



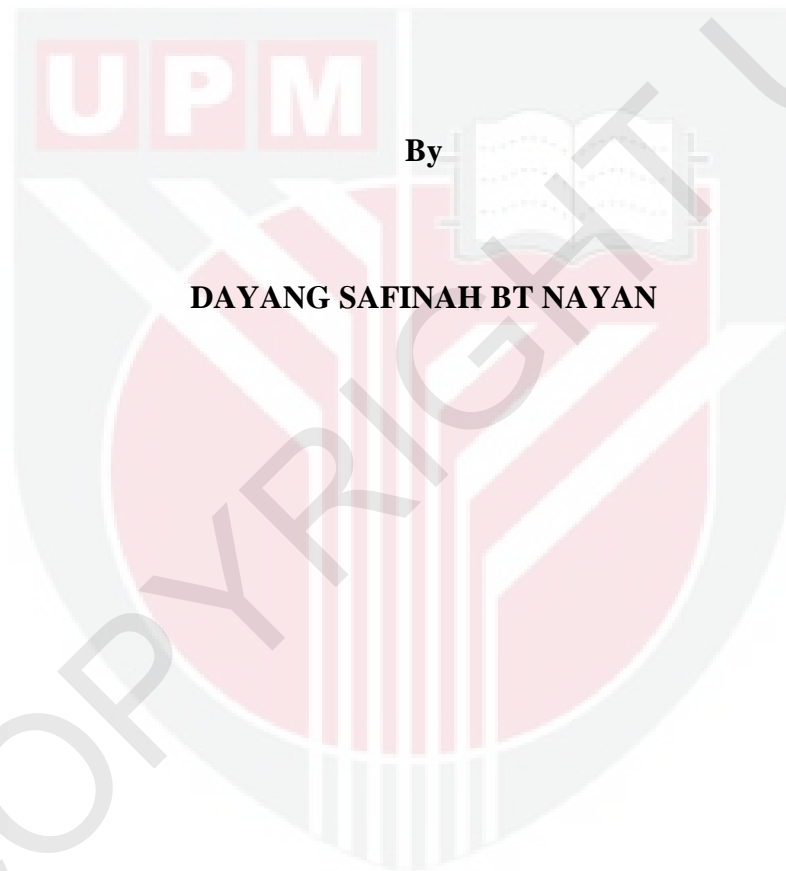
**UNIVERSITI PUTRA MALAYSIA**

**HEAVY METAL CONCENTRATIONS IN SELECTED MEDICINAL  
PLANTS AND HERBAL PRODUCT, AND THE EFFECT OF SELENIUM ON  
ANTIOXIDANT ACTIVITY OF MAS COTEK (*FICUS DELTOIDEA JACK*)**

**DAYANG SAFINAH BT NAYAN**

**FP 2012 30**

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By

**DAYANG SAFINAH BT NAYAN**

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

**August 2012**

## DEDICATION

**I would like to dedicate this thesis especially to:**

**My beloved parents,**

*Nayan b Amit*

*And*

*Tharinah bt Ishak*

**Sister,**

*Hazlina bt Abdul Halim*

**And lastly my brothers,**

*Ja'far*

*Ahmad Rafiqan*

*Ahmad Ridzuan*

**Who always supported and encourage me to do the best.**

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

**HEAVY METAL CONCENTRATIONS IN SELECTED MEDICINAL PLANTS AND HERBAL PRODUCT, AND THE EFFECT OF SELENIUM ON ANTIOXIDANT ACTIVITY OF MAS COTEK (*Ficus deltoidea* Jack)**

By

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**August 2012**

**Chairman: Associate Professor Che Fauziah bt Ishak, PhD**

**Faculty: Agriculture**

Three studies were involved in this research. First study on medicinal plants and soils where the plants are grown was conducted with the aim of finding soil factors which influence heavy metals uptake by medicinal plants. This screening study were performed on heavy metals concentrations in medicinal plants at 3 different sites (different soil types) and the soils on which the plants grow. Soil and plant samples were collected from FRIM External Research Station, Setiu, Terengganu (17 samples), Felda Agricultural Services Sdn Bhd, Jengka 25, Bandar Jerantut, Pahang (16 samples) and MARDI Jalan Kebun Station, Klang, Selangor (24 samples) with each sites having their own management practices. Each location has different soil types. History of fertilization for each sites also differed. Result of this study indicated that total heavy metals in plants were related with soil properties (pH, CEC, organic carbon and/or clay content), and its concentration in soils, but it all depends on location and plant parts involved. Therefore, it is concluded that soil properties and total heavy metals concentration in soils affect its availability for medicinal

plants uptake, but it all depends on the prevailing soil conditions and soil types where the plants are grown.

Continued from the first study, the second study was done to monitor whether common herbal teas in the market are safe to consumers in terms of heavy metals content. Thirty six samples of herbal teas were randomly purchased from the local market (15 Mas cotek herbal teas and 21 Misai kucing herbal teas). In general, heavy metals concentrations for both herbal teas are still under the maximum permissible levels except for Zn and Pb in Misai kucing herbal teas, and Zn and As in Mas cotek herbal teas. Other than that, the data also shows that Se is deficient in herbal teas especially Mas cotek herbal teas. Thus, it is suggested that both Mas cotek and Misai kucing herbal teas in the local market need to be monitored with regards to concentrations of heavy metals. While, in terms of its daily intake, average daily dietary intake (ADDI) values has not reached the threshold value. Therefore, there is no danger of toxic heavy metals originating from herbal teas to happen.

Finally, for the third study, a glasshouse experiment was carried out to investigate the effect of selenium fertilization on the antioxidant activity of Mas cotek at the selenium rates of 0, 10, 20, 40 and 50 g Se/ha in limed (2 t/ha  $\text{CaCO}_3$ ) and unlimed soils treated with (100 kg  $\text{P}_2\text{O}_5$ /ha) and without P fertilizer. From this study, selenium content in Mas cotek was significantly increased with selenium application, and the highest selenium uptake were recorded when lime, P fertilizer and 50 g Se  $\text{ha}^{-1}$  were applied. In terms of the antioxidant activity, Se, in general, augments antioxidant activity in Mas cotek leaves, these activities being induced more effectively by higher Se concentration in the soils. In short, for maximum antioxidant

activity and Se content, the recommended fertilization rate is 50 g Se/ha when lime and P fertilizer were applied, although this rate will gradually affect plant growth.



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

**KEPEKATAN LOGAM BERAT DALAM TANAMAN UBATAN TERPILIH DAN PRODUK HERBA, SERTA PENGARUH SELENIUM TERHADAP AKTIVITI ANTIOKSIDAN DALAM MAS COTEK (*Ficus deltoidea Jack*)**

Oleh

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**Ogos 2012**

**Pengerusi: Profesor Madya Che Fauziah bt Ishak, PhD**

**Fakulti: Pertanian**

Tiga eksperimen telah terlibat dalam kajian ini. Kajian pertama pada tumbuh ubatan dan tanah di mana tumbuh-tumbuhan tersebut ditanam telah dijalankan untuk mencari faktor-faktor yang mempengaruhi pengambilan logam berat oleh tumbuhan ubatan tersebut. Kajian saringan ini telah dijalankan pada kepekatan logam berat dalam tumbuhan ubatan dan tanah di 3 lokasi yang berbeza (jenis tanah yang berbeza). Sampel tanah dan tumbuhan dikumpulkan dari Stesen Penyelidikan Luar FRIM, Setiu, Terengganu (17 sampel), Felda Agricultural Services Sdn Bhd, Jengka 25, Bandar Jerantut, Pahang (16 sampel) dan Stesen MARDI Jalan Kebun, Klang, Selangor (24 sampel) dengan setiap lokasi mempunyai amalan pengurusan yang tersendiri. Setiap lokasi juga mempunyai jenis tanah yang berbeza. Sejarah perbajaan bagi setiap lokasi juga berbeza. Hasil kajian ini menunjukkan bahawa jumlah logam berat dalam tumbuhan adalah berkaitan dengan sifat-sifat tanah (pH, CEC, karbon organik dan / atau kandungan tanah liat), dan kepekatan logam berat dalam tanah, walaubagaimanapun ia bergantung kepada lokasi dan bahagian tumbuhan yang

terlibat. Oleh itu, dapat disimpulkan disini bahawa sifat-sifat tanah dan jumlah kepekatan logam berat dalam tanah menjejaskan ketersediaan logam berat untuk diambil oleh tumbuhan ubatan, tetapi ia bergantung kepada keadaan tanah semasa dan jenis tanah di mana tumbuhan tersebut ditanam.

Lanjutan daripada kajian yang pertama, kajian kedua dilakukan untuk memantau sama ada teh herba yang kebiasaannya terdapat di pasaran adalah selamat kepada pengguna dari segi kandungan logam berat. Tiga puluh enam sampel teh herba telah dibeli secara rawak dari pasaran tempatan (15 teh herba Mas cotek dan 21 teh herba Misai kucing). Secara umumnya, kepekatan logam berat bagi kedua-dua teh herba ini masih di bawah paras maksimum yang dibenarkan kecuali untuk Zn dan Pb dalam teh herba Misai kucing, dan Zn dan As dalam teh herba Mas cotek. Selain daripada itu, data juga menunjukkan bahawa terdapat kekurangan Se di dalam teh herba terutamanya teh herba Mas cotek. Oleh itu, dicadangkan bahawa kedua-dua teh herba Mas cotek dan Misai kucing di dalam pasaran tempatan perlu dipantau dari segi kepekatan logam berat. Manakala, dari segi pengambilan harian, nilai purata pengambilan makanan harian (ADDI) tidak pernah mencapai had yang ditetapkan. Oleh itu, tidak ada bahaya, khususnya dari logam berat toksik yang berasal dari teh herba untuk berlaku.

Akhir sekali, untuk kajian ketiga, satu eksperimen rumah kaca telah dijalankan untuk mengkaji kesan pembajaan selenium terhadap aktiviti antioksidan Mas cotek pada kadar selenium 0, 10, 20, 40 dan 50 g Se/ha apabila kapur ( $2 \text{ t/ ha CaCO}_3$ ) dan tiada kapur serta baja P ( $100 \text{ kg P}_2\text{O}_5/\text{ha}$ ) dan tiada baja diletakkan pada tanah. Daripada kajian ini, kandungan selenium di dalam Mas cotek telah meningkat dengan ketara dengan pembajaan selenium, dan pengambilan selenium tertinggi direkodkan apabila kapur, baja P dan 50 g Se/ha telah digunakan. Dari segi aktiviti antioksidan, Se,



secara umumnya meningkatkan aktiviti antioksidan di dalam daun Mas cotek, aktiviti antioksidan nya akan terdorong dengan lebih tinggi jika terdapat kepekatan Se yang lebih tinggi dalam tanah. Pendek kata, untuk aktiviti antioksidan dan kandungan Se yang maksimum, kadar pembajaan yang disyorkan ialah 50 g Se / ha apabila kapur dan baja P digunakan, walaupun kadar ini secara beransur-ansurnya akan menjejaskan pertumbuhan pokok.



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I certify that a Thesis Examination Committee has met on 28 July 2011 to conduct the final examination of Dayang Safinah bt Nayan on her thesis entitled “**Heavy Metal Concentrations in Selected Medicinal Plants and Herbal Product, and the Effect of Selenium on Antioxidant Activity of Mas Cotek (*Ficus deltoidea Jack*)**” 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 degree of Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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**Umi Kalsom bt Yusuf**

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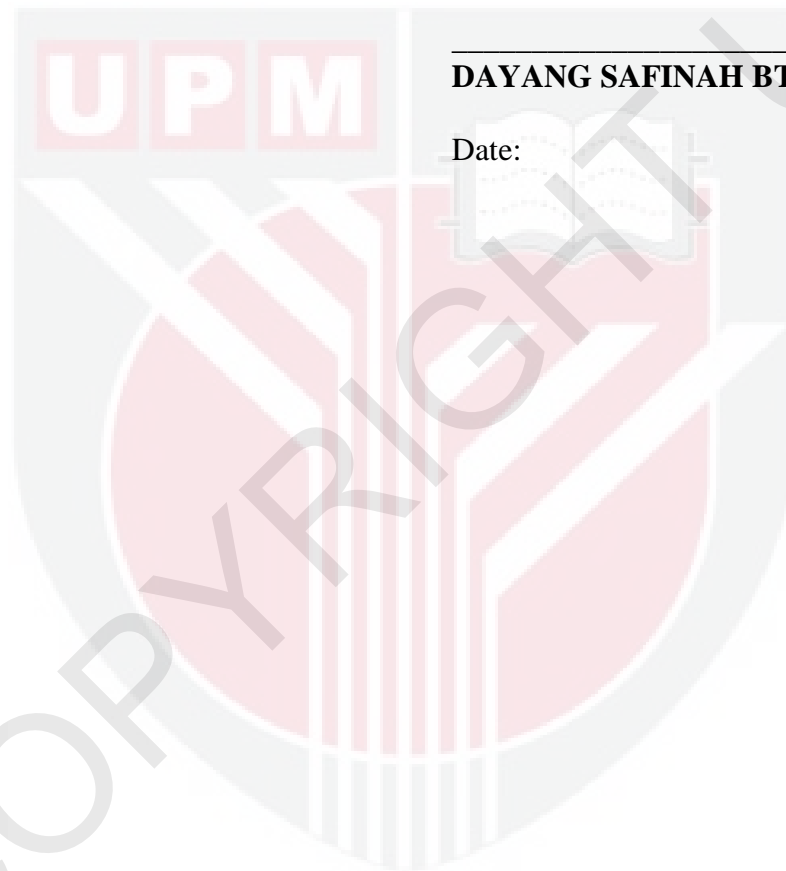
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Date:

## DECLARATION

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



**DAYANG SAFINAH BT NAYAN**

Date:

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