UNIVERSITI PUTRA MALAYSIA

OPTIMISED APPLICATION OF THE MICROWAVE EXTRACTION TECHNIQUE OF ESSENTIAL OILS FROM AQUILARIA *MALACCENSIS* LAMK WOOD AND CYMBOPOGON *NARDUS* (L.) RENDLE LEAVES

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By

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Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

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Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

OPTIMISED APPLICATION OF THE MICROWAVE EXTRACTION TECHNIQUE OF ESSENTIAL OILS FROM AQUILARIA *MALACCENSIS* LAMK WOOD AND CYMBOPOGON *NARDUS* (L.) RENDLE LEAVES

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May 2011

Chairman : Prof. Haji Kaida bin Khalid, PhD.

Faculty : Science

In this study, the important process parameters such as microwave power, temperature and extraction time of MET are controlled to obtain the highest yield of extracted essential oil. The microwave extraction method for the essential oil from gaharu and citronella grass is compared with the conventional extraction technique (CET). In such a way to obtain the first droplet of distillation, it is necessary to heat up only 10 to 13 minutes with MET against 25 to 45 minutes with CET for Aquilaria *malaccensis* wood while for Cymbopogon *nardus* extraction, it requires 3 to 7 minutes for MET and about 12 to 20 minutes for CET to obtain the first droplet of oil. After 1 hour of extraction, MET gives higher percentage yield of oil with 0.016% for wet distillation for Aquilaria *malaccensis* and 1.21% for Cymbopogon *nardus* while the percentage yield of oil obtained by the CET is only 0.140% for Aquilaria *malaccensis* and 3.51% for Cymbopogon *nardus* after 8 hours of extraction. Another parameter is day of soaking for the samples. It plays an important role in the extraction where by the long time the sample was soaked, the more yield were collected. The highest yield was 0.116% which

obtained in ten days of soaking. Identification of the chemical component was based on comparison of calculated retention indices and mass spectral data with literature values. The tested result of the oils showed some variation and differences in terms of GC profiles, concentration and chemical derivatives. In gaharu essential oil, the composition of oil isolated by the hydro distillation (MET) is dominated by dodecanoic acid, ethenyl ester, lauric acid, and vinyl ester yielding 12.75%. while in citronella essential oil, the composition is dominated by 6-octenal, 3,7-dimethyl and citronellal yielding 24.68% This project is also looking for the various techniques of extraction process such as hydro (HD), dry (DD) and steam (SD) distillation techniques. The results from each technique were presented. The project has successfully proved that MET is more efficient than CET in terms of rapidity and the quantity of the yield.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

APLIKASI OPTIMUM MIKRO GELOMBANG BAGI PENGEKSTRAKAN MINYAK PATI DARIPADA KAYU AQUILARIA *MALACCENSIS* LAMK DAN DAUN CYMBOPOGON *NARDUS* (L.) RENDLE

Oleh

BIBI SABRINA BINTI YAHAYA

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Dalam kajian ini, parameter-parameter proses penting seperti kuasa mikrogelombang, suhu dan masa dalam MET dikawal sepanjang proses pengekstrakan untuk memperoleh ekstrak minyak pati yang maksimum dan berkualiti tinggi. Kaedah mikrogelombang (MET) untuk ekstrak minyak pati dari kayu gaharu dan daun serai wangi dibandingkan dengan kaedah lama atau *Conventional Extraction Technique* (CET). Didapati titisan minyak pati pertama yang jatuh untuk adalah antara minit ke-10 dan ke-13 bagi MET dan antara minit ke 25 dan minit ke 45 bagi CET untuk sampel Aquilaria *malaccensis*. Manakala bagi sampel Cymbopogon *nardus* pula, adalah antara minit ke-3 dan minit ke-7 untuk MET dan antara minit ke-12 hingga minit ke-20 untuk CET. Selepas tempoh pengekstrakan selama 60 minit menggunakan gelombang mikro MET memberikan peratusan ekstrak yang lebih tinggi dengan 0.016% bagi Aquilaria *malaccensis* dan 1.21% untuk Cymbopogon *nardus*, manakala peratusan hasil ekstrak daripada CET hanya 0.14% untuk Aquilaria malaccensis dan 3.51% bagi Cymbopogon nardus selepas tempoh 8 jam tempoh pengekstrakan. Parameter lain adalah hari rendaman untuk

sampel. Hal ini memainkan peranan penting dalam pengekstrakan di mana lebih lama sampel direndam, hasil lebih banyak minyak diperoleh. Keputusan tertinggi adalah 0.116% yang diperoleh dalam sepuluh hari rendaman. Komponen kimia dikenalpasti melalui perbandingan pengiraan indeks retensi dan data spektrum jisim dengan nilai rujukan. Keputusan ujian menunjukkan beberapa variasi dan perbezaan dalam profil GC, kepekatan dan terbitan bahan kimia. Dalam minyak pati gaharu, komposisi minyak yang diperoleh dari penyulingan basah (MET) didominasi oleh asid dodecanoic, ester etenil, asid laurik, dan ester vinyl menghasilkan 12.75%. Manakala dalam minyak pati serai, komposisi didominasi oleh 6-octenal, dimetil 3,7-dan citronelal menghasilkan 24.68%. Projek ini juga mengenalpasti pelbagai teknik penyulingan seperti hidro (HD), kering (DD) dan wap (SD). Hasil kajian bagi setiap teknik dibentangkan. Projek ini telah berjaya membuktikan bahawa proses MET lebih cekap berbanding CET dari segi kecekapan dan kuantiti hasil ekstrak.

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I certify that a Thesis Examination Committee has met on **27 May 2011** to conduct the final examination of **Bibi Sabrina binti Yahaya** on her thesis entitled **"Optimized Application of the Microwave Extraction Technique of Eessential Oils from Aquilaria *malaccensis* Lamk. Wood and Cymbopogon *nardus* (L.) Rendle Leaves"** in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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DECLARATION

I hereby declare that the thesis is my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

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Date: 27 May 2011

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