



# A combination of magnolia officinalis bark extract and heptyl undecylenate as a new multi-functional cosmetic ingredient

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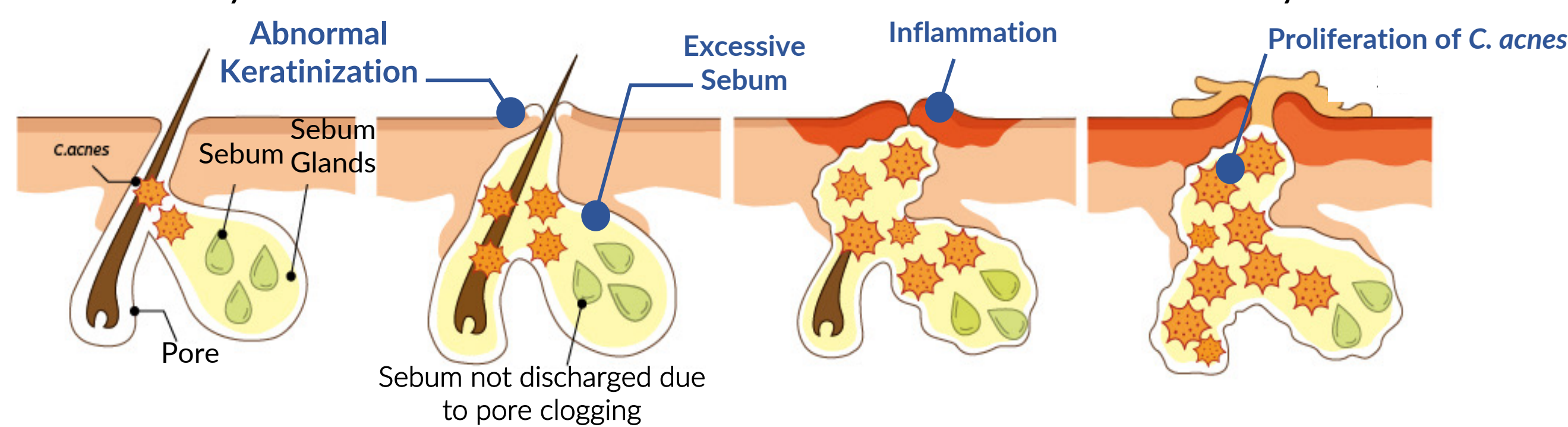


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## Introduction:

Acne is a chronic inflammatory disease outbreak in the sebaceous glands within the hair follicle. The proliferation of *Cutibacterium acnes* (*C. acnes*, formerly known as *Propionibacterium acnes*) causes monocytes to stimulate secretion of inflammatory cytokines (Fig 1). A number of studies have been proposed the inhibitory effects of *C. acnes* and *C. acnes*-mediated inflammation by natural extracts.



**Fig 1. Acne caused by *C. acnes* and *C. acnes*-mediated inflammation**

*Cutibacterium acnes* hydrolyses neutral lipids into free fatty acids, which promotes oxidative stress, inflammatory reaction, and tissue destruction. It also interacts with various components of the immune system. In addition, the aerobic bacteria *Staphylococcus aureus* proliferates in acne lesions and causes inflammatory skin diseases.

Silicone oil is one of the most widely used ingredients in personal care products. Silicones have exceptional physicochemical and sensory properties but their high chemical stability results in very low biodegradability. Consumers are becoming increasingly sensitive to environmental issues and demand more environmentally friendly personal care products. This recognition strongly encourages the personal care products industries to develop plant derived biodegradable alternatives to silicone oils.

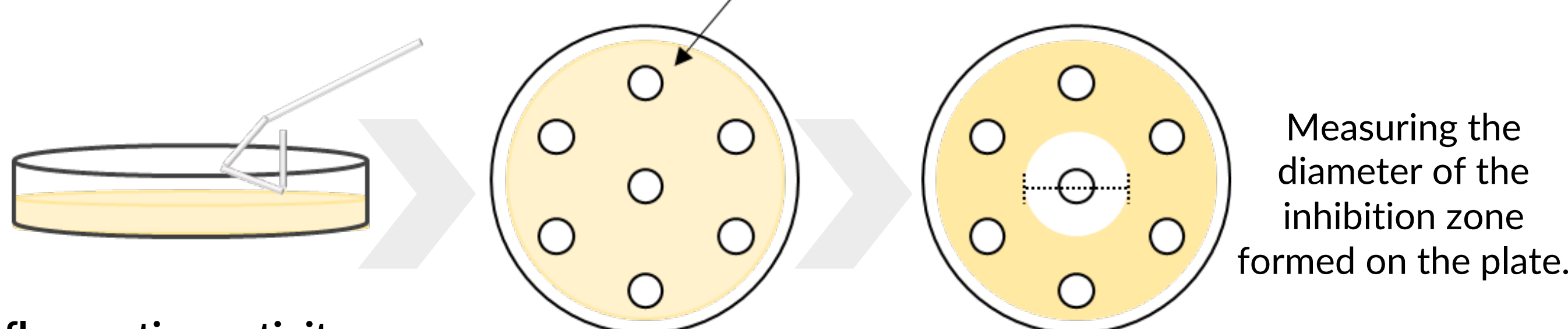
Natural extracts has various properties in personal care products, including anti-inflammatory, anti-oxidant, and anti-microbial properties. In particular, the anti-microbial activity of natural extracts is more effective in inhibiting the growth of microorganisms due to various modes of action.

Therefore, we constructed research to develop plant-derived magnolia officinalis bark extract and heptyl undecylenate as multifunctional ingredients with various activities.

## Materials & Methods:

### Growth inhibition activity against *C. acnes*

- As recommended by the 2013 Clinical and Laboratory Standards Institute guidelines, the concentration of the strain was adjusted to yield approximately 10<sup>8</sup>CFU/ml by direct colony suspension method.
- The inoculated agar plate of *C. acnes* was incubated at 35°C under anaerobic conditions.
- Cutibacterium acnes* ATCC 6919 (formerly known as *Propionibacterium acnes*)



### Anti-inflammation activity

- RAW 264.7 macrophages at a density of 10<sup>5</sup> cells/well were treated with the test sample in the presence of LPS (1 µg/ml) for 24 h.
- Quercetin (25 µg/ml) was used as a positive control.
- The sample was measured for nitrite levels by the Griess assay
- The absorbance was performed at 550 nm to assess the NO production inhibition rate using the equation below.

$$\text{The NO production inhibition rate (\%)} = \frac{(N - S)}{(N - C)} \times 100$$

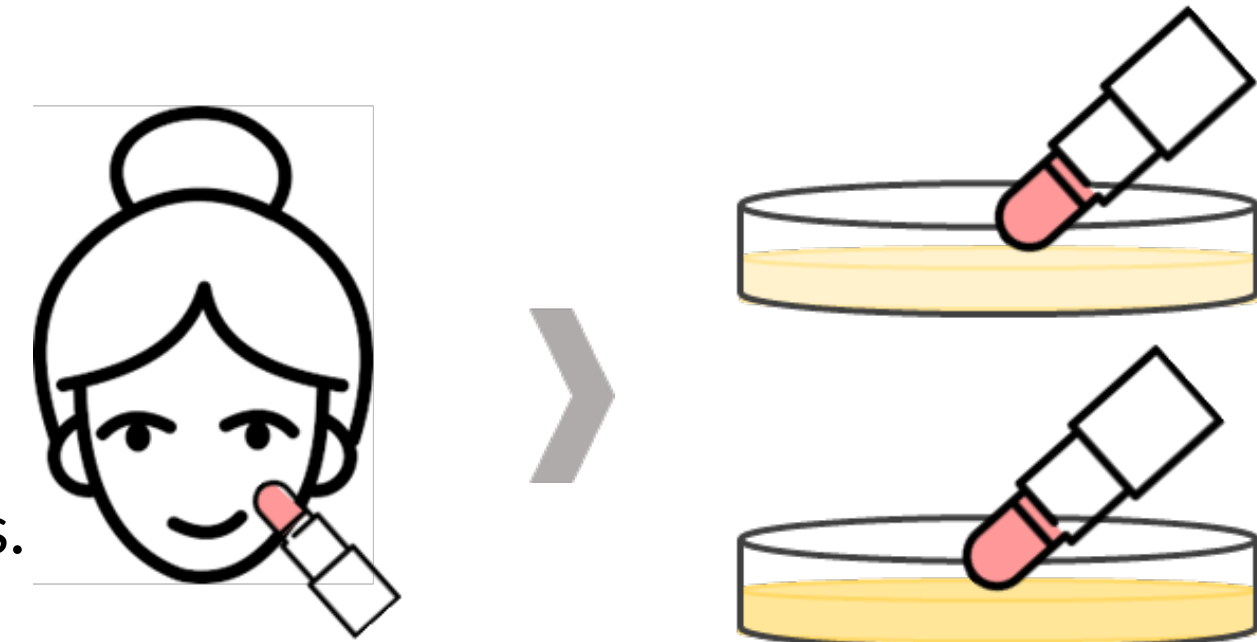
N : the absorbance of the negative control with LPS  
 C : the absorbance of the control without the LPS  
 S : the absorbance of the test sample with LPS

### Sensory profile improvement

- Blind sensory test
- Performed with 10 volunteers aged 20~50 years ( 5 male and 5 female).
- Oil balm was available to the volunteers that were oriented to apply on the back of the left hand in circular movement.
- Oil balm without MEHU and oil balm containing silicone oils (dimethicone, 200/100cs) were used as a comparative group.

### Anti-microbial activity

- The oil balm samples applied to skin multiple times and stored at room temperature for a day.
- Microbial contamination of oil balm product surfaces was measured by spreading on TSA and PDA surfaces.

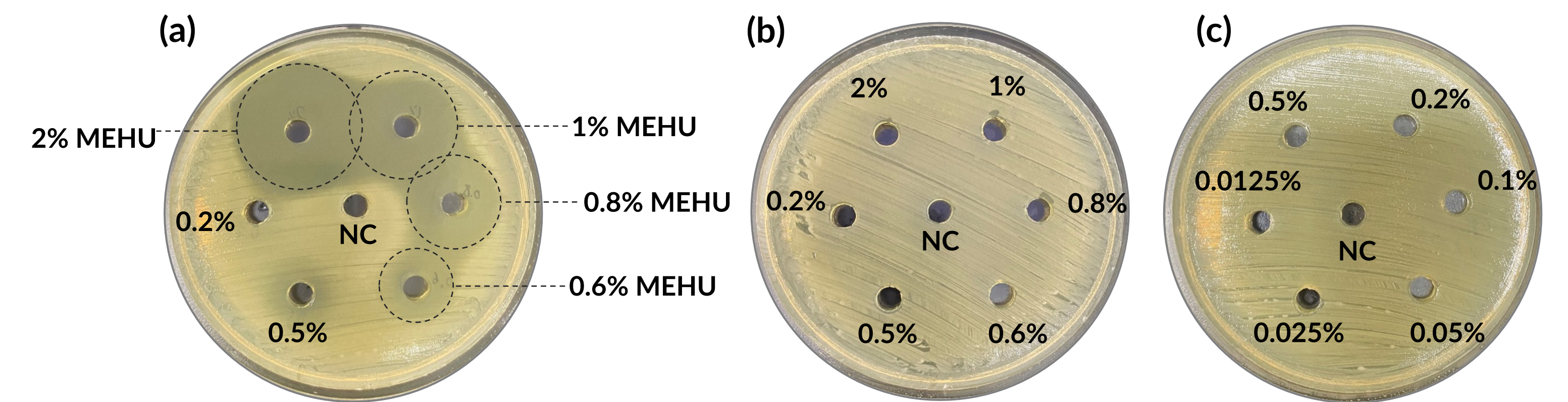


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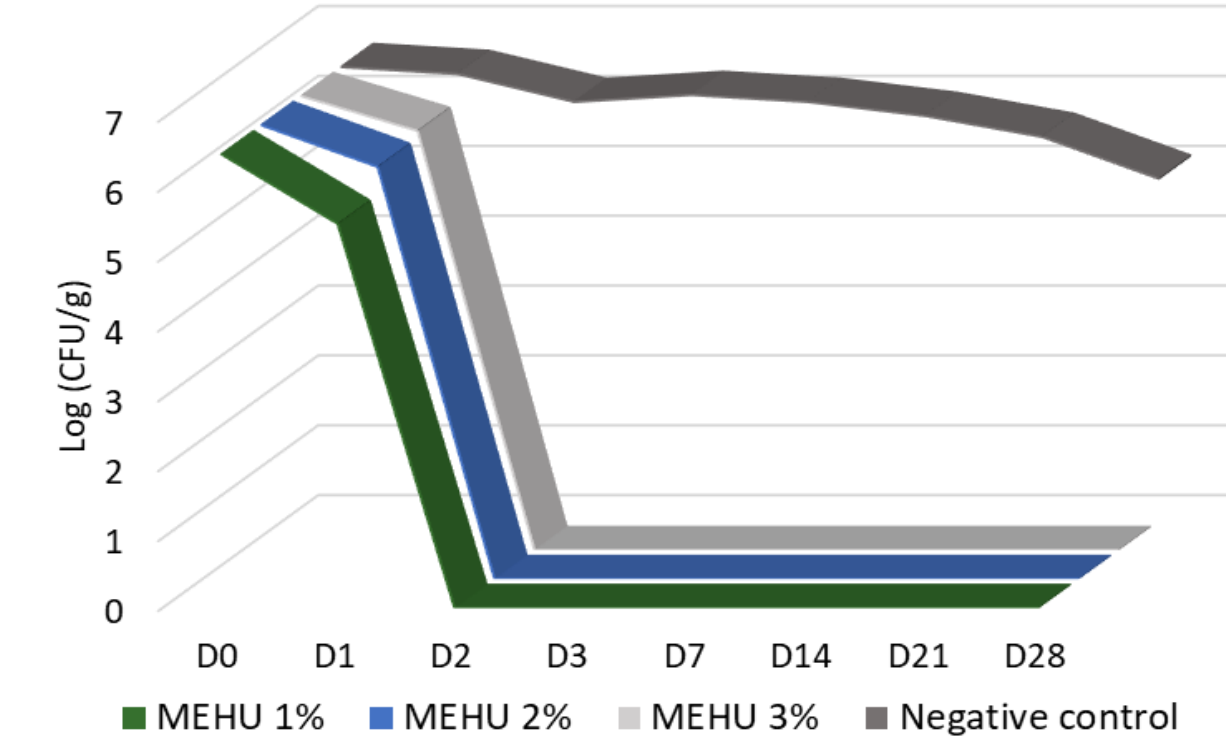
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## Results & Discussion:

### Growth inhibition activity against *C. acnes*



**Fig 2. Inhibition zone of MEHU, *Centella asiatica* extract, and salicylic acid against *C. acnes*** (a) MEHU; (b) *Centella asiatica* extract; (c) Salicylic acid. NC, negative control with DMSO.

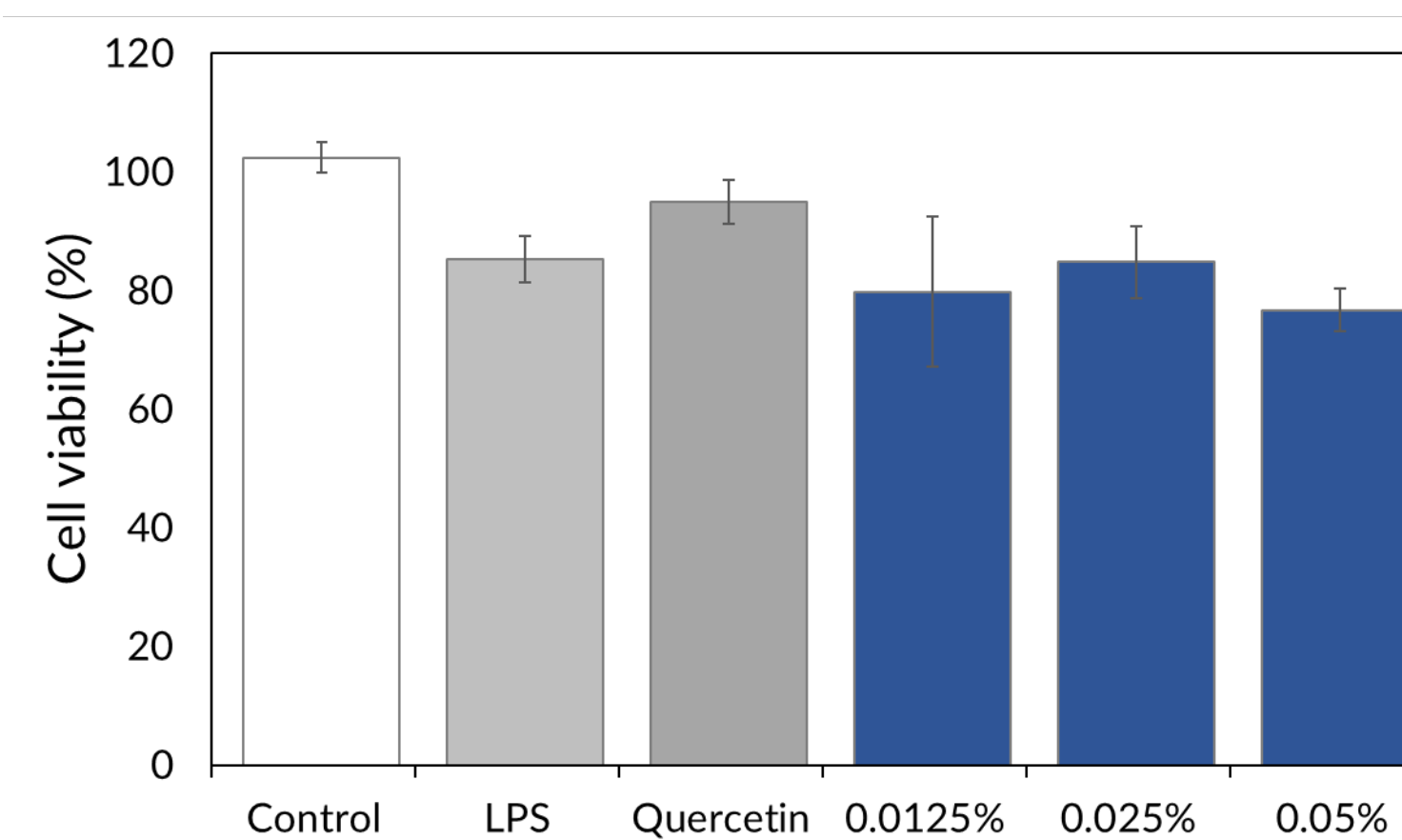


MEHU (% w/w)	Inoculation (Log CFU/g)	Log reduction (CFU/g)							
		D1	D2	D3	D7	D14	D21	D28	
1%	6.5	0.5	6.5	6.5	6.5	6.5	6.5	6.5	
2%		0.6	6.5	6.5	6.5	6.5	6.5	6.5	
3%		1.0	6.5	6.5	6.5	6.5	6.5	6.5	
Negative control		0.1	0.5	0.4	0.5	0.7	1.0	1.6	

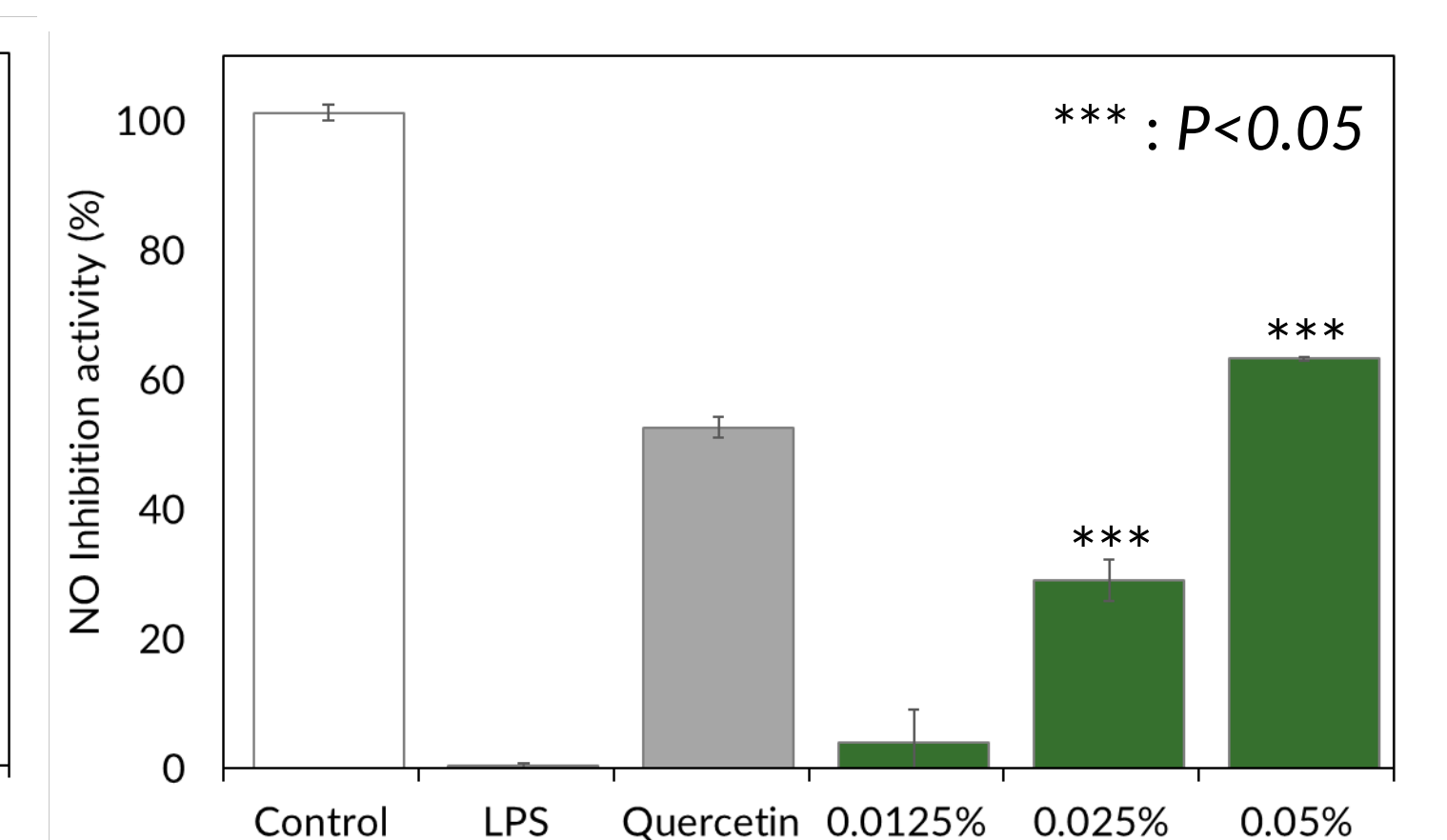
**Fig 3. The growth inhibition effect of MEHU against *C. acnes* in oil balm**

MEHU was able to effectively inhibit *C. acnes* at a low concentration without skin dryness or skin irritation (salicylic acid was generally used less than 0.5% due to skin dryness and irritation). In addition, oil balm applied MEHU has powerful protect ability against contaminated *C. acnes*.

### Anti-inflammation activity



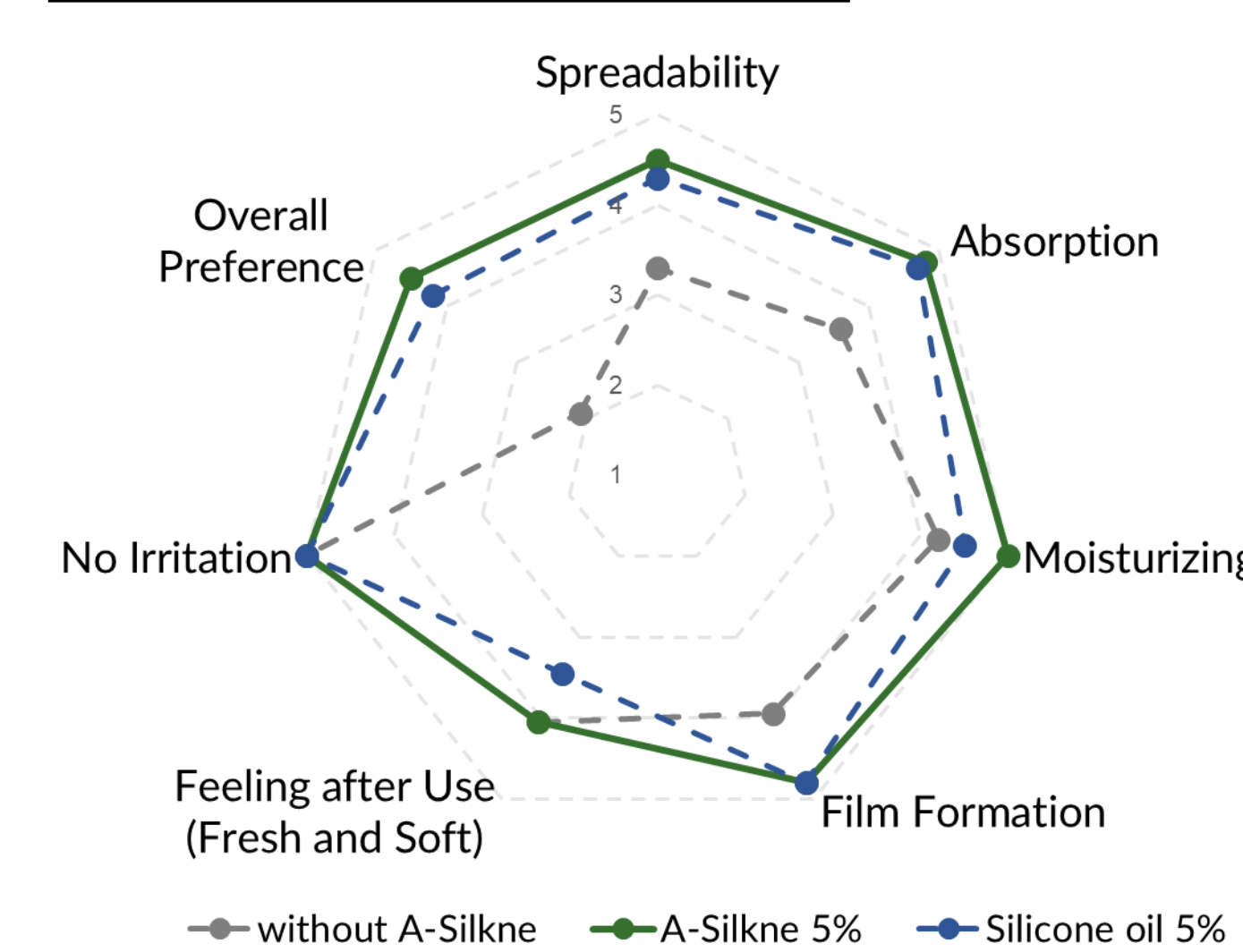
**Fig 4. Cytotoxicity assay of MEHU**



**Fig 5. Anti-inflammation activity of MEHU**

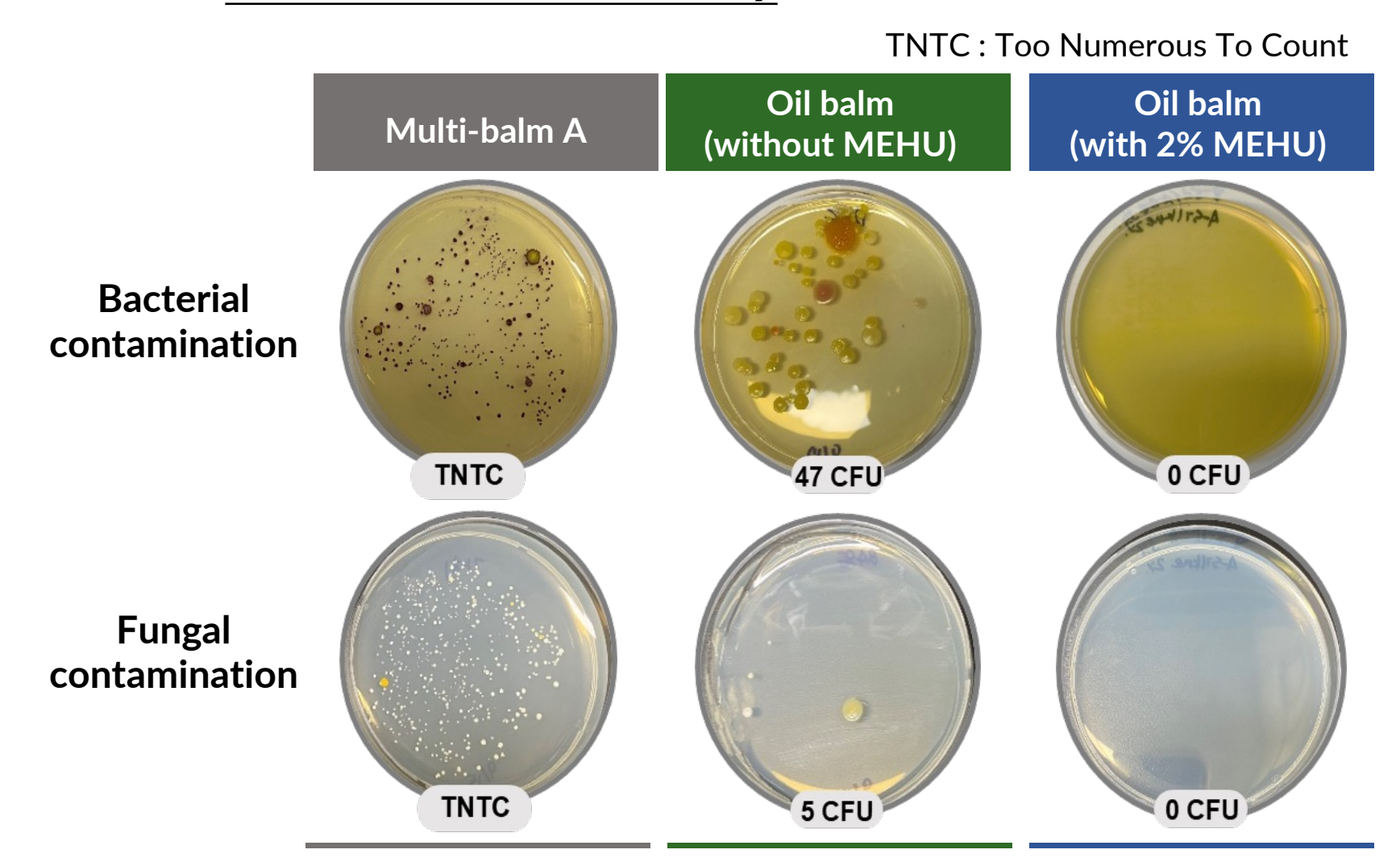
Inflammation is one of the mechanisms and aspects that induce acne formation. MEHU inhibits the NO production in RAW 264.7 cells stimulated by LPS without cytotoxicity.

### Sensory profile improvement



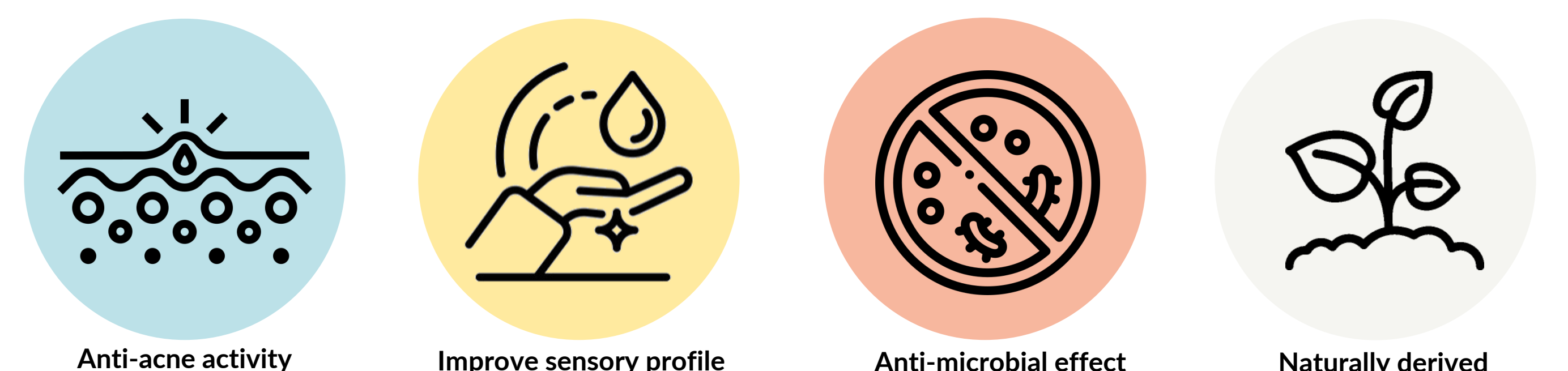
**Fig 6. Sensory profile obtained using volunteers' questionnaires**

### Anti-microbial activity



**Fig 7. Anti-microbial activity of MEHU in oil balm**

## Conclusions:



- The MEHU can be recommended as a candidate for effective an an alternative preservative system and also an anti-acne ingredient.
- The MEHU can be simultaneously replaced the use of synthetic silicone oils.
- These interesting results demonstrate that MEHU is a new multifunctional ingredient for personal care products that is effective as an anti-acne and this can be feasible to resolve the sensitive skin issues occurring by the mask regularly used in COVID-19 situations.