UNIVERSITI PUTRA MALAYSIA

OPTIMISATION OF SOLID LIQUID EXTRACTION OF BIOACTIVE COMPOUNDS FROM ORTHOSIPHON STAMINEUS BENTH LEAVES

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MASTER OF SCIENCE

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By

MOHD FARHAN B ABDUL RAZAK

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

June 2012

This thesis is specially dedicated to
my wife, parents,
friends and
family members.

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

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Chairman: Professor Luqman Chuah Abdullah, PhD

Faculty: Engineering

Orthosiphon stamineus, also known as Misai Kucing, is one of the invaluable medicinal plants originated from Southeast Asia. *O. stamineus* leaves were used in plenty of applications related to the medicinal purposes and are believed to cure certain disease such as hypertension, gout and fever. However, very little research done with regards to ascertain optimum extraction process and quality extract of *O. stamineus* leaves.

This research studied a solid- liquid extraction (SLE) process which are involved in processing of bioactive extract from *O. stamineus* leaves. Different experiments were carried out to determine the effects of various operating parameters on the qualitative and quantitative aspects of *O. stamineus* leaves. Rosmarinic acid (RA) and Sinensetin (SEN) were selected as the quality indicators of the product because these two compounds were played a major role in the bioactivities including anti- inflammatory, anti- oxidant and anti- pyretic of *O. stamineus* leaves.

Water is most suitable solvent for extracting *O. stamineus* leaves compared to ethanol, ethyl acetate, and hexane. This was because water gave the highest extraction yield as well as

quality extract that related to RA and SEN. Besides, water also indicated highest antioxidant and anti- inflammatory compared to other solvents.

The optimum extraction condition of *O. stamineus* leaves was determined as 60°C and the ratio of water to solid is 10:1 (ml:g) to avoid degradation of SEN based on analysis using Response Surface Methodology (RSM) technique. of 6 hours were found to be optimum based on analysis of Response Surface Methodology (RSM). Two hours of extraction duration was selected as optimum extraction time based on kinetic study. The activation energy of the extraction is 36.57 kJ mol^{-1}.

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

MENG- OPTIMUMKAN KADAR SEBATIAN AKTIF YANG WUJUD DI DALAM DAUN *ORTHOSIPHON STAMINEUS* BENTH MENGGUNAKAN TEKNIK PENGEKSTRAKAN PEPEJAL- CECAIR

Oleh

MOHD FARHAN ABDUL RAZAK

June 2012

Pengerusi: **Professor Luqman Chuah Abdullah, PhD**

Fakulti: **Kejuruteraan**

Orthosiphon stamineus, juga dikenali sebagai Misai Kucing, adalah salah satu daripada tumbuhan ubatan yang bernilai dan berasal dari Asia Tenggara. Banyak kajian telah dijalankan menggunakan daun *O. stamineus* dan hasil kajian tersebut menunjukkan bahawa daun *O. stamineus* dipercayai dapat menyembuhkan penyakit tertentu seperti tekanan darah tinggi, gout dan demam. Walau bagaimanapun, amat sedikit penyelidikan yang dilakukan mengenai proses penentuan kadar optimum semasa proses pengekstrakan dan kualiti bagi daun *O. stamineus*.

Kajian ini dijalankan menggunakan kaedah pengekstrakan pepejal-cecair (SLE) bertujuan untuk mengkaji kadar bahan aktif dalam daun *O. stamineus*. Kajian dijalankan menggunakan pemboleh ubah yang berbeza bagi menentukan kaitan antara pemboleh ubah tersebut kepada kualiti dan kualitatif aspek bagi daun *O. stamineus*. Asid Rosmarinic (RA) dan Sinensetin (SEN) telah dipilih sebagai petunjuk kualiti produk kerana kedua-dua bahan aktif ini telah memainkan peranan utama dalam kajian anti-radang, anti-oksida dan dapat menurunkan suhu badan.

Berdasarkan kajian ini, air adalah pelarut yang paling sesuai untuk mengekstrak daun *O. stamineus* berbanding etil asetat, etanol dan heksana. Ini adalah kerana air memberi hasil ekstrak yang tertinggi serta menunjukkan kadar kepekatan kedua- dua bahan aktif (penunjuk kualiti) yang tinggi iaitu RA dan SEN. Selain itu, air juga menunjukkan antioksidan dan anti-radang yang tertinggi berbanding pelarut-pelarut lain.

Hasil ekstrak yang optimum diperolehi daripada suhu pengekstrakan 60 ° C dan nisbah air kepada pepejal adalah 10:1 (ml:g) berdasarkan analisis Kaedah Respons Permukaan (RSM) bagi mengelakkan degradasi bahan aktif SEN. Dua jam dipilih sebagai masa pengekstrakan yang optimum berdasarkan ujian kinetik yang dijalankan. Tenaga pengaktifan juga dikira dan nilainya adalah 36.57 kJ mol^{-1}.

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I certify that a Thesis Examination Committee has met on 11th Jun 2012 to conduct the final examination of Mohd Farhan Bin Abdul Razak on his thesis entitled "Optimisation of Solid Liquid Extraction of Bioactive Compounds From *Orthosiphon stamineus* Benth 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 (Biochemical Engineering).

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement of the Master Degree. The members of the Supervisor Committee were as follows:

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DECLARATION

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

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MOHD FARHAN ABDUL RAZAK

Date : 11 June 2012

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