

Consumer trends throughout 2020 have been shaken by the global pandemic we are experiencing. This health crisis has marked a milestone in consumer behavior patterns, and cosmetics is no exception.

Currently, due to the use of protective elements such as masks, as well as other related factors, the appearance of acne has increased among the population, no matter the age. The constant friction of the mask fabric on our skin, together with the lack of perspiration, has led to the phenomenon known as ‘maskne’.

A more technical term is mechanical acne, commonly known as ‘athlete’s acne’ or ‘friction acne’, because it is the result of the mechanical friction of a tissue against the skin and is common in athletes.

The maskne phenomenon is something more usual in health professionals, as stated in an investigation published by the *Journal of the American Academy*. It said that at least 83% of health professionals in Hubei (China) got dermatological diseases on their face as a result of mask wearing.

When either talking or breathing, the mask tends to trap a lot of hot air, which, in addition to being annoying, creates an ideal environment for the growth of bacteria and skin mites. The friction of the mask then accentuates acne breakouts.

Oily or acne-prone skin, not new, but one of the biggest concerns in skin care, together with an obligation that seems to have come to stay (the use of a mask) led us to consider new strategies to deal with acne in a more natural way.

Vytrus Biotech proposes a new treatment based on plant stem cells, which is respectful of the skin microbiota and acts on skin conditions caused by mask wearing, such as acne.

BLOCKING MICROBIAL COMMUNICATION

The active ingredient Quora Noni (INCI: *Morinda citrifolia* callus culture lysate) is the concentrated metabolome from noni totipotent cells. This ingredient acts as a treatment for and to prevent acne-prone skin, being a great sebum-regulator and improving skin imperfections.

But what is the origin of acne? Quorum sensing (QS) is a bacterial coordination system. Bacteria use QS to carry out coordinated behaviors, such as antibiotic generation, biofilm generation or bioluminescence.

Environmental changes, such as an excess of sebum or pore-clogging in acne-prone skin, cause microbial dysbiosis (microbiome imbalance). The bacterial dysbiosis promotes the activation of QS and consequently the development of coordinated behaviors of certain bacterial species in the pore.

Through QS, species such as *Cutibacterium acnes* or *Staphylococcus aureus* can coordinate the generation of biofilm or virulence factors that



White paper HACKING MASKNE: A QUORUM QUENCHING STORY

Mask wearing has resulted in many of us suffering from acne – in this article, Vytrus Biotech explores how its Quora Noni ingredient can be a useful tool in the fight against ‘maskne’

Friction acne is common in both athletes and mask-wearing health professionals; but, thanks to the pandemic, it is now a problem for the general public too

activate the inflammatory system of the skin, causing the appearance of skin imperfections.

This metabolome is rich in anti-quorum sensing molecules (anti-quormones), especially designed for ‘dermohacking’: they act synergistically against the microbial dysbiosis mediated by quorum sensing and bring the activity previously described.

The plant (origin of the active) is widely used in traditional Polynesian medicine and has its origin in the islands of the South Pacific, such as Tahiti or Fiji, with more than 150 actives described. Noni plant is used worldwide in analgesic, anti-tumor and anti-inflammatory remedies. There are numerous clinical studies that validate the remarkable benefits of the plant for our health.

The mechanism of action of the active (quorum

quenching, figure 1) is based on the natural strategy of noni and consists of blocking the bacterial coordination (QS), respecting the skin microbiota and being an alternative to the use of antibiotics.

The composition of the active is 100% natural (ISO 16128), preservative-free, certified by COSMOS-Ecocert and respectful of the microbiota.

BIOLOGICAL ACTIVITY

***In vitro* 1: Broad spectrum bacteriostatic effect**

Several microorganism species were incubated (*Malassezia furfur*, *C. acnes*, *S. aureus*, *Pseudomonas aeruginosa*, *Corynebacterium striatum* and *Epidermophyton floccosum*) with several concentrations of the active over 24 hours, under specific conditions for each microorganism.

Viable cells were quantified at time 0 and after 24 hours of contact to evaluate the bacteriostatic and fungistatic activity of the active.

The result shows that the active ingredient is able to inhibit the growth and reproduction of several microorganisms (G+, G- and fungi), maintaining the populations without destroying the microbes, thereby demonstrating its bacteriostatic effect.

***In vitro* 2: Anti-biofilm effect (anti-quorum sensing)**

In this second assay, the anti-biofilm properties of the active were evaluated and representative biofilms were generated in *C. acnes*, *M. furfur*, *C. striatum* and *S. aureus*. The objective of the trial was the quantification of:

- Biofilm population density, measured as colony-forming units per coupon, after 24h of incubation;
- Planktonic live cells in suspension.

It was demonstrated that the active significantly inhibited the biofilm formation up to 99% while preserving the planktonic cells alive, showing its anti-biofilm effect on *C. acnes* and *S. aureus* (figures 2 and 3, respectively).

***In vitro* 3: Modulation of microbial quorumones synthesis**

In order to measure the ability of the ingredient to inhibit the expression of the Lux-S gene, a key

Figure 2

Anti-biofilm effect in *C. acnes*

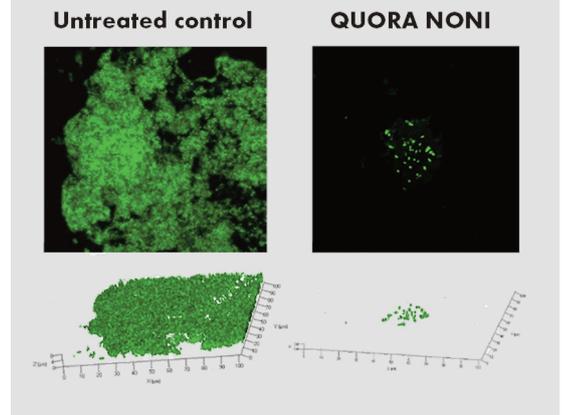
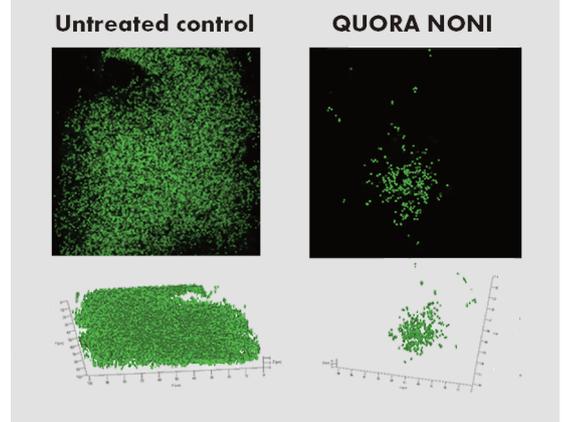


Figure 3

Anti-biofilm effect in *S. aureus*



gene in the synthesis of quorumones, an experiment was specially designed: gene expression was measured through retro-transcription and quantitative PCR, expressing the resulting values in Cqs.

The results show that the active was able to inhibit the Lux-S gene expression up to 89%. This means that the active has the ability to interfere very specifically in the quorum sensing system of *C. acnes*, by inhibiting the synthesis of quorumones and offering a new mechanism of action.

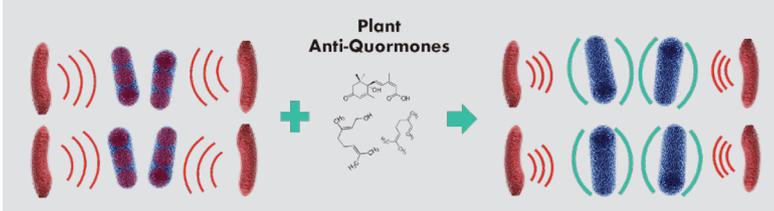
***In vitro* 4: Modulation of toll-like receptor-2 (TLR2)**

This test measured the ability of the active to block the membrane receptors TLR2 (the microbe-keratinocyte connection). The ability of the activation of TLR2 of a solution of *Propionibacterium acnes* lysate was measured. The TLR2 activation by fragments of *P. acnes* membrane leads to IL- α induction, which is, therefore, a marker of this interaction.

The keratinocytes were incubated over 24 hours with the ingredient. The supernatant was

Figure 1

Mechanism of action (quorum quenching)



then eliminated and cleaned, and the pre-treated keratinocytes were exposed to the *P. acnes*. IL-1 α was measured by ELISA.

The active was able to decrease the levels of IL-1 α by up to -46% compared with control without treatment. This means that the ingredient has the ability to interfere very specifically in the microbial-keratinocyte interaction by blocking the TLR2.

In vitro 5: Anti-inflammatory activity

To measure the anti-inflammatory activity of the ingredient, human inflamed monocytes (THP1) were treated with the active for 24 hours and then the levels of TNF- α and IL-8 were quantified from supernatant by ELISA. The positive control was dexamethasone (reference drug).

The active completely restored TNF- α levels from inflamed cells. The effect was very potent at all tested doses, reaching up to -97%, demonstrating a higher level of restoration than dexamethasone (-56%).

The ingredient also completely restored IL-8 levels from inflamed cells. The effect was very potent at all tested doses, reaching up to -69%. Dexamethasone restoration levels were up to -33%. This demonstrates the anti-inflammatory ability of the ingredient as even higher than that of dexamethasone.

CLINICAL EVALUATION

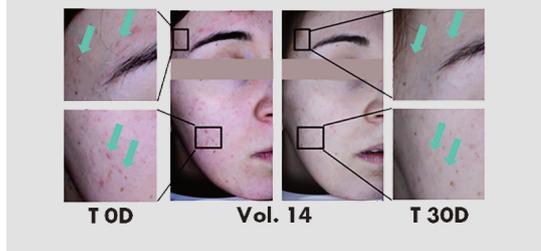
In vivo 1: Dysbiosis rebalance

The first clinical trial was carried out with a panel of acne-prone skin volunteers (12-29 years old) where the number of skin microbial cells were quantified. The results showed that the active reduced the relative proportion of virulent bacteria (*S. aureus* and *P. acnes*), while maintaining the most beneficial microbial population of the skin (*S. epidermidis*).

This *in vivo* test shows that the active ingredient rebalances the microbiota of

Figure 5

HD-Visioface macrophotographies



acne-prone skin, respecting the most beneficial commensal bacteria.

In vivo 2: Reduction of sebum level production

To measure the levels of production of sebum, a Sebumeter SM815 was used and the measures were taken on the forehead of the volunteers.

Results show that the active significantly decreased the sebum production down to 28% at 30 days. The sebum levels went down going from an average value considered 'oily skin' to 'normal skin' in terms of skin sebum.

In vivo 3: Pore size reduction

To measure the area with pores, the sophisticated technique VisioFace 1000D was used. The active decreased the area with pores by 48% on average, compared with placebo, reaching up to 92% reduction in the best case (figure 4).

In vivo 4: Dermatologic evaluation of acne lesions & HD-Visioface macrographies

To evaluate the effect of the active in acne lesions, the Spanish Scale of Acne Gravity (Escala de Gravedad del Acné Española – EGAE) was used and physical examinations were done by a dermatologist using a visual scale to determine the intensity and scope of the lesions.

Three grades of acne were used (soft, moderate and severe) and the evolution of comedones was evaluated.

The plant stem cell-derived active reduced the presence of open comedones by -15% on average, compared with placebo, reaching up to -80% in the best case. These data and the macrophotographies taken with HD-Visioface (figure 5) demonstrate the ability of the ingredient to reduce the number of lesions caused by acne and to perfect the skin surface.

The active ingredient Quora Noni brings a new mechanism of action against acne, blocking the microbial quorum sensing. It is recommended both for the treatment and prevention of acne, as well as dandruff or sensitive and greasy scalps.

It offers a revolutionary mechanism of action that is in line with the consumer demand for 'clean' beauty and represents an ally against maskne ●

Authors

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Figure 4

Pore decrease

