PARAGONCORP

8TH MICROBIOME R&D & BUSINESS COLLABORATION CONGRESS: ASIA

Enhancing Antibacterial Activity Against *C. acnes* and *S. aureus*: Optimized Delivery System of Salicylic Acid and Its Efficacy in Anti-acne Serum

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Introduction

The skin is a protective barrier and is enveloped by an invisible layer comprising a complex set of microorganisms. *Cutibacterium acnes* and *Staphylococcus aureus* play an important role in acne pathogenesis[1]. Acne treatment that targets both bacteria while minimizing disruption to other bacterial species is a common approach in treating patients with acne vulgaris. Salicylic acid is already known as an effective antibacterial, especially for *C. acnes*[2]. It can be further improved through advanced delivery systems utilizing encapsulation technology. Delivery systems by encapsulated technologies can improve the antibacterial properties. This study aims to conduct a comparative analysis of the antibacterial activity and efficacy of SA in several forms: non-encapsulated SA, sub-micron sphere encapsulation (SMSE), double-layered sub-micron sphere inside microsphere (DLME), and sub-micron sphere SA and Lactic Acid encapsulation (SMSALA).

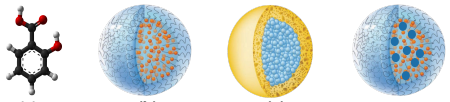


Figure 1. (a) Salycilic Acid molecule, **(b)** SMSE average diameter 0.1-2 µm, **(c)** DLME average diameter 30-50 µm, **(d)** SMSALA average diameter 0.1-2 µm

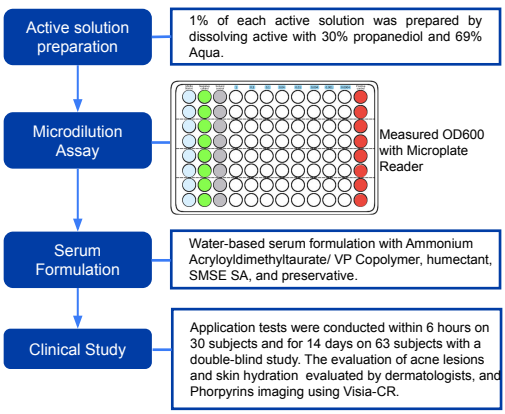
Materials & Methods

Materials

Table 1. Active ingredients solution

Active Ingredients	% Solution	% SA in tested formula	Solvent
Salicylic Acid	1%	1%	Propanediol 30% and Aqua
SMSE SA		0.3%	
DLME SA		0.1%	
SMSALA SA		0.05%	

Methods



Results & Discussion

All of the encapsulated SA showed better MIC for *C. acnes* than non-encapsulated SA, with 100 times lower MIC. The MIC against *S. aureus* for SMSE, DLME, SMSLA, and SA were 0.0004%, 0.01%, 0.04%, and 1% (g/ml) respectively. SMSE showed considerable efficacy, demonstrated by the lowest MIC for both *C. acnes* and *S. aureus*. Encapsulation improved and prolonged the bioavailability of SA by challenging the low water solubility of SA and creating a slow-release mechanism. SMSE and DLME also used positive-charged ingredients that create cationic conditions in the outer capsules which further contributed to the improvement of antibacterial capacity. Cationic polymers mimic host-defence antibacterial peptides that act on bacterial cell walls or membranes[3].

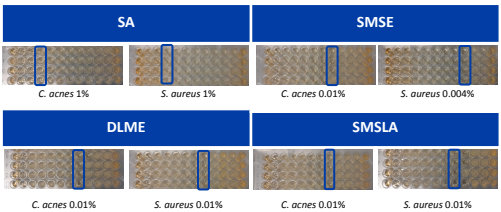
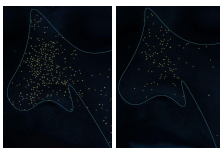


Figure 2. Microplate reader result of SA and encapsulated SA

MIC difference in *S. aureus* between SA was observed and can be correlated with the amount of SA inside the capsules. SMSLA has the highest *S. aureus* MIC compared with other encapsulated SA because it contains the lowest SA. However, all of the encapsulated SA shows higher efficiency in inhibiting *C. acnes,* compared with non-encapsulated SA.



(a) day-0 and (b) day-14

Figure 3. Phorpyrins image by Visia

The efficacy of SMSE in serum formulation showed acne lesions reduction at -6.90% ($p<0.05$) and instant skin hydration improvement of +32.29% ($p<0.05$) at 6 hours of evaluation and acne lesions reduction at -68.95% ($p<0.05$) and skin hydration at +9.84% ($p<0.05$) after 14 days.

Based on Visia image analysis, there was reduction of porphyrins significantly in subjects. These results related to the MIC result that showed bacteria reduction on the skin. Furthermore, none of the subjects involved showed any significant irritation signs during the test.

Conclusion

SMSE was better at inhibiting *C. acnes* and *S. aureus* and clinically proven to improve acne skin without drying and irritating the skin. All encapsulated SA showed higher efficacy efficiency compared with non-encapsulated SA. Encapsulation of SA improved SA stability and increased bioavailability of SA on the skin to combat *C. acnes* and *S. aureus* more effectively.

Acknowledgement

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References

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