

## CHAPTER 4

### CONCLUSIONS

From this research work the following conclusions can be drawn:

1. Ethyl acetate and methanol extracts of 18 Thai medicinal plants were tested for antibacterial activity against *Propionibacterium acnes* using disc diffusion and broth dilution methods. The results from the disc diffusion method showed that 16 plant extracts were capable of inhibiting the growth of *P. acnes*. Of these, the ethyl acetate extract of *Alpinia galanga* showed the strongest antibacterial effect, with MIC and MBC values of 156 and 312  $\mu\text{g/ml}$ , respectively. The other plant extracts exhibited MIC values between 312 and  $>5000 \mu\text{g/ml}$ , and MBC values between 625 and  $>5000 \mu\text{g/ml}$ .

2. On the basis of bioassay-guided fractionation, the ethyl acetate extract of *A. galanga* was separated using several chromatographic techniques to afford an antibacterial compound, which was identified as 1'-acetoxychavicol acetate (1'-ACA).

3. 1'-ACA had a strong inhibitory effect against *P. acnes* with MIC and MBC values of 62 and 250  $\mu\text{g/ml}$ , respectively. In addition, 1'-ACA exhibited antibacterial activity against *Staphylococcus aureus* and *S. epidermidis* with the same MIC (250  $\mu\text{g/ml}$ ) and MBC values (1000  $\mu\text{g/ml}$ ).

4. *A. galanga* extract would be an interesting material for further study on an alternative treatment of acne, and 1'-ACA could be recommended as an indicative marker for standardization of *A. galanga* extract.

5. High performance liquid chromatographic method was established for the determination of 1'-ACA content in *A. galanga* rhizome extract. This analytical method showed good resolution as well as linearity.

6. Standardized hexane extract of *A. galanga* rhizome was used for preliminary formulation study. The content of 1'-ACA in hexane extract was  $76.1 \pm 0.62$  %w/w.

7. Solubility and stability of *A. galanga* extract were examined prior to the formulation study. The solubility study showed that *A. galanga* extract is sparingly miscible with ethanol and mineral oil, slightly miscible with propylene glycol and very slightly miscible with glycerin. Physical and chemical stability studies of the extract demonstrated that the examined temperatures (25°C, 30°C and 45°C) did not affect the stability of the extract. However, the extract was not stable if it was exposed to light.

8. The anti-acnes cream containing *A. galanga* extract were prepared. The results showed that 1'-ACA was not stable in oil in water cream bases. However, the degraded products of 1'-ACA, which may be 1'-hydroxychavicol acetate and *p*-acetoxy-trans-cinnamic alcohol, still exhibited inhibitory effect against *P. acnes*.

9. Preliminary formulation study of anti-acne cream using *A. galanga* extract revealed that although the *A. galanga* cream exhibited inhibitory effect after heating and cooling cycle test and at room temperature after 30 days of storage, 1'-ACA is not stable in the oil in water cream bases. Stability of *A. galanga* cream in this research was not success. Therefore, it requires further studies to find a suitable cream base or suitable dosage form. In addition, skin irritation should be a further study.