

**CODIF**  
R&N

# PHYCOSACCHARIDE AC

Get it over with acne!





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# PHYCOSACCHARIDE AC

## OVERALL ANTI-ACNE TREATMENT

Phycosaccharide AC is a biotechnological product that treats all of the cutaneous disorders associated with acne: excess sebum production, bacterial spots, acneic lesions, inflammation, and scarring.

This complete treatment and reparative action is provided by a specific oligoalginate whose design is inspired by an original defence system developed between a brown alga and its symbiotic micro-organism. The chelation of the oligoalginate with zinc results in an active compound with antimicrobial, soothing, and reparative virtues to treat all types of acneic skins.

## AT THE ORIGIN...

The development of this active ingredient began with a surprising discovery.

Certain brown algae with very high polysaccharide content have a sugar composition that is very beneficial for skin health. Whilst working on the composition of the cell walls of Laminaria, which are rich in mucilage, Codif Recherche et Nature laboratories discovered a marine micro-organism living in symbiosis with the brown alga. The role of the micro-organism in this mutually beneficial relationship is crucial. On its own, the alga is incapable of controlling the accumulation and degradation of the polysaccharides that compose its mucilage. The micro-organism intervenes in their digestion by secreting an enzyme called alginate lyase.

This symbiotic lifestyle becomes even more interesting when the brown alga is attacked. Under such circumstances, the micro-organism synthesises a high quantity of alginate lyase to release small fragments of oligosaccharides capable of activating the defence systems of the alga.

In an effort to combat acneic infections, our laboratories have developed a production method for Phycosaccharide AC in accordance with this symbiotic life. An alginate lyase of marine origin is produced and purified via the culture of the marine micro-organism. Polysaccharides of Laminaria harvested in the natural habitat are then digested by the marine enzyme to obtain an oligoalginate. The latter is finally chelated with zinc to obtain our active ingredient Phycosaccharide AC.

## ACTION MECHANISM

Acne results from various metabolic disorders at the level of the sebaceous units located in the dermis. The latter are composed of a follicle and a sebaceous gland whose principal function is the production of sebum. This mixture of fats and waxes is designed to form a barrier on the surface of the skin and limit water losses.

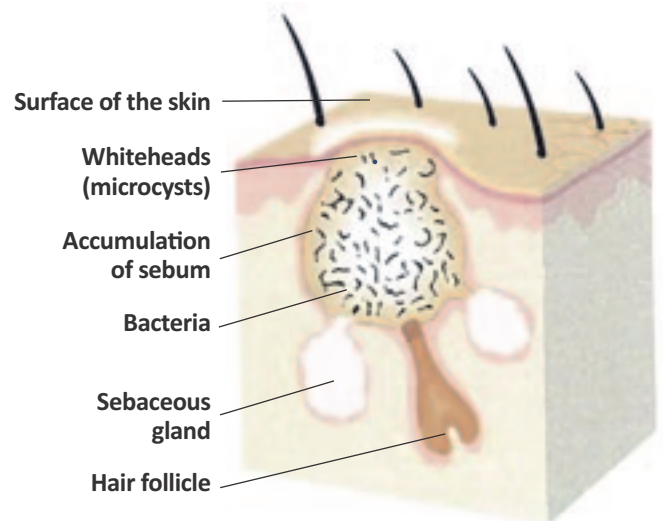
At puberty, under the effect of hormones, the sebaceous glands secrete large quantities of sebum that make the skin oily and shiny. When this overproduction of sebum is accompanied by bacterial development and thus an infectious state, acneic lesions develop.

There are two types of acneic lesions according to the stage of infection of the follicle.

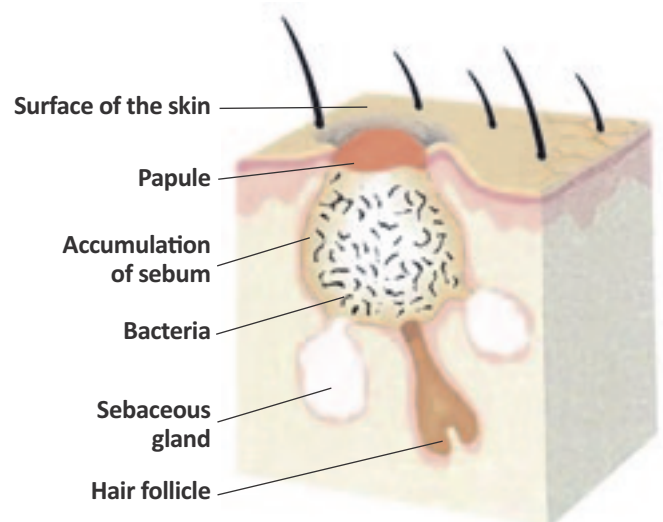
Retentional lesions: these are the first to appear. As their name indicates, they are due to the retention of the sebum under the surface of the skin. This retention creates white spots called microcysts, or comedones and blackheads, when the phenomenon is accompanied by an accumulation of keratin.

Inflammatory lesions: these appear secondarily and are due to inflammation of the hair follicle under the effect of a bacterial infection. They are characterised by the development of red spots: papules, often accompanied by a white spot called a pustule.

### RETENTIONAL LESION



### INFLAMMATORY LESION



PHYCOSACCHARIDE AC reduces the production of sebum as well as the growth of *Propionibacterium acnes* (*P. acnes*) and *Staphylococcus aureus* (*S. aureus*) bacteria to limit acneic tendencies. It also reduces inflammation of the lesions and accelerates healing.

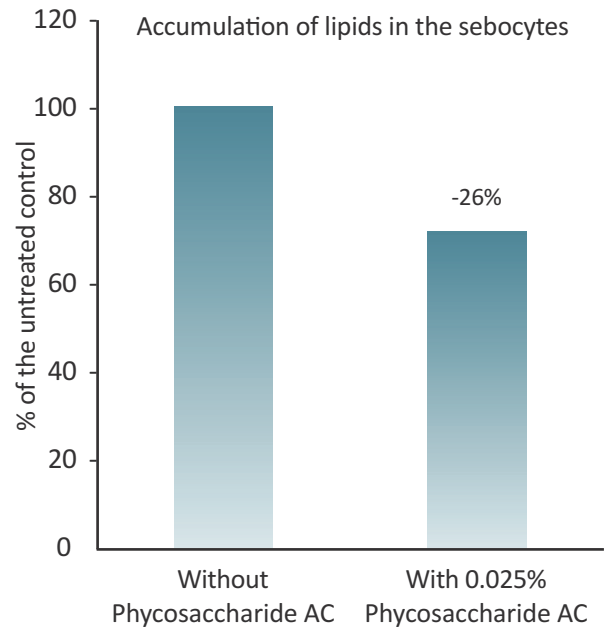


## IN-VITRO TEST TREATING ACTION

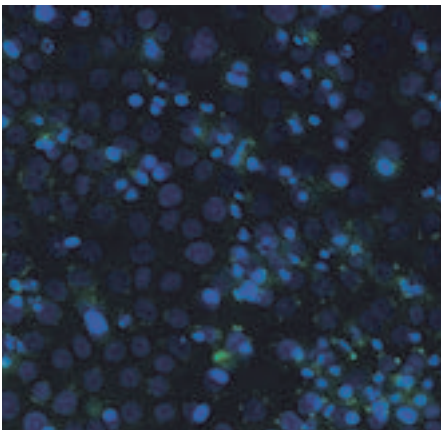
PHYCOSACCHARIDE AC REDUCES THE PRODUCTION OF SEBUM BY -26%.

PHYCOSACCHARIDE AC inhibits the synthesis and accumulation of lipids in the sebocytes thus regulating the production of sebum.

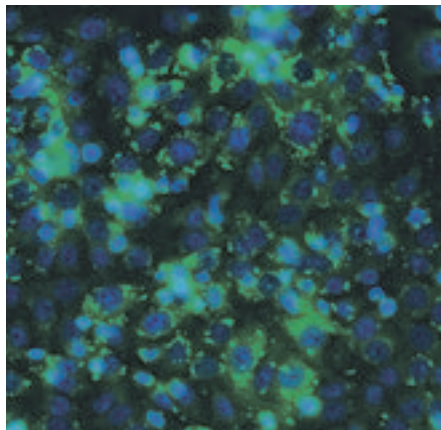
*Protocol: human sebocytes stimulated with testosterone and treated with 0.025% Phycosaccharide AC. Visualisation and measurement of the quantity of lipids by fluorescence (green).*



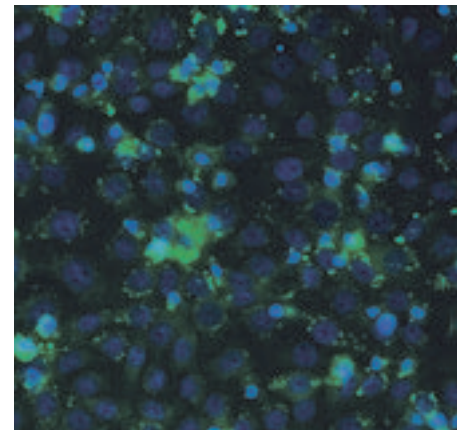
Visualisation of the accumulation of lipids (green fluorescence) in the sebocytes.



Unstimulated sebocytes



Stimulated sebocytes



Stimulated sebocytes treated with Phycosaccharide AC

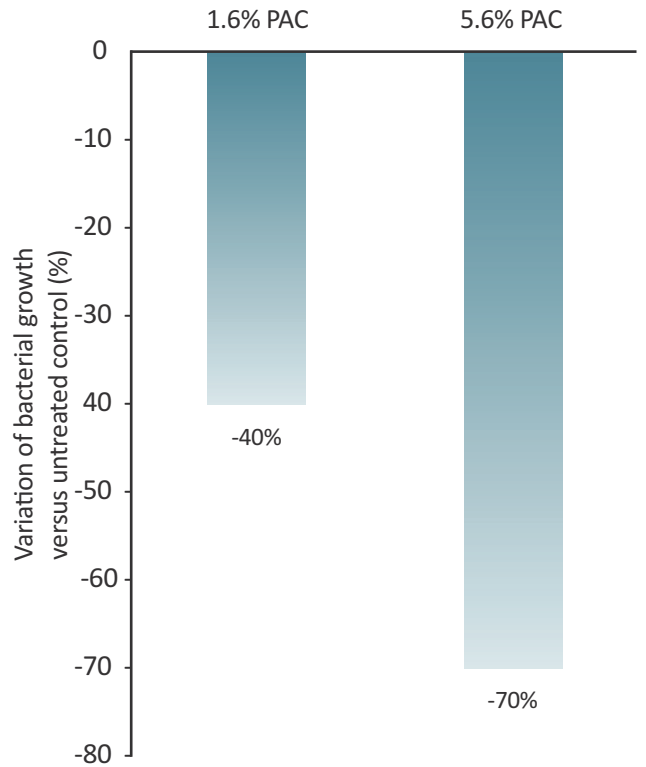


## IN-VITRO TEST TREATING ACTION

PHYCOSACCHARIDE AC (PAC) INHIBITS  
THE GROWTH OF *P.ACNES* BY -70%.

Phycosaccharide AC inhibits the growth of *P. acnes* by up to -70%. This action reduces infection.

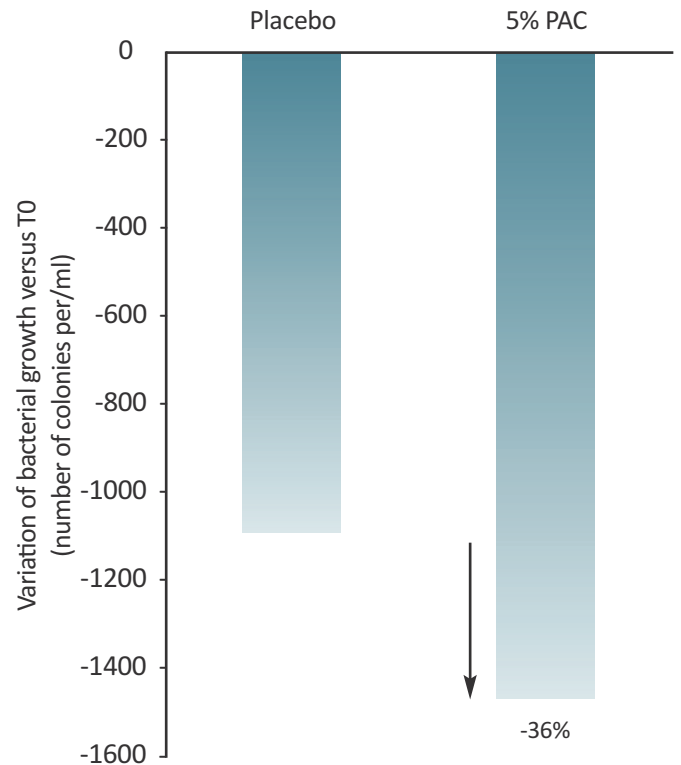
*Protocol: culture of P. acnes in liquid medium with or without Phycosaccharide AC (PAC). Evaluation of bacterial growth by turbidity at 750 nm after 48 hours of culture.*



## PHYCOSACCHARIDE AC INHIBITS THE GROWTH OF *S.AUREUS* BY -36%.

Phycosaccharide AC inhibits the growth of *S. aureus* by -36% compared to the placebo.

*Protocol: 12 volunteers with acne applied a gel containing 5% PAC twice daily for 28 days. Bacterial sample on two zones of the face and culture for 48 hours. The results were expressed as the variation of the number of colonies per millimetre between D0 and D28.*





## IN-VITRO TEST REPARATIVE ACTION

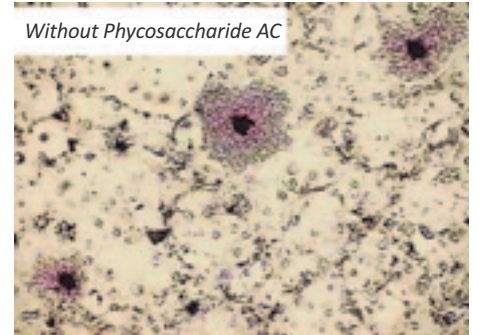
### PHYCOSACCHARIDE AC STIMULATES THE PROCESSES OF RE-EPITHELISATION

*Kawada and al* (1) demonstrated that oligoalginates with a similar composition to Phycosaccharide AC act as cofactors of EGF (Epidermal Growth Factor), in the recruitment and activation of keratinocytes during re-epithelisation of the skin. The rate of division and recruitment of keratinocytes can be determined by the size of the colonies that they form to heal the tissues.

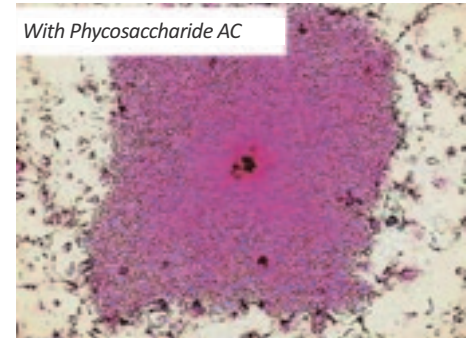
**RESULT: +136% increase in the size of the colonies.**

Phycosaccharide AC, by promoting the recruitment and mobilisation of keratinocytes, increases the size of the colonies by +136%. This promotes the healing of acneic lesions.

*Protocol: keratinocytes from human epidermis cultured with or without 0.5% Phycosaccharide AC for 16 days. The surface area of the colonies was determined after staining with Rhodamine.*



Without Phycosaccharide AC



With Phycosaccharide AC



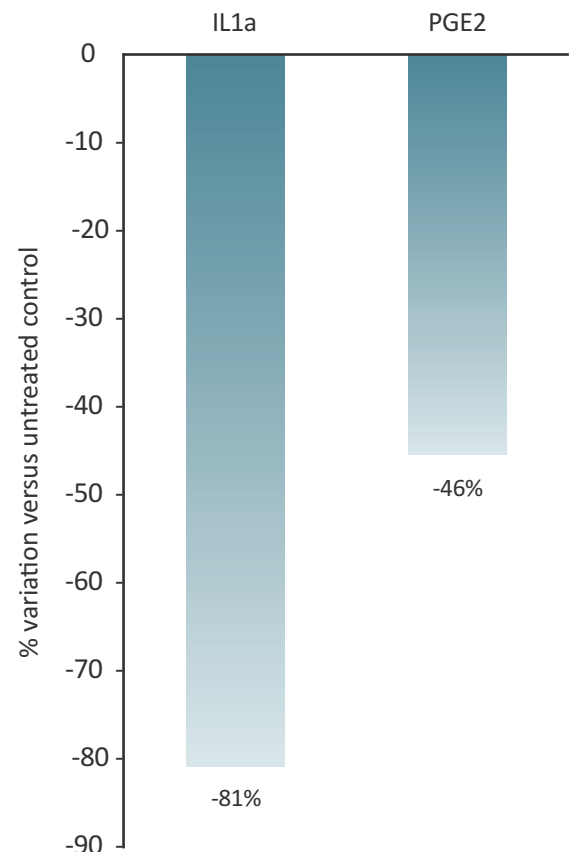
## IN-VITRO TEST SOOTHING ACTION

### PHYCOSACCHARIDE AC REDUCES THE MEDIATORS OF INFLAMMATION: -81% IL1A AND -46% PGE2

Phycosaccharide AC reduces the release of inflammatory mediators, thus promoting a soothing action.

*Protocol: IL1a: human skin explants. Topical application of 1% Phycosaccharide AC followed by exposure to UVBs. Quantification of IL1a in the culture medium, 24h after application.*

*PGE2: human keratinocytes cultured in the presence of a Phorbol ester (PMA) with or without 0.1% Phycosaccharide AC for 24 hours. Quantification of PGE2 in the culture medium.*



## CLINICAL TEST

### PROTOCOL

20 volunteers aged between 14 and 30 years with acneic skins.

Two applications per day of a cream containing 1% Phycosaccharide ACP for 28 days.



### SOOTHING AND REPARATIVE ACTION AFTER 4 DAYS

#### -6%\*\*\* INFLAMMATION

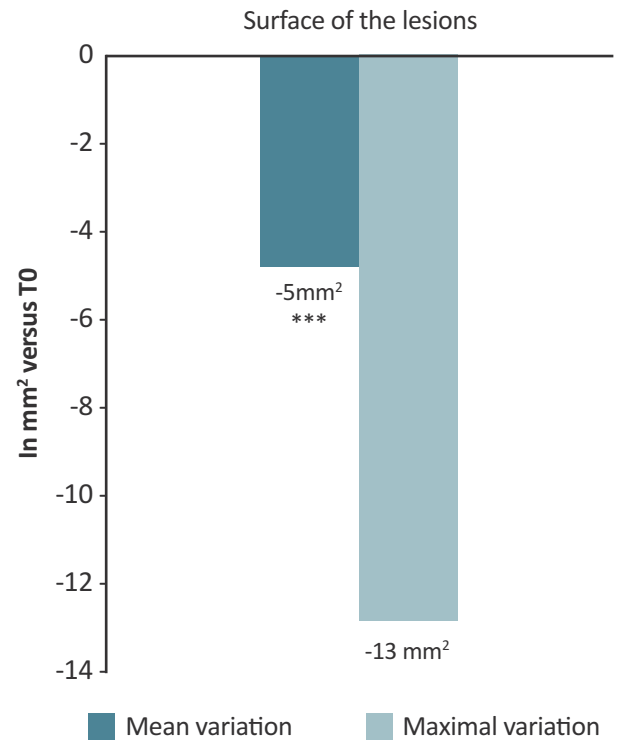
The inflammation of the acneic lesions was reduced by 6%\*\*\* on average and up to -22%

\*\*\* $p < 0.001$  Student test

#### -5 mm<sup>2</sup> IN THE SURFACE OF THE LESIONS

The surface of the acneic lesions is reduced by 5 mm<sup>2</sup>\*\*\* on average and up to -13 mm<sup>2</sup>

\*\*\* $p < 0.001$  Student test

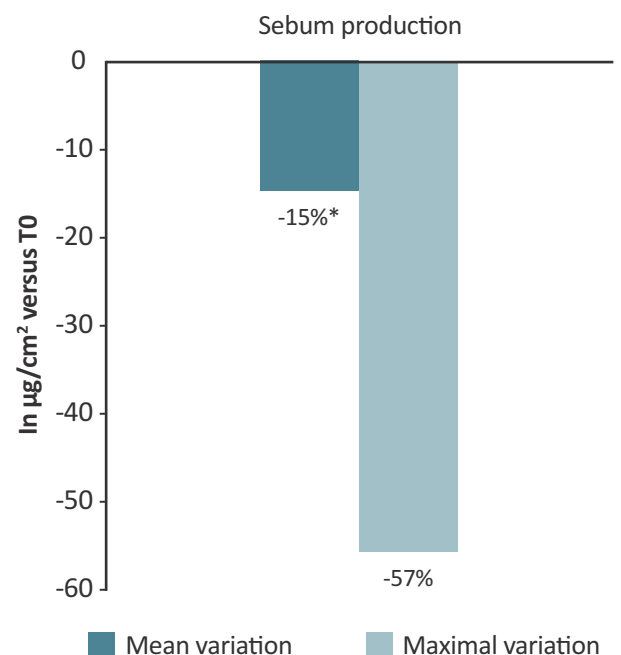


### TREATING ACTION AFTER 28 DAYS

#### -15%\* OF SEBUM ON THE SURFACE OF THE SKIN

The quantity of sebum on the surface of the skin was reduced by 15%\* on average and up to -57%. The speed with which the skin becomes oily again was also reduced by 9%\*\*\* on average.

\* $p < 0.05$  ; \*\*\* $p < 0.001$  Student test







## TREATING ACTION AT 28 DAYS

### -6%\*\*\* OF RETENTIONAL LESIONS

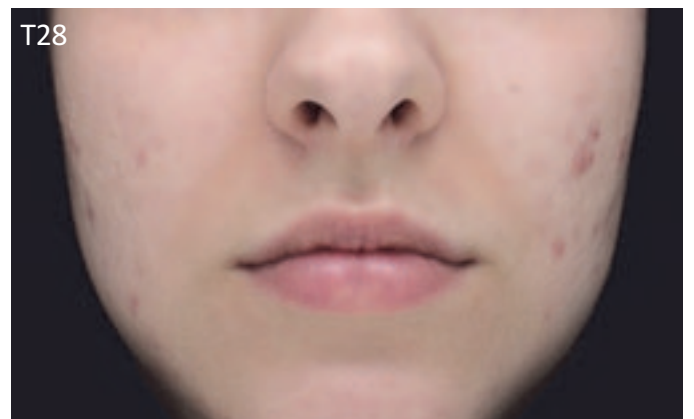
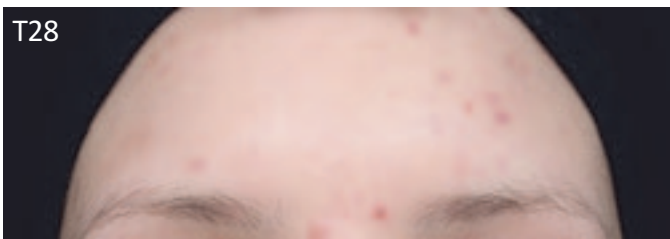
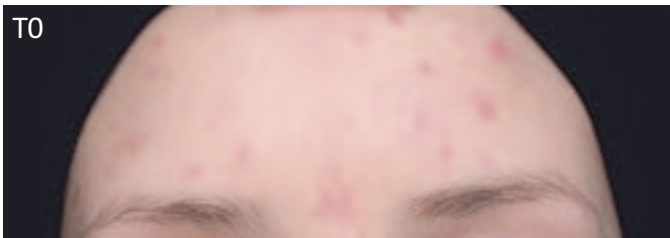
|                      |                   |                 |
|----------------------|-------------------|-----------------|
| Retentional lesions: | -6%*** on average | and up to -44%  |
| Comedones:           | -3%*** on average | and up to -18%  |
| Microcysts:          | -3%* on average   | and up to -26%. |

### -5%\*\*\* OF INFLAMMATORY LESIONS

|                       |                   |                 |
|-----------------------|-------------------|-----------------|
| Inflammatory lesions: | -5%*** on average | and up to -14%  |
| Nodules :             | -4%*** on average | and up to -12%. |

\* $p < 0.05$  ; \*\*\* $p < 0.001$  Student test

## GLOBAL EFFICACY ON THE FOREHEAD AND CHEEKS



FORMULATION GUIDE  
EMULSIFIED CREAM FOR GREASY SKIN

| Phase | Commercial name            | INCI   | Percentage |
|-------|----------------------------|--|------------|
| A     | Water                      | Water  | Sq 100     |
| A     | Glycerin                   | glycerin   | 1.00       |
| B     | Micropear M100             | Polymethyl methacrylate  | 2.00       |
| B     | Velvetveil ZC              | Silica and mica  | 1.50       |
| C     | Cosmedia SP                | Sodium polyacrylate  | 1.20       |
| D     | Cegermil                   | Zea Mays and glycine soja and helianthus annuus                                    | 3.00       |
| D     | Silicone DC 345            | cyclomethicone   | 2.00       |
| D     | Silicone DC 200            | dimethicone  | 2.00       |
| D     | Preservative               |  | 1.00       |
| E     | <b>Aroleat Samphira</b>    | Caprylic/Capric Triglyceride and hydrogenated vegetable oil and Crithmum maritimum | 1.00       |
| F     | <b>Phycosaccharide ACP</b> | Aqua and hydrolyzed algin and zinc sulfate   | 1.00       |
| F     | Parfum                     | /  | 0.2        |

**Protocol:**

Prepare A. Disperse B while stirring. Then, add C.

Add the matters D one by one while stirring then E (warmed). Finally, add F while stirring.

## **BIBLIOGRAPHIC REFERENCES**

- (1) Kawada A., Hiura N., Takahara H. Stimulation of human keratinocyte growth by alginate oligosaccharides, a possible co-factor for epidermal growth factor in cell culture. *FEBS lett.*, 408 : 43 – 46. (1997)

