UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF DURIAN LEATHER AND DETERMINATION OF ITS FLAVOUR RETENTION DURING PROCESSING AND STORAGE

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DEVELOPMENT OF DURIAN LEATHER AND DETERMINATION OF ITS FLAVOUR RETENTION DURING PROCESSING AND STORAGE

BY

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Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Faculty of Food Science and Biotechnology, Universiti Pertanian Malaysia

December, 1996

ACKNOWLEDGEMENTS

Alhamdulillah, first of all I would like to express my utmost thanks and gratitude to Almighty Allah SWT who has given me the will and strength to complete this project and *salawat* and *salam* to His righteous messenger, Prophet Muhammad SAW.

I would also like to express my most sincere appreciation and deepest gratitude to Assoc. Prof. Dr. Yaakob Bin Che Man, the Chairman of my Supervisory Committee for his kind understanding, assistance, advice and guidance during the course of this study and in the preparation of this thesis. I am also grateful to other members of the Supervisory Committee: Assoc. Prof. Dr. Jinap Selamat, Assoc. Prof. Dr. Salmah Yusof and Prof. Dr. Hiroshi Sugisawa for their supervision, support and comments.

I would like to acknowledge the financial support provided by the IRPA fund for this research, which was awarded to Assoc. Prof. Dr. Yaakob Bin Che Man. I would also like to acknowledge Assoc. Prof. Dr. Faujan Ahmad of the Chemistry Department, UPM and Assoc. Prof. Dr Mohd. Ambar Yarmo and Mr. Mohd Noor Ibrahim of UKM for their assistance in GC/MS analysis. My deep appreciation is also extended to the following laboratory assistants of the Faculty of Food Science and Biotechnology : Mr. Azhar Mohd. Noor, Mr. Soib Yusof, Mr. Amran Suratman,

Mr. Halim Abdul Rahman and Mr. Chan Tin Wan for their technical help; and also to my good friends: Fauzi Mohd. Ali, Muhd. Edwin Lubis, Tri Haryati, Rohaizah Ahmad, Amin Ismail and Felix Moh for their generous assistance.

Last but not the least, I wish to express my deepest gratitude to my beloved parents, brothers and sisters for their endless encouragement, patience and sacrifices which had helped me in undertakings and completing this research study. I also owe my special thanks to my special friend, Desi for her moral encouragement and support.

dedicated to

my beloved
parents

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December, 1996

Chairman : Associate Professor Yaakob Bin Che Man, Ph.D.

Faculty : Food Science and Biotechnology

Durian (*Durio zibethinus* Murr) is a popular seasonal fruit grown in many parts of South-East Asia. Malaysia, Thailand and Indonesia are major producers of this fruit in the world. Today, durians are not only planted in home garden but also grown commercially in large-scale plantation to meet the local and export demands. Normally, durians are eaten shortly after harvest in fresh form as it quickly turns sour and rancid due to some chemical changes that follow. To a lesser extend, durian is also processed into products like *lempuk* (durian cake) and *tempoyak* (fermented durian), two traditional products widely consumed in Malaysia and Indonesia.

However, these product are not commercially produced in large quantities. Meanwhile, fruit leather, a product prepared by dehydration of fruit puree, is an established product particularly in the North American and European markets; however it is relatively unknown product in Malaysia. Therefore, the development of

a new fruit leather from durian could be an alternative to increase the commercial value of durian.

Four aspects in the development of durian leather were conducted in this study. These were preliminary study on the development of durian leather, optimization of formulation and drying conditions of durian leather, product stability during storage and determination of the retention of its flavouring components during processing and storage. In the preliminary study, the results showed that processing of durian leather was feasible to diversify the use of durian. Proximate composition of the leather was comparable to other fruit leathers in the market. The product was relatively stable and showed low mould counts and organoleptically acceptable in all attributes studied during three months storage.

Optimizations of ingredient formulation and drying conditions were carried out using Response Surface Methodology (RSM) technique. The results based on sensory evaluation showed that the most acceptable formulation was an ingredient combination of 10% glucose syrup solid, 5% sucrose, 2.67% hydrogenated palm oil and 0.45% soy-lecithin added into durian aril for the preparation of durian leather. Optimum drying conditions were 50°C for 12.6 h for oven-dried leather, and 52.5°C for 10 h for cabinet-dried leather.

A storage study on the optimum formulation and processing conditions indicated that durian leather was a stable product up to 12 weeks storage. All samples packed in four different types of packaging materials i.e. laminated aluminium foil

(LAF), high-density polyethylene (HDPE), low-density polyethylene (LDPE) and polypropylene (PP), were shown to be organoleptically acceptable by the panelists. LAF, however, was proven to be the finest packaging material in maintaining the stability of durian leather during storage.

Determination on flavour retention in durian leather revealed that the processing condition was relatively good to retain the durian aroma. At least, 26 of 38 fresh durian volatile flavouring components were still detected in durian leather. During storage, the relative proportions of acids in durian leather increased, esters, alcohols and aldehydes decreased, while hydrocarbons and phenolic compounds fluctuated. However, the two types of dryer used exhibited different phenomenon for sulphurous (S) and nitrogenous (N) compounds. For cabinet-dried leather, the proportion of S and N compounds decreased, while for oven-dried leather, the proportion fluctuated during 12 weeks storage.

Abstrak Tesis yang Dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai Memenuhi Syarat untuk Ijazah Master Sains

PERKEMBANGAN PRODUK KEPINGAN DURIAN DAN PENENTUAN PENGEKALAN CITARASANYA SEMASA PEMPROSESAN AND PENYIMPANAN

Oleh

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Durian *(Durio zibethinus* Murr) merupakan buah bermusim yang popular dan banyak tumbuh di kawasan Asia Tenggara. Malaysia, Thailand and Indonesia adalah negara-negara pengeluar buah durian yang utama di dunia. Pada masa kini, durian tidak hanya ditanam di persekitaran rumah, tetapi telah ditanam di ladang-ladang besar untuk memenuhi keperluan tempatan dan ekspot. Kebiasaannya durian dimakan secara segar sebaik dipungut kerana ianya cepat berubah menjadi masam disebabkan perlakuan tindak-balas kimia. Secara kecil-kecilan, durian juga diproses menjadi lempuk atau tempoyak, dua jenis produk yang disukai ramai di Malaysia dan Indonesia. Tetapi, produk-produk ini tidak dikeluarkan secara komersial. Sementara itu, kepingan buah-buahan, iaitu produk yang disediakan secara mengeringkan puri buah, merupakan produk yang sudah mendapat tempat di Amerika Utara dan Eropah, tetapi belum begitu dikenali di Malaysia. Oleh itu,

perkembangan sesuatu produk kepingan buah-buahan yang baru daripada durian boleh meningkatkan nilai komersialnya.

Empat aspek dalam perkembangan produk kepingan durian telah dijalankan dalam kajian ini. In termasuk kajian awal perkembangan produk kepingan durian, pengoptimuman formulasi dan keadaan pengeringan, stabiliti kepingan durian semasa penyimpanan dan pengukuran pengekalan komponen citarasa produk kepingan durian semasa pemprosesaan dan penyimpanan. Di dalam kajian awal, didapati bahawa pemprosesan produk kepingan durian adalah memungkinkan untuk mempelbagaikan pemanfaatan buah durian. Komposisi proksimat menunjukkan bahawa kepingan durian setanding dengan kepingan buah yang lain di pasaran. Produk kepingan durian adalah stabil, rendah hitungan kulat dan melalui ujian deria, diterima dari semua ciri-ciri deria yang diuji semasa tiga bulan dalam simpanan.

Pengoptimuman formulasi dan keadaan pengeringan dilakukan dengan menggunakan teknik "Random Surface Methodology" (RSM). Berdasarkan pengujian deria, formulasi yang paling diterima ialah penggunaan kombinasi 10% sirap glukosa pepejal, 5% gula sukrosa, 2.67% minyak kelapa sawit terhidrogenasi dan 0.45% lesitin kacang soya, yang ditambahkan kepada puri durian ketika penyediaan. Keadaan pengeringan optimum ialah pada 50°C selama 12.6 jam bagi kepingan durian yang dikeringkan menggunakan oven, dan bagi produk yang dikeringkan dengan pengering kabinet pula pada 52.2°C selama 10 jam.

Kajian stabiliti keatas formulasi dan keadaan pengeringan optimum menunjukkan bahawa kepingan durian merupakan produk yang stabil sehingga 12 minggu penyimpanan. Semua sampel yang dibungkus dengan empat jenis bahan pembungkus yang berlainan iaitu kepingan aluminium berlaminat (LAF), polietilena berketumpatan tinggi (HDPE), polietilena berketumpatan rendah (LDPE) dan polipropilena (PP), menunjukkan secara organoleptik, masih diterima oleh ahli panel. LAF, bagaimanapun, merupakan bahan pembungkus yang paling baik dalam pengekalan kestabilan kepingan durian sewaktu penyimpanan.

Pengukuran terhadap pengekalan citarasa durian menunjukkan bahawa keadaan pemprosesan adalah baik dalam mempertahankan aroma durian. Sekurangnya-kurangnya, 26 daripada 38 komponen meruap dalam buah durian segar masih dikesan di dalam kepingan durian. Sewaktu penyimpanan, secara relatif nisbah asid dalam kepingan durian meningkat, ester, alkohol dan aldehid menurun, manakala hidrokarbon dan komponen fenolik tidak konsisten. Walaubagaimanapun, bagi komponen sulfur (S) dan nitrogen (N), kedua jenis pengering yang digunakan menunjukkan fenomena yang berbeza. Bagi kepingan durian yang dikeringkan dengan pengering kabinet, komponen S dan N menurun, manakala bagi produk yang dikeringkan dengan oven, komponen S dan N tidak konsisten sehingga 12 minggu penyimpanan.

CHAPTER 1

GENERAL INTRODUCTION

Durian (*Durio zibethinus* Murr) is a popular seasonal fruit grown in many parts of South-East Asia and believed to be a native of Borneo island. The fruit has a special taste, strong and indescribeable aroma, and is always dubbed as king of all fruits. Undoubtedly, durian is highly prized in the region, with Thailand, Malaysia and Indonesia are major producers of this fruit in the world. Durian production and its planted area in the three countries have shown a steady increase over the years. Today, durians are not only planted in home garden but are also grown commercially in large-scale plantation to meet the local and export demands (Tarmizi and Abidin, 1991).

The bulk of the durian fruit is mainly for fresh consumption. The edible portion (aril) emanates a very strong odour much liked by the people in the region. Normally, the fruits are allowed to mature and develop their full flavour on the tree and collected after they fall to the ground. Durians are eaten shortly after harvest in fresh form as it quickly turns sour and rancid due to some chemical changes that follow. To a lesser extend, durian is processed into products like *lempuk* (durian cake), durian-flavoured *dodol* and *tempoyak* (fermented durian aril). These traditional products, however, are not commercially produced in large

quantities (Faridah et al., 1982). Presently, some products manufactured from durian such as candy, durian powder and durian flavour can be also found in the market.

Fruit leather is the term used for the products prepared by dehydration of fruit puree (Raab and Oehler, 1976). It is an established product, particularly in the North American and European markets; however, it is a relatively unknown product in Malaysia. The drying of fruit to make rolls or leathers offers a convenient method of marketing fruit that would be unacceptable for the fresh fruit market (Steele, 1987). Fruit leathers can be made from wide variety of fruits such as apple, apricot, banana, cherry, grape, peach, pear, pineapple, plum, raspberry, strawberry, papaya, sweet potato, ciku and jack fruit (Chauhan et al., 1993; Lodge, 1981; Chan and Cavaletto, 1978; Che Man and Raya, 1983; Che Man et al., 1992; Che Man and Taufik, 1995; Ahmed and Choudhary, 1995).

The consumer trend nowadays is to look for more natural snack foods. Today, the consumers are more aware of what kind of food they are eating and with a greater buying power, they tend to be choosy in terms of nutrition and safety. Confectionary like sweets and candies, made from high amount of sugar, has very little nutrition and could cause cavity among children. Fruit leather, which is made from fruit, can be an alternative confectionary not only to children but also to adults. Being made from natural fruits, fruit leather has all the goodness and nutrients of fruits in it. Therefore, the development of a new fruit leather from durian could be an alternative to increase the commercial value of durian, particularly when there is an over production of the fruit during a season.