evaluation of ELUDRIL® and one of its generics.

Nanoparticles of organogels or gelsosomes

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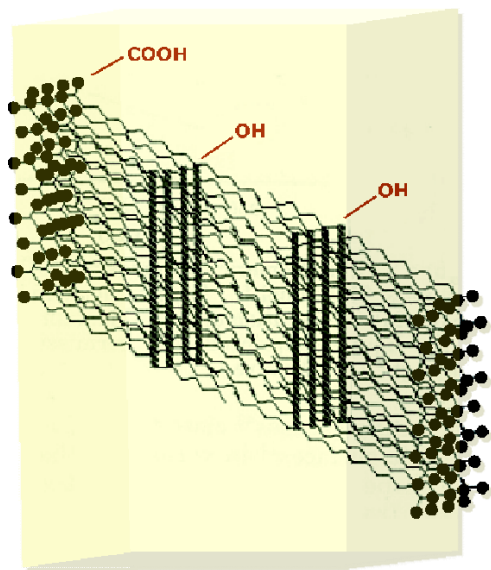
Principle of preparation and applications

"Nouvelles particules d'organogel, leur procédé de préparation, et leurs utilisations en cosmétique"

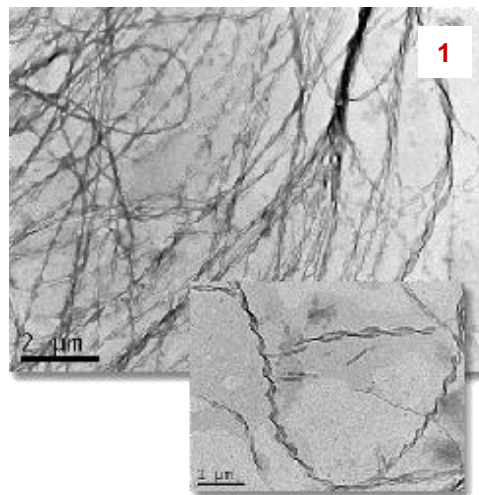
P. KIRILOV, S. FRANCESCHI, E. PEREZ, I. RICO-LATTES, P. BORDAT

BF n° 06 08371, déposé le 25/09/2006 par la Société Pierre Fabre dermo-cosmétique

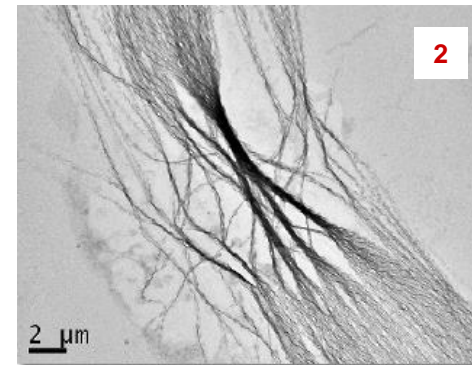
Organogelator: HSA



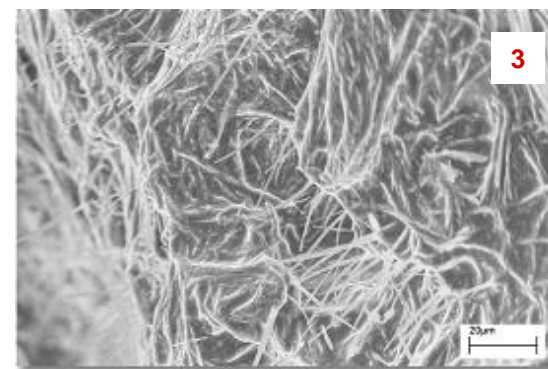
Self assembly in a 3D network of fibers



HSA self-organization in fibrils



Fiber bundles



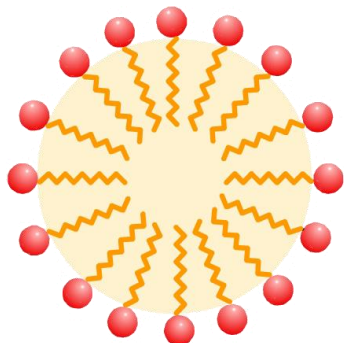
Gel: 3D fiber network

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Organogel nanoparticles or gelsomes preparation

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Droplet of emulsion
oil + HSA

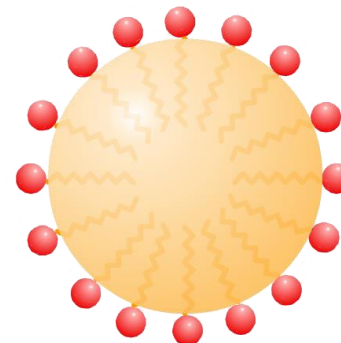


$T^\circ > T^\circ_{gel}$

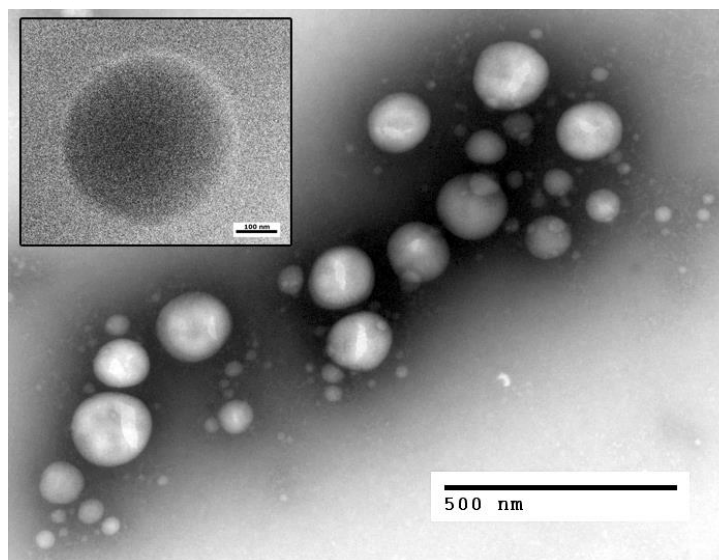
Cooling
→
Stabilizing agent



Functionalized gelsome



$T^\circ < T^\circ_{gel}$

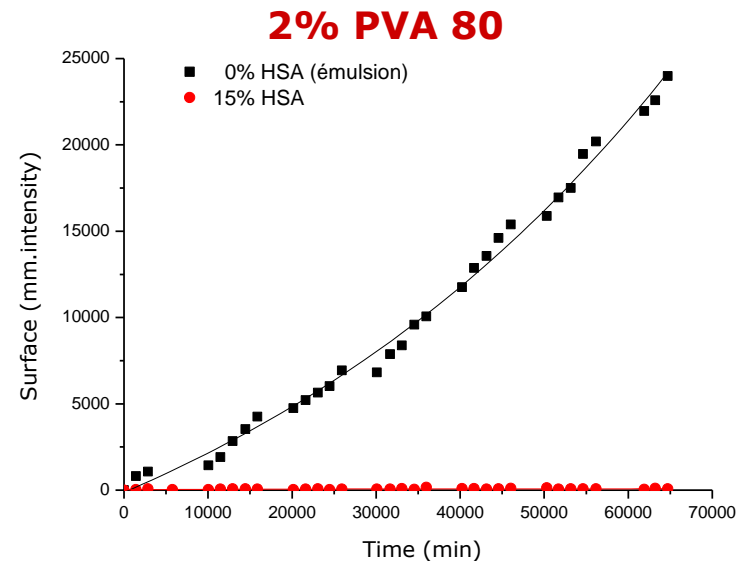
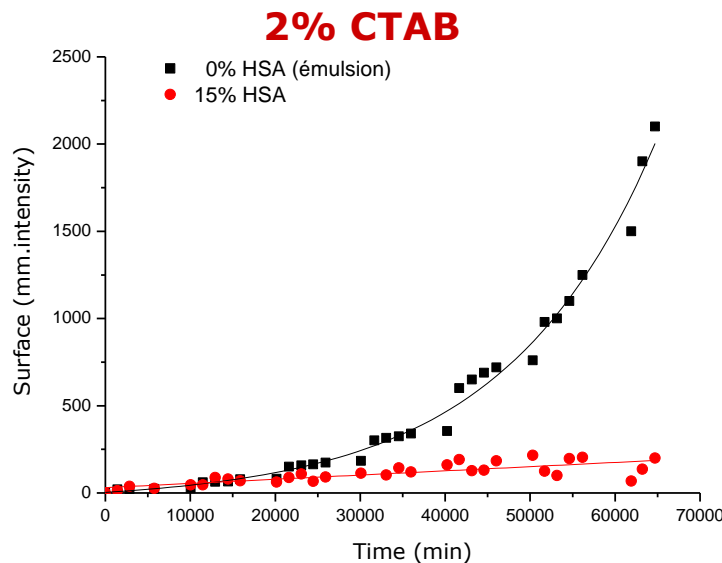


TEM of gelsomes

Sonication

Emulsions stability/gelosome dispersions

5% oil with and without HSA during 45 days



✓ gelosomes dispersions more stable than the corresponding emulsions

- No coalescence (semi-rigid droplets)
- Good stabilization of the interface (surfactant adsorption)

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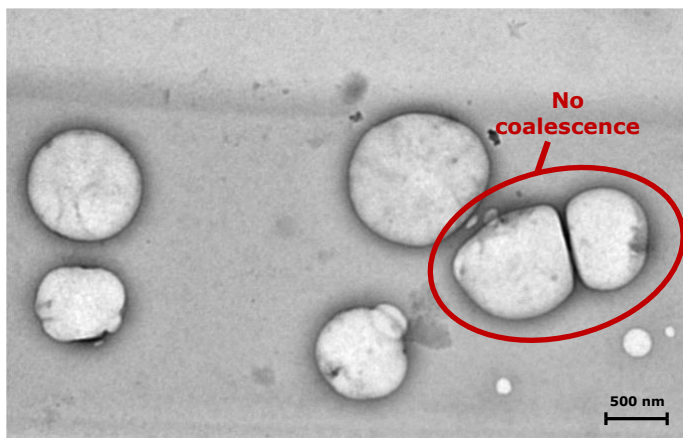
Gelosomes of sunscreen oil

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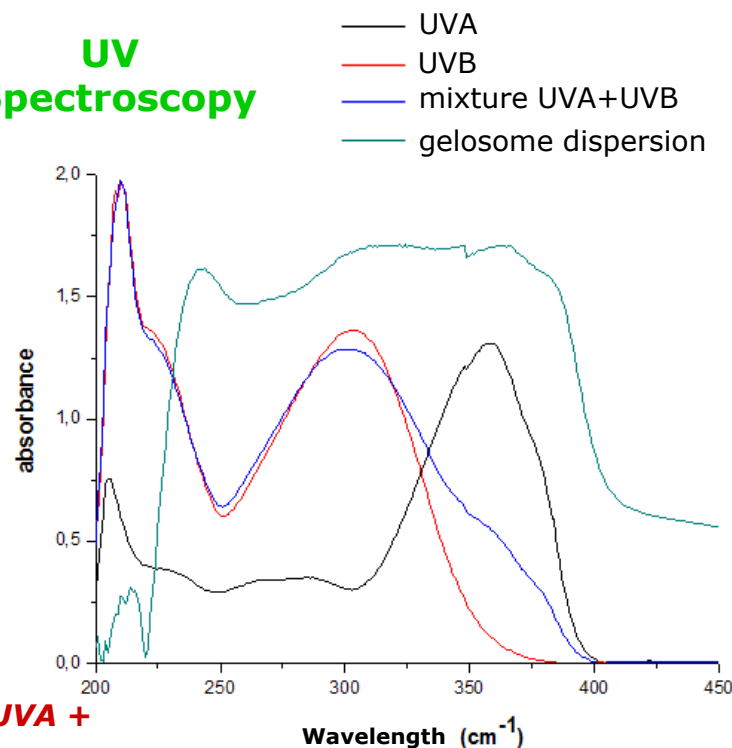
Used sunscreen : Avobenzone UVA (17%), solubilized in octocrylene UVB

Mixture composition : 15% HSA, PVA 80 2%, oil 10% $T_{gel} \sim 70^{\circ}\text{C}$

Mean diameter 800 nm (TEM)



UV Spectroscopy



- Absorption of dispersions in UVA and UVB
- Absorbance intensity greater than the mixture (UVA + UVB).
- Phenomenon of optical diffusion of the gelosomes



Pierre Fabre

Gelosomes and essential oils (EO)

- Use of gelosomes to introduce essential oils into oral care formulations***
- Proof of concept with Toulouse Tech Transfer***

Methods to introduce essential oils in an aqueous phase

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1) Homogeneous systems :

- **Use of a cosolvent(ethanol)**
Disadvantages → irritation, toxicity, regulation
- **Use of solubilizers (short chain surfactant (SU))**
Disadvantages → Important amount (40% SU for 10% EO)

2) Heterogeneous systems :

- **Emulsions**
Disadvantages → Unstable systems
- **Gelosomes**
Advantages → Stable systems
Disadvantages → Need gelation of EO + vegetable oil

Existing mouthwashes based on essential oils:

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Advantages :

- Antibacterial products of natural origin
- Low but persistent antibacterial activity
- Respect of the oral ecosystem (moderate activity spectrum)
- Possible daily and prolonged use
- Possible synergy by mixing essential oils

Disadvantages :

- Essential oils insoluble in water



- Mouthwashes based on ethanol
- Mouthwashes based on instables O/W emulsions

Oily mouthwashes (oil pulling, ayurvedic medicine) :

Advantages :

- Natural antibacterial vegetable oils
- Solubilizes fatty waste in the mouth
- Antibacterial on specific strains (*Streptococcus mutans* for sesame and coconut oil)
- Limits the erosion of enamel and dentine (lubricating film)
- Very trendy practice (yoga, Indian medicine)

Disadvantages :

- Very limited antibacterial activity
- Unpleasant fatty sensation in the mouth, gagging
- Must be stirred in the mouth for a long time (20 min) to form an effective emulsion
- After use, requires rinsing and brushing teeth
- Limited to oils with pleasant taste (coconut, sesame)

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Choice of essential oils

- According to the literature:
 - Thyme essential oil:
 - Antibacterial
 - Clove essential oil:
 - Antibacterial
 - Antihaemorrhagic
 - Tea Tree essential oil:
 - Antihaemorrhagic
- Possibility to choose other essential oils according to the desired properties
- Possibility also to choose a vegetable oil with interesting properties

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Antibacterial Test 1

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- Test to prove the effectiveness of EO
 - Tests performed in the laboratory FONDEREPHAR (Toulouse)
- Study n°1 : Evaluation of the inhibitory activity of 3 essential oils
 - Test carried out on agar media
 - Study of EO activity on 10 strains of bacteria

Antibacterial Test 1

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Bacteria	Type	Chlorhexidine	Sunflower oil	EO Tea Tree	EO Clove	EO Thyme
<i>Lactobacillus casei</i>	Gram +	0.25%	> 5%	5%	0.625%	1.25%
<i>Porphyromonas gingivalis</i>	Gram -	0.125	> 5%	0.31%	< 0.16%	< 0.16%
<i>Prevotella intermedia</i>	Gram -	0.25%	5%	1.25%	0.625%	0.16%
<i>A. actinomycete mcomitans</i>	Gram -	<0.03%	> 5%	< 0.16%	< 0.16%	< 0.16%
<i>A. odontolyticus</i>	Gram +	<0.03%	> 5%	< 0.16%	< 0.16%	< 0.16%
<i>S. salivarius</i>	Gram +	<0.03%	> 5%	0.625%	< 0.16%	< 0.16%
<i>S. mutans</i>	Gram +	<0.03%	> 5%	0.625%	< 0.16%	< 0.16%
<i>T. forsythensis</i>	Gram -	<0.03%	> 5%	0.625%	< 0.16%	< 0.16%
<i>C. Rectus</i>	Gram -	<0.03%	> 5%	0.31%	< 0.16%	< 0.16%
<i>Wolinella species</i>	Gram -	<0.03%	> 5%	0.31%	< 0.16%	< 0.16%

- Study carried out with CIP bacteria (Collection de l'Institut Pasteur)

Antibacterial Test 2

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- Evaluation of the antibacterial activity of gelosomes containing essential oils
 - Test carried out on stirred culture medium
 - The samples to be analyzed are suspended in the culture medium with the bacteria
 - Different dilutions are made, the presence or absence of turbidity indicates the antibacterial activity of the sample
 - Activity study on 2 bacteria
 - *Lactobacillus casei*
 - *Prevotella intermedia*

Stability study of the gelosomes

- Study carried out with the LUMiFuge®
 - Technique that accelerates the aging of emulsions and dispersions
 - Analytical centrifugation
- Study carried out with gelosomes at 20% oil at 4000 rpm speed

Sunflower oil	EO Thyme	EO Clove	Destabilization (%/h)
100%	0%	0%	2.00
95%	5%	0%	2.30
95%	0%	5%	1.91
95%	2.5%	2.5%	2.08

- Gelosomes stability >> 1 an

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Gelosomes mouthwashes (vegetable oil + EO) :

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Advantages :

- Advantages of EO (natural antibacterials)
- Benefits of the oil pulling
- Modular efficiency according to the duration
- Very stable dispersion of gelosomes
- Possible daily and prolonged use (respect of the oral ecosystem)
- Synergy vegetable oil/essential oils (cleansing and antibacterial)

Inconvénients :

- Milky aspect...



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