

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1. The rate and the amount of anthraquinones extracted increases with increasing extraction time, temperature, and ultrasonic power.
2. The main mechanism for enhanced recovery anthraquinones with ultrasound assisted extraction was acoustic cavitation, a phenomenon occurring in liquid medium under the influence of ultrasound which causes the root tissue disruption, thus enhancing the mass transfer of the solute into the solvents.
3. The main mechanism for enhanced recovery of anthraquinones with microwave assisted extraction was the dipole rotation of the polar solvent in the microwave field, which was highly influenced by the solvent dielectric constant, and dissipation factor.
4. The appropriate condition for ultrasonic extraction was operating at 50% ethanol, extraction temperature at 60 °C, ultrasonic setting power 9 and extraction times for 60 minutes.
5. The appropriate condition for microwave extraction was operating at 80% ethanol, extraction temperature at 60 °C, and extraction times for 15 minutes.
6. Microwave extraction gives the highest yields while requiring the shortest extraction times when compare with the other methods.
7. The antioxidant activity of the extracts obtained with soxhlet extraction and microwave assisted extraction was found to be highest, compared with those obtained with maceration and ultrasonic assisted extraction.

5.2 Recommendations

1. Microwave assisted Soxhlet extraction (Figure 5.2.1) is an interesting choice of system that could potentially enhance the extraction efficiency by combining the advantages each systems offer. This system is of interest for future investigation.

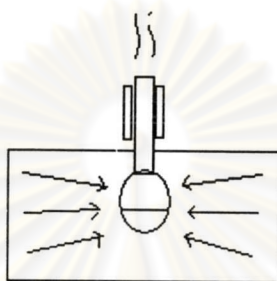


Figure 5.2.1 microwave soxhlet extraction apparatus

2. Experiments in this study suggested energy used in ultrasonic bath and microwave were energy input but in extraction has energy loss in system then the real energy for extraction was interest in next time.
3. The measurement of different anthraquinones components in the extract using HPLC is recommended for the future study.
4. Other factors affecting extraction efficiency such as particle sizes, solvent to sample ratio, and sample moisture content should be considered the further work.

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