UNIVERSITI PUTRA MALAYSIA

ANTIOXIDANT ACTIVITIES FROM PULP, PEEL AND SEED OF WHITE [HYLOCEREUS UNDATUS (HAW.) BRITTON & ROSE] AND RED FLESH PITAYA [HYLOCEREUS POLYRHIZUS (F.A.C. WEBER) BRITTON & ROSE]

LIANA BINTI ADNAN

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By

LIANA BINTI ADNAN

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ANTIOXIDANT ACTIVITIES FROM PULP, PEEL AND SEED OF WHITE [*HYLOCEREUS UNDATUS* (HAW.) BRITTON & ROSE] AND RED FLESH PITAYA [*HYLOCEREUS POLYRHIZUS* (F.A.C. WEBER) BRITTON & ROSE]

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Chairman: Azizah binti Osman, PhD

Faculty: Faculty of Food Science and Technology

Consumption of fruits and vegetables is important in maintaining good health as being proven by many studies. Their functional qualities as natural antioxidant, antimicrobial and anticancer were the common interest among researchers. Best known for its betacyanin pigments, pitaya fruit gained a lot of attention recently in investigating its functional properties. Hence, this study was conducted to determine the bioactive compounds (total phenolic, betacyanin, ascorbic acid, flavonoids and tocopherols) and antioxidant activity [2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging, conjugated diene and ferric thiocyanate (FTC)] of pulp, peel and seed of white (*Hylocereus undatus*) and red flesh pitaya (*H. polyrhizus*). Evaluations of antioxidant activity were carried out against the samples that were extracted using ethanol, chloroform and hexane. The chemical profiling of the selected extracts were then

determined using gas chromatography-mass spectrometry (GC-MS). Seed of white and red flesh pitaya gave significantly ($p<0.05$) higher amount of total phenolic compounds but the least in betacyanin and ascorbic acid content in comparison to the pulp and peel. All flavonoids (catechin, epicatechin, myricetin and quercetin) tested were present in peel and seed of both types of pitaya fruits except for kaempferol while only catechin was detected in both pulps. Antioxidant activity of ethanol extract from red flesh pitaya pulp was significantly ($p<0.05$) higher than that of white flesh as determined by all the three different methods of antioxidant determination. The ethanol, chloroform and hexane extracts of peel and seed gave the same trend between the white and red flesh pitaya. Hexane extracts of peel gave the highest free radical scavenging activity as compared to that of ethanol and chloroform. However, there is no significant difference among all the extracts as determined by conjugated diene and FTC assay methods. On the other hand, ethanol extracts of the red flesh pitaya seed exhibited the highest antioxidant activity in comparison to other extracts and the seed of white flesh pitaya. Based on their high antioxidant activities, hexane extracts of both white and red flesh pitaya peel and ethanol extract of red flesh pitaya seed were selected to undergo fractionation and GC-MS analysis. Various compounds such as tocopherols, squalene and phytosterols were revealed from the fractionated hexane extracts of both types of pitaya peel and ethanol extract of red seed. In conclusion, numerous antioxidants are present in all parts of white and red flesh pitaya. Their utilization and further study can be carried out especially on the peel and seed judging from their ability to act as antioxidant.

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

AKTIVITI ANTIOKSIDAN DARIPADA ISI, KULIT DAN BIJI PITAYA ISI PUTIH [*HYLOCEREUS UNDATUS* (HAW.) BRITTON & ROSE] DAN MERAH [*HYLOCEREUS POLYRHIZUS* (F.A.C. WEBER) BRITTON & ROSE]

Oleh

LIANA BINTI ADNAN

Jun 2012

Pengerusi: Azizah binti Osman, PhD

Fakulti: Fakulti Sains dan Teknologi Makanan

Pengambilan buah-buahan dan sayuran adalah penting dalam mengekalkan kesihatan yang baik seperti dibuktikan oleh beberapa kajian. Kualiti fungsian mereka sebagai antioksidan, antimikrobial dan antikanser yang semulajadi adalah perhatian umum di kalangan penyelidik. Diketahui terbaik dengan pigmen betasianinnya, buah pitaya menerima perhatian yang banyak baru-baru ini dalam pencarian ciri-ciri fungsiannya. Maka, kajian ini dijalankan untuk menentukan sebatian bioaktif (fenolik keseluruhan, betasianin, askorbik asid, flavonoid dan tokoferol) dan aktiviti antioksidan [memerangkap radikal bebas 2,2-diphenyl-1-picrylhydrazyl (DPPH), diene berkonjugasi dan ferric tiosianat (FTC)] daripada isi, kulit dan biji buah pitaya isi putih (*Hylocereus undatus*) dan merah (*H. polyrhizus*). Penilaian aktiviti antioksidan dijalankan terhadap sampel yang diekstrak menggunakan etanol, kloroform dan heksana. Profil kimia

ekstrak-ekstrak yang terpilih kemudiannya ditentukan menggunakan gas kromatografi-spektrometri jisim (GC-MS). Biji pitaya isi putih dan merah memberi jumlah sebatian fenolik keseluruhan yang lebih tinggi secara signifikan ($p<0.05$) tetapi terendah dalam kandungan betasianin dan askorbik asid berbanding dengan isi dan kulit. Kesemua flavonoid (catechin, epicatechin, myricetin dan quercetin) diuji hadir dalam kulit dan biji kedua-dua jenis buah pitaya kecuali kaempferol manakala hanya catechin dikesan dalam kedua-dua isi. Aktiviti antioksidan ekstrak etanol daripada isi pitaya isi merah adalah lebih tinggi secara signifikan ($p<0.05$) berbanding isi putih seperti dikenal pasti dengan kesemua tiga kaedah berbeza penilaian antioksidan. Ekstrak etanol, kloroform dan heksana daripada kulit dan biji memberi trend yang sama di antara pitaya isi putih dan merah. Ekstrak heksana kulit memberi aktiviti memerangkap radikal bebas tertinggi dibanding dengan etanol dan kloroform. Bagaimanapun, tiada perbezaan signifikan di antara kesemua ekstrak seperti ditentukan dengan kaedah assay diene berkonjugasi dan FTC. Sebaliknya, ekstrak etanol biji pitaya isi merah mempamerkan aktiviti antioksidan tertinggi berbanding ekstrak lain dan biji pitaya isi putih. Berpandukan ketinggian aktiviti antioksidan mereka, ekstrak heksana kedua-dua kulit pitaya isi putih dan merah dan ekstrak etanol biji pitaya isi merah dipilih untuk menjalani fraksinasi dan analisis GC-MS. Pelbagai sebatian seperti tokoferol, squalene dan fitosterol telah didedahkan daripada ekstrak heksana kulit kedua-dua jenis pitaya dan ekstrak etanol biji merah difraksinasi. Sebagai kesimpulan, pelbagai antioksidan hadir dalam kesemua bahagian pitaya isi putih dan merah. Penggunaan dan kajian selanjutnya boleh dijalankan terutama sekali ke atas kulit dan biji dihakimi daripada kebolehan mereka untuk bertindak sebagai antioksidan.

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I certify that a Thesis Examination Committee has met on 4 June 2012 to conduct the final examination of Liana binti Adnan on her thesis entitled "Antioxidant Activities from Pulp, Peel and Seed of White [*Hylocereus undatus* (Haw.) Britton & Rose] and Red Flesh Pitaya [*Hylocereus polyrhizus* (F.A.C. Weber) Britton & Rose]" in accordance with the Universities and University College 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.

Members of the Thesis Examination Committee were as follows:

Abdul Azis Ariffin, PhD
Associate Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Chairman)

Lasekan Olusegun Olaniyi, PhD
Associate Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Internal Examiner)

Alfi Khatib, PhD
Associate Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Internal Examiner)

Osman Hassan, PhD
Professor
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
(External Examiner)

_____

ZULKARNAIN ZAINAL, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

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

Azizah binti Osman, PhD
Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Chairman)

Azizah Abdul Hamid, PhD
Associate Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Member)

_____

BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which has 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 at any other institution.

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LIANA BINTI ADNAN

Date: 4 June 2012

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