

CHAPTER V

CONCLUSION

In the study of the extraction of *R. hieroglyphicum* by water and 95% (v/v) ethanol; the aqueous extract (RW) showed a higher extraction yield than the ethanolic extract (RE). This indicated that most components of the algae dissolved in high-polarity solvents and that more polar compounds were found.

The determination of antimicrobial activity by an agar well diffusion method was also carried out. The results revealed that all of the extracts did not contain active antimicrobial compounds. They had no effective antibacterial activity against the test microorganism i.e., *Staphylococcus aureus* ATCC 29213, methicillin-resistant *S. aureus* and *Propionibacterium acne* ATCC 6919.

The phenolic compounds and antioxidant activity of *R. hieroglyphicum* extracts (RW and RE) were compared with the ethanolic extract of *Spirulina platensis* (SE), then the antioxidant activity determined by three different methods: DPPH, ABTS and TBARS assay, compared with reference antioxidants (gallic acid, trolox and quercetin). The results suggested that the ethanolic extract of *S. platensis* showed higher levels of antioxidant activity in DPPH, ABTS and TBARS assay than that of the ethanolic extract from *R. hieroglyphicum* but it contained less total phenolic compounds. This indicated that *S. platensis* contained other hydrophobic or non-polyphenolic antioxidative substances. For the extracts from *R. hieroglyphicum*, the RW showed higher ABTS scavenging activity than RE and SE extracts. This

indicated that the polar polyphenolic compounds, phenolic compounds, other hydrophilic compounds including peptides, fucoidan and polysaccharides have shown antioxidant properties. Our results indicate that extracts of *R. hieroglyphicum* exhibit a potential natural antioxidant source. In addition, the RW extract shows high amount of sulfated polysaccharides which are demonstrated by corresponding to the high antioxidant activity. Moreover, it contained amino acids and exhibited gelling ability. At low concentration, it was also stable under high temperatures and a broad range of pH levels which were the promising properties for useful in cosmeceutical products. From these activities and properties, the extract is interesting for further studies on applications in pharmaceutical products. Then, its moisturizing effect was investigated because it contained mostly polysaccharides and amino acids which might play an important role as skin moisturizer. The moisturizing effect of RW extract was compared with well-known commercial moisturizers such as glycerol (G), propylene glycol (PG) and hyaluronic acid (HA) in short- and long-term use. Results demonstrated that RW extract revealed a good moisturizing effect on human skin besides glycerol, propylene glycol and hyaluronic acid. The RW extract is a hygroscopic substance and contains a class of sugar units that provides the moisturizing effect as in hyaluronic acid. The skin hydration increased after using RW cream even for long-term usage which was comparable to hyaluronic acid and no skin irritation occurred.

This work reveals that *R. hieroglyphicum* extract seems to be appropriated as a new skin moisturizing ingredient for cosmetic industry. The present data showed that when the moisturizer test creams were applied to the skin, the skin hydration had increased compared to untreated skin. This may be due to an increased penetration of

the hydrophilic substances and occlusive barrier to prevent water loss from the skin, supporting the results from previous studies on short- and long-term use of moisturizer.

For the aqueous extract from freshwater macroalga, it was safe and revealed the same moisturizing property as hyaluronic acid via humectancy effect, followed by occlusive effect which can retain longer effect for skin hydration. Therefore, the RW extract might be an alternative skin moisturizer to hyaluronic acid which is quite expensive.