

QS Control AC

ACNE Care by Anti-Quorum Sensing Strategy



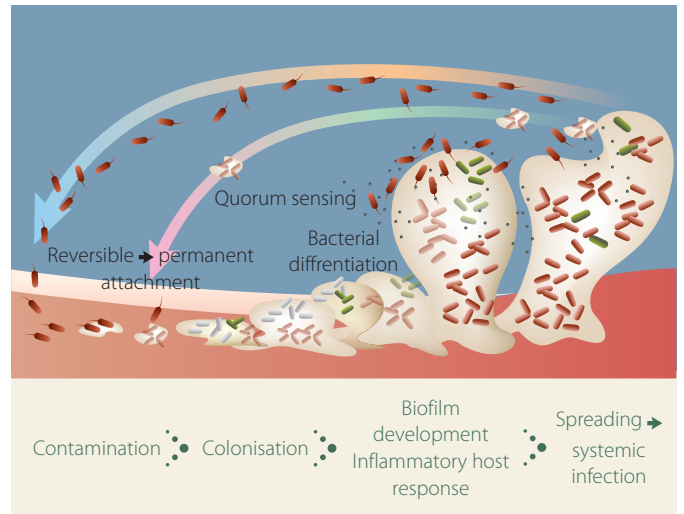
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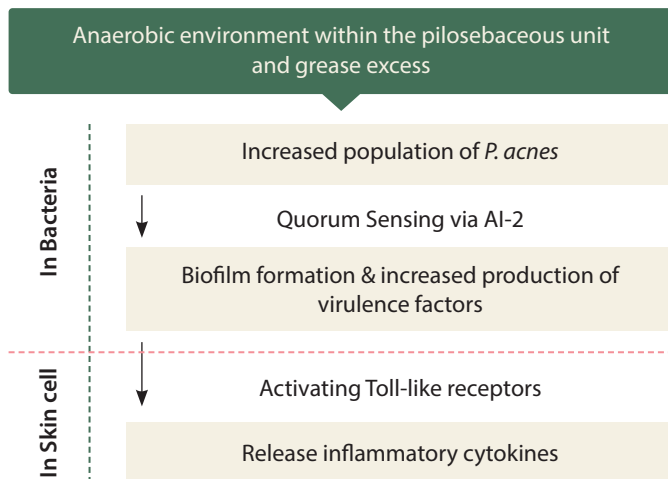
JAMMING THE COMMUNICATION SIGNAL IN P. ACNES

What is Quorum Sensing?

Quorum Sensing (QS) refers to a series of phenomena regulating the minimum population density or triggering the active proliferation of bacteria to form a quorum and adjusting the expression of the accompanying genes. Bacteria population density increase is accompanied by the production and accumulation of low-molecular substances called autoinducers outside of the cells. If the concentration of these substances reach a certain level gene expression is induced. As a result of this quorum sensing, the bacteria exhibit diverse biological activity to include, symbiosis, virulence, competence, conjugation, antibiotic production, motility, sporulation and biofilm formation. A research approach to quorum sensing can have the beneficial target of suppressing the virulence of bacteria.



Quorum Sensing and ACNE



Elevated androgen induced sebum production is the cause of blockage of the pilosebaceous unit creating an oil abundant anaerobic environment which enables the increased proliferation of acne bacteria. The increased acne bacteria, through the processes of Autoinducer (AI)-2 production and quorum sensing, form and release biofilm and virulence factors like Pathogen-associated molecular patterns (PAMPs). One of these PAMPs, Peptidoglycans activate Toll-like receptors (TLRs), and stimulate the expression of inflammatory cytokines. Due to this immune response inflammatory acne is formed and stimulated. Disturbance of Quorum Sensing is an advanced mechanism for weakening the virulence of acne bacteria.

Existing acne treatment materials are mostly antimicrobial agents for destruction of acne bacteria. This results in the occurrence of weaknesses such as skin dryness and increased antimicrobial resistance. Therefore, DermaLab has set a new paradigm through the development of a treatment with an Anti Quorum Sensing effect which can resolve the limits of existing antimicrobial treatments.

QS CONTROL AC - THE SYNERGIC EFFECTS OF Extraordinary antibacterial property of Korean Red Pine + Bio-preservation property of *Lactobacillus sakei*.



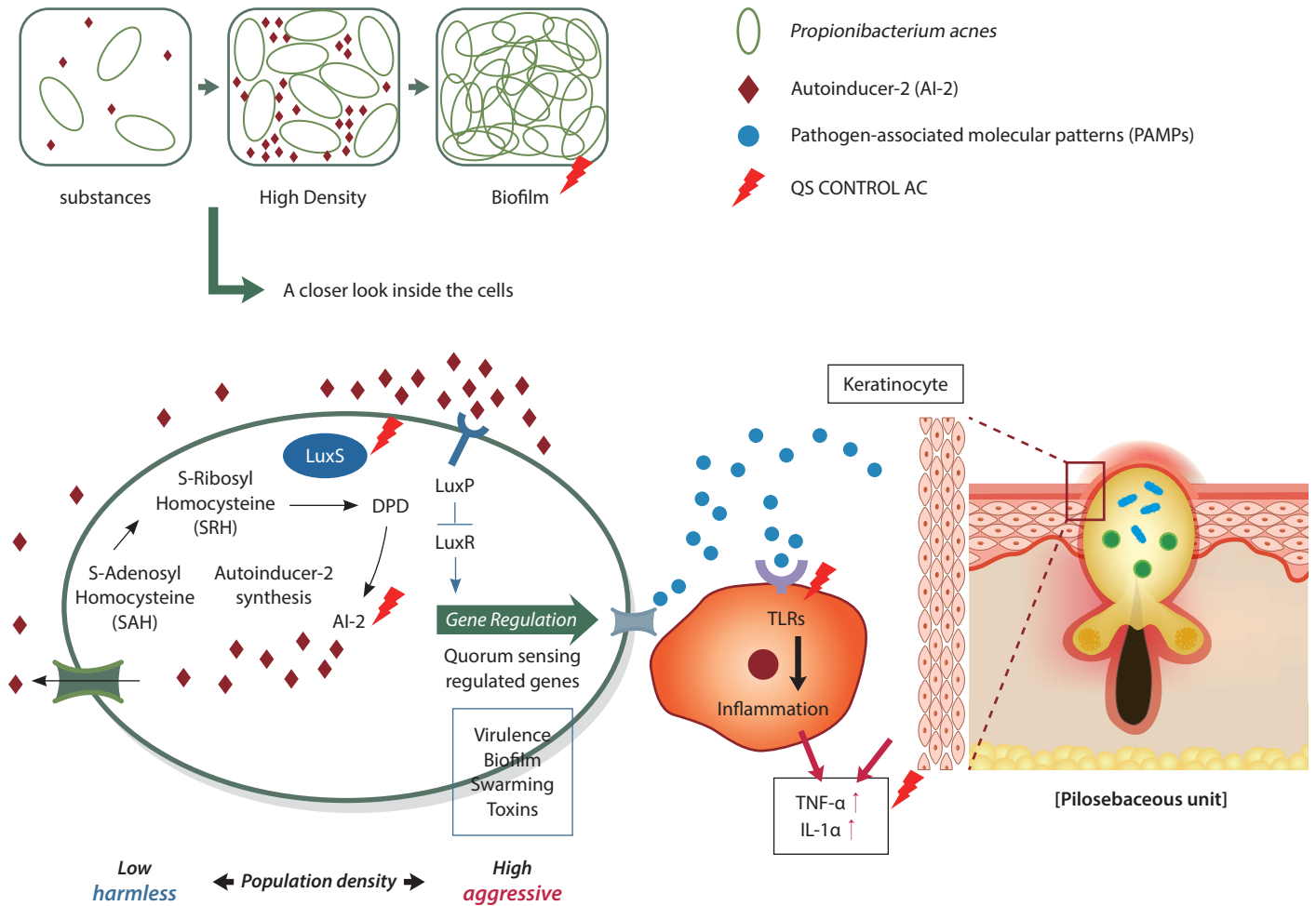
Korean Red Pine as Korea's indigenous pine tree, is mentioned in the Principles and Practice of Eastern Medicine (called "Donguibogam"), as having the essence of the pine tree being so special that no part of it should be wasted. A standout among trees having a strong life force, it is said that insects do not infest the Korean Red Pine and its antibacterial applications are exceptional heightening acne immunity.



L. sakei, a microorganism especially beneficial to the human body, creates an acidic environment impeding and controlling bacterial growth. As an example, *L. sakei* has the application of suppressing the occurrence of harmful bacteria during "Kimchi" fermentation to prevent spoiling. As such, it suppresses the propagation of various bacteria and revitalizes active components.

MECHANISM

[*Propionibacterium acnes* Quorum Sensing]



Propionibacterium acnes produce and release intercellular signal molecules called autoinducer-2 to communicate each other. *P. acnes* can regulate the gene expression in respond to fluctuations in cell-population density through quorum sensing.

When sufficient *P. acnes* are present and autoinducer-2 concentrations reach a threshold level that allows *P. acnes* to activate target genes, form biofilm and release Pathogen-associated molecular patterns (PAMPs). PAMPs are recognized by Toll-like receptors (TLRs) and Inflammatory response is initiated.

QS CONTROL AC controls the inflammatory acne by disrupting the bacterial Cell-to-Cell Communication (Quorum Sensing) in *P. acnes*.

In Bacteria	In Skin Cell
Suppression of LuxS enzyme activity Reduction of AI-2 production Inhibition of Biofilm formation	Suppression of TLR-2 expression Reduction of TNF-α & IL-1α expression

IN-VITRO TEST

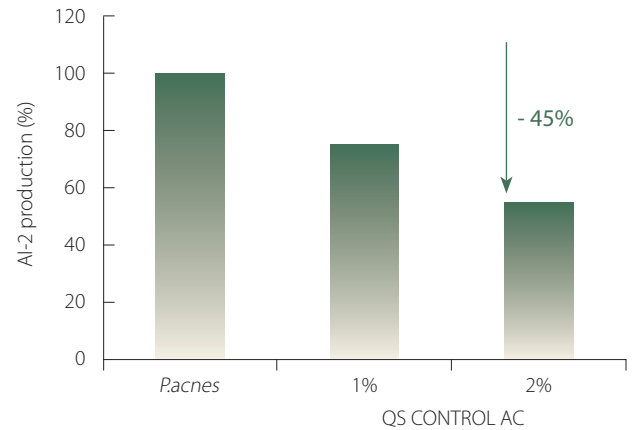
ANTI-QUORUM SENSING EFFECT IN BACTERIA

QS CONTROL AC INHIBITS AI-2 SYNTHESIS

Autoinducer (AI)-2 is a member of a family of signaling molecules used in quorum sensing.

AI-2 production : 45% ↓

Protocol: *P. acnes* were cultivated during 72 hours (at 37°C, anaerobic condition) in presence of QS CONTROL AC. AI-2 production was measured by Ellman's assay.

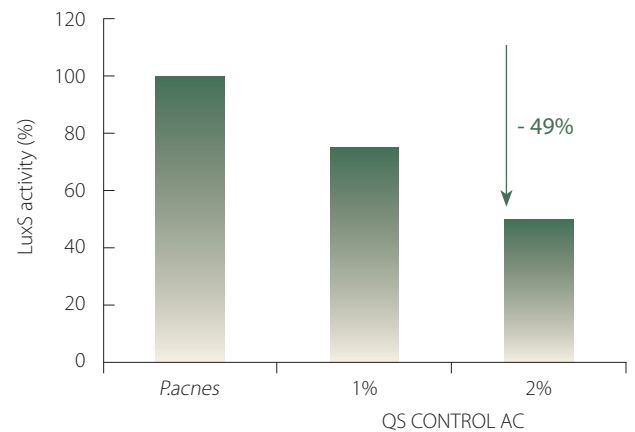


QS CONTROL AC INHIBITS LuxS ACTIVITY

S-ribosylhomocysteine lyase (LuxS) is involved in the synthesis of autoinducer (AI)-2 which plays a key role in quorum sensing.

LuxS activity : 49% ↓

Protocol: The protein of *P. acnes* and S-adenosylhomocysteine (SAH) were reacted during 1hr (at 37°C, anaerobic condition) in presence of QS CONTROL AC. LuxS activity was measured by Ellman's assay.

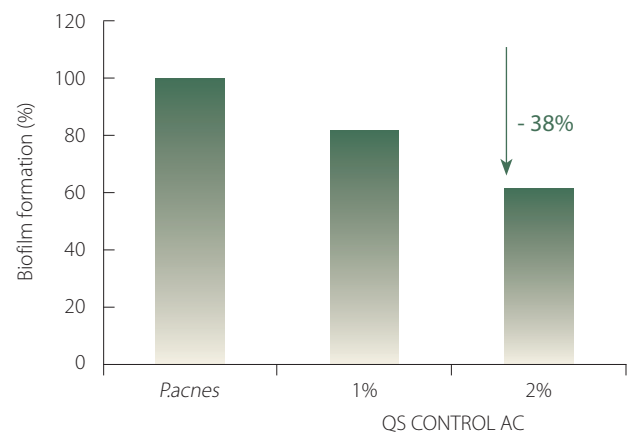
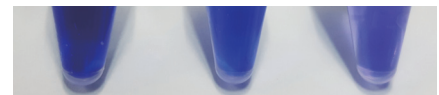


QS CONTROL AC INHIBITS BIOFILM FORMATION

Biofilms play an important role in the pathogenesis of many human infections. *P. acnes* strains can form highly resistant biofilms on various biomaterials.

Biofilm formation : 38% ↓

Protocol: *P. acnes* were cultivated during 72 hours (at 37°C, anaerobic condition) in presence of QS CONTROL AC. Biofilm formation by *P. acnes* was evaluated with the crystal violet assay.



IN-VITRO TEST

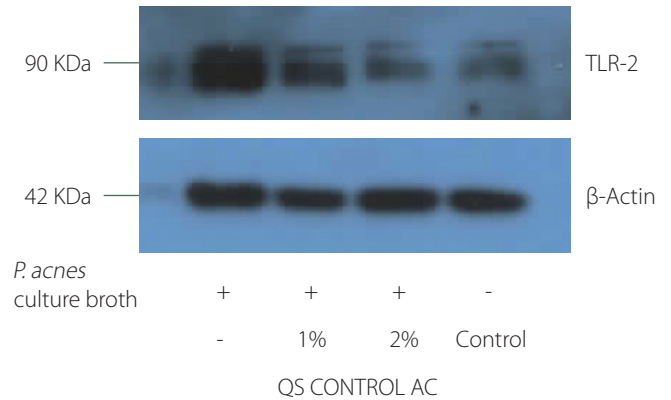
ANTI-INFLAMMATORY EFFECT IN SKIN CELL

QS CONTROL AC DECREASES TLR-2 EXPRESSION

Toll-like receptor (TLR)-2 is a class of protein that plays a key role in the innate immune system. By stimulating TLR-2, the innate immune system is able to recognize microbial components and then induces cytokine/chemokine secretion in acne.

Suppression of TLR-2 expression by QS CONTROL AC

Protocol: Human Epidermal Keratinocyte (HaCaT) cultures were incubated during 48 hours (at 37°C, CO₂: 5%) in presence of QS Control AC with *P. acnes* culture broth 1000 ppm. The expression levels of protein were analyzed by western blot.

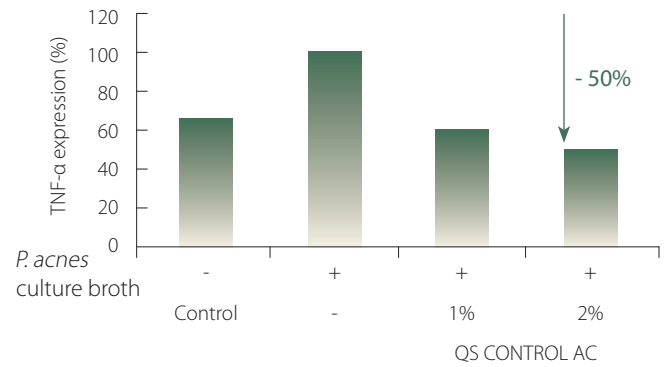


QS CONTROL AC DECREASES TNF-α EXPRESSION

Tumor necrosis factor alpha (TNF-α) is a cell signaling protein (cytokine) involved in systemic inflammation.

The expression of TNF-α : 50% ↓

Protocol: Human Epidermal Keratinocyte (HaCaT) cultures were incubated during 48 hours (at 37°C, CO₂: 5%) in presence of QS Control AC with *P. acnes* culture broth 1000 ppm. The expression levels of mRNA were analyzed by RT-PCR.

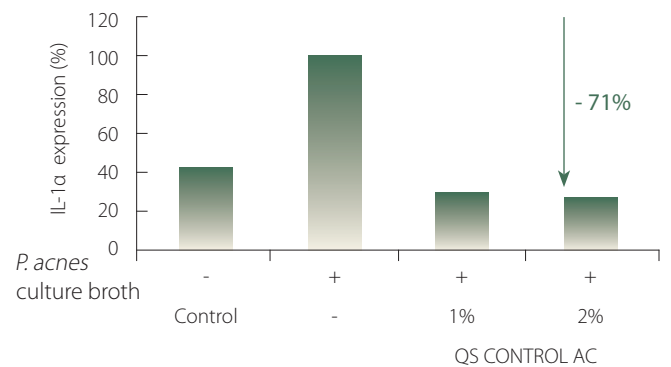


QS CONTROL AC DECREASES IL-1α EXPRESSION

Interleukin 1 alpha (IL-1α) is responsible for the production of inflammation, as well as the promotion of fever and sepsis.

The expression of IL-1α : 71% ↓

Protocol: Human Epidermal Keratinocyte (HaCaT) cultures were incubated during 48 hours (at 37°C, CO₂: 5%) in presence of QS Control AC with *P. acnes* culture broth 1000 ppm. The expression levels of mRNA were analyzed by RT-PCR.

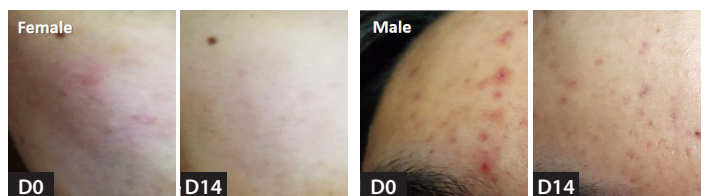


IN-VIVO TEST

SKIN IMPROVEMENT EFFECT

QS Control AC improves skin damaged by acne.

- Volunteers : 8 male & female aged between 14 and 27 years old.
- Formulation : Cleansing Water containing 2% QS Control AC.
- Application : twice a day for 14 days.
- Analysis : Photo comparison (before and after)





Dermalab Co., Ltd.

231 Munmakgongdan-gil Munmak-eup Wonju-si Gangwon-do 26362 Rep. of Korea

TEL. +82-33-732-7561 FAX. +82-33-732-7563

info@dermalab.co.kr www.dermalab.co.kr

Cosmetic activities	<ul style="list-style-type: none">• Reduction of AI-2 production• Suppression of LuxS enzyme activity• Inhibition of Biofilm formation• Suppression of TLR-2 expression• Reduction of TNF-α & IL-1α expression
INCI name	Butylene Glycol (and) Water (and) Hydroxypropyl Cyclodextrin (and) Dipropylene Glycol (and) Pinus Densiflora Leaf Extract (and) Lactobacillus Ferment
Recommended % of use	2 % ~