CHAPTER 7
CONCLUSIONS AND FURTHER STUDY

7.1 CONCLUSIONS

The conclusions of the experimental results are following:

1. The extraction equilibrium experiment, the distribution (partition) coefficient of berberine/kerosene, which is between berberine/n-hexane and berberine/paraffin, is an optimum value. The distribution coefficients vary to the pH of the external solution.

2. The extraction equilibrium experiment, kerosene should be used as the membrane solvent.

3. From the experimental result of berberine extraction on emulsion liquid membrane from synthetic berberine solution, it was found that the suitable conditions are shown in Table 7.1.

Table 7.1 Suitable Conditions for Extraction of Synthetic Berberine Solution by Emulsion Liquid Membrane Process

Parameters	Suitable Conditions
Initial pH in the external phase	pH 11
Span-80 dissolved in kerosene	1%(v/v)
Internal HCl concentration	0.02 M

From the experimental data, the recovery percentage of synthetic berberine was demonstrated 80% of atmospheric single batch extraction within 1 minute and

99% within 4 minutes. The berberine concentration of the initial phase was 5 times higher than the initial concentration of the external phase.

4. From the experimental result of crude berberine extraction on emulsion liquid membrane from Khamin Khruea, it was found that the suitable conditions are shown in Table 7.2

Table 7.2 Suitable Conditions for Extraction of Crude Berberine Solution by Emulsion Liquid Membrane Process

Parameters	Suitable Conditions
Initial pH in the external phase	pH 12
Span-80 dissolved in kerosene	1%(v/v)
Internal HCl concentration	0.03 M

From the experiment of these, the recovery percentage of crude berberine was demonstrated 70% of atmospheric single batch extraction within 1 minute and 94% within 5 minutes. The berberine concentration of the initial phase was 4.19 times higher than the initial concentration of the external phase.

5. The shrinking core model can be used to predict the rate of berberine transfer and the influence of pH value in the external phase on the berberine flux. The model was porposed as

$$\frac{dC_B}{dt} = -\frac{kAC_B}{V_E}\left(1 - \frac{k}{k + \frac{r_C D_B K_D}{RL}}\right)$$

where k is the mass transfer in the external phase which is defined from duffusion of berberine in the external phase,by using Moo-Young correlation, which is

equal to $7.4359*10^{-4}$ cm/s. The diffusion of berberine in the external phase and the diffusion of berberine in the membrane phase (D_B) was tanken to be $4.7506*10^{-6}$ cm^2/s and $2.0781*10^{-5}$ cm^2/s, respectively. The emulsion globule radius was found to be 0.03 to 0.05 cm.

7.2 Further Study

From the batch of emulsion liquid membrane extraction study, the primary conditions could be used for study the continuous extraction of the crude berberine solution.