

**THIN LAYER DRYING CHARACTERISTIC OF *MORINDA CITRIFOLIA*  
FRUIT AND DRYING EFFECTS ON 6 – METHOXY-7-HYDOXY-COUMARIN  
CONTENT**

**By**

**RABIHA BT SULAIMAN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
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This study presents the thin layer drying characteristic of *Morinda Citrifolia Linn* fruit and drying effects on *scopoletin* content. The optimum mature stage of *M.citrifolia* fruit was found to be four months after bud flowering with high *scopoletin* content of 1.65 $\mu$ gSC/g fresh weight.

Thin-layer drying characteristics of *M. citrifolia* fruit slices were investigated at 50, 60 and 70°C, and air velocity of 0.5, 1.5 and 2.5 m/s. Relative humidity range of 64-85 % was observed. The drying time required to reduce the moisture content from initial average value of 5.25g water/g dry solid (= 84%<sub>wet basis</sub>) to a desired final moisture of less than 0.053g water/g dry solid (=5%<sub>wet basis</sub>) was 6.0h, 3.0h and 1.5h for drying air temperatures of 50°C, 60°C and 70°C respectively. An increase in drying temperatures

shortened the drying time. The drying time needed to dry *M. citrifolia* fruit slices at intermediate moisture content decreased when the air velocities was increased at constant drying temperature. However, different air velocity had no significant difference in overall drying time to achieve equilibrium moisture content at constant temperature. Drying rates for *M. citrifolia* fruit as affected by drying air temperature and air velocity were determined. The influence of temperature on the drying rate is more pronounced as compared to the influence of the air velocity. From the drying rates it was observed that drying of *M. citrifolia* fruit slices took place under the falling rate period.

The drying data were then fitted to different semi-theoretical models such as diffusion, Lewis and Page models, based on the moisture ratio (MR). The results of analysis showed that Page model gave better predictions than other models, and satisfactorily described the thin-layer drying characteristics of sliced *M. citrifolia* fruit.

Freeze drying and hot air drying experiments were conducted on *M.citrifolia* fruit. The effect of drying on *scopoletin* content of *M.citrifolia* was evaluated. Spectrofluorometer was used for the determination of *scopoletin* in *M.citrifolia* fruit. An analysis of variance (ANOVA) revealed that there is no significant difference in *scopoletin* content obtained from freeze dried and hot air dried sample. This study shows that the remaining *scopoletin* content after either drying technique is nearly 26% of the initial content.

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

**SIFAT PENGERINGAN LAPISAN NIPIS BUAH *MORINDA CITRIFOLIA L* DAN  
KESAN PENGERINGAN KE ATAS KANDUNGAN 6 – *METHOXY-7-HYDOXY-  
COUMARIN***

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Kajian ini menunjukkan sifat pengeringan lapisan nipis buah *M.citrifolia* dan kesan pengeringan pada kandungan *scopoletin*. Buah *M.citrifolia* mencapai tahap matang optimum selepas empat bulan dari pembungaan di mana kandungan tertinggi *scopoletin* yang diperolehi adalah 1.65 $\mu$ gSC/g berat segar.

Sifat-sifat pengeringan udara panas diselidiki untuk julat suhu 50, 60 and 70°C, dan kelajuan udara 0.5, 1.5 and 2.5m/s. Di dapati kelembapan nisbi berada dalam julat 64-85%. Masa pengeringan yang diperlu untuk menurunkan kandungan lembapan awal dari 5.25g air/g jirim kering (=84%<sub>asas basah</sub>) kepada kandungan lembapan akhir kurang daripada 0.053g air/g jirim kering (=5%<sub>asas basah</sub>) adalah 6 jam, 3 jam dan 1.5 jam pada suhu 50, 60 and 70°C masing-masing. Peningkatan suhu pengeringan meningkatkan

masa pengeringan. Masa pengeringan yang diperlu untuk mengeringkan hirisan buah *M.citrifolia* kepada kandungan lembapan pertengahan berkurang apabila kelajuan udara meningkat pada suhu tetap. Namun, kelajuan udara yang berbeza tidak memberikan perubahan pada keseluruhan masa pengeringan untuk mencapai kandungan lembapan seimbang. Kadar pengeringan lapisan nipis bagi buah *M.citrifolia* pula dipengaruhi oleh suhu dan kelajuan udara. Bagaimanapun, kesan suhu lebih mempengaruhi kadar pengeringan berbanding dengan kelajuan udara. Kadar pengeringan menunjukkan pengeringan hirisan buah *M.citrifolia* termasuk dalam kala kadar menurun sahaja.

Data pengeringan yang diperolehi dipadankan dengan model diffusion, Lewis dan Page, berasaskan pada nisbah lembapan (MR). Keputusan analisis yang diperolehi menunjukkan model Page memberikan gambaran yang lebih tepat mengenai perlakuan pengeringan lapisan nipis bagi buah *M.citrifolia* berbanding model lain.

Kesan pengeringan ke atas kandungan *scopoletin* telah ditentukan melalui kaedah pengeringan sejuk beku dan pengeringan udara panas. Spectrofluorometer diguna untuk menentukan kandungan *scopoletin*. Ujian statistic iaitu varian analisis (ANOVA) menunjukkan tiada perbezaaan signifikan dalam kandungan *scopoletin* bagi sample yang dikeringkan melalui kaedah pengeringan sejuk beku dan pengeringan udara panas. Kajian ini juga menunjukkan bahawa baki kandungan *scopoletin* selepas pengeringan adalah hanya 26% daripada kandungan asal.

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*“Success is a blessing journey for those who continually seek knowledge”*

I certify that an examination committee met on 26 February 2004 to conduct the final examination of Rabiha binti Sulaiman on her Master of Science thesis entitled “Thin layer drying characteristics of *Morinda Citrifolia L* fruit and drying effect on *6-methoxy-7-hydroxy-coumarin* content” in accordance with Universiti Pertanian Malaysia ( Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are 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 UPM or other institutions.

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