UNIVERSITI PUTRA MALAYSIA

PASTEURISATION OF SOURSOP (ANNONA MURICATA L.) PUREE AND ITS EFFECTS ON PHYSICO-CHEMICAL PROPERTIES

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PASTEURISATION OF SOURSOP (*ANNONA MURICATA* L.) PUREE AND ITS EFFECTS ON PHYSICO-CHEMICAL PROPERTIES

By

UMME ARA

Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Food Science and Biotechnology Universiti Putra Malaysia

April 2000

Dedicated To
My

Parents:

Late father Ashraf Ali Bhuiyan and Syeda Razia Begum

Husband:

Jamal Uddin Afgani

Son and Daughter:

Mostafa and Fahmeen

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy.

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Chairman: Assoc. Prof. Salmah binti Yusof, Ph. D.

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A study was carried out to process soursop puree. The study includes, the establishment of optimum conditions of temperature and time for pasteurisation; shelf life study using different packaging and storage temperature combinations; characterisation and ultrastructural identification of puree and juice cloud at two processing and storage conditions; and characterisation of pectin-protein particulate in the juice cloud.

Physico-chemical evaluation of freshly extracted soursop pulp showed high pectin esterase (PE) activity (32.1 unit/ g) and vitamin C content (21mg/ 100g). The pH was low (3.7) and the acidity was high (1.02%). These properties were considered advantageous for pasteurisation. A Response surface methodology was used to determine optimum pasteurisation conditions for inactivation of PE with maximum ascorbic acid retention. The results showed that the optimum pasteurisation condition was at 79°C for 69 sec, with predicted nil PE activity and ascorbic acid content of 5.88 mg/ 100g.

The storage stability of the puree was evaluated for 12 weeks and the parameters examined were microbial count (total plate count, yeast & mould, and *E. coli*), PE activity, cloud stability, colour, viscosity, pH, titratable acidity, ^{o}Brix, ascorbic acid and sugar content, as well as sensory properties. The packaging materials used were laminated aluminium foil, general purpose lacquered can and

polypropylene bottles and the samples were stored at ambient temperature (28-37°C), 15°C, 4°C, and -20°C. It was observed that natural soursop puree pasteurised at the established optimum conditions of 79°C for 69 sec completely inactivated the PE and stabilised the cloud in juice without affecting nutrients and sensory quality. Samples packed in laminated aluminium foils and stored at 4°C was most stable during the storage period of 12 weeks. It showed decreased loss in cloud, viscosity, colour, nutrient, and lowest microbial growth.

Effect of processing and storage studies showed that the puree prepared by maceration process was low in pulp sediment and high in cloud content. Viscosity, °Brix, pulp volume and cloud stability were affected by freezing damage of cloud particles. Scanning electron micrograph of fresh and pasteurised juice cloud showed a continuous matrix of protein filaments. On the other hand, similar observation made on frozen juice cloud showed shrinked protein filaments and collapsed network. This suggest that there was a loss in consistency and cloud due to freezing.

The cloud of single strength soursop juice was white, fine, cottony textured and constituted about 0.103% of the dry solid. The cloud composed of 35.5% protein, 22.5% carbohydrate, 14.3% lipid and 0.64% polyphenol content and a density of 1.08 g/ ml. Transmission electron micrograph of stable juice revealed that the cloud particles ranged in size from 0.13 µm - 3.0 µm and showed an obvious close association of protein-lipid and protein-pectin. Flocculates of insoluble pectates and aggregated particles formed by enzymatic action were evident in unpasteurised juice cloud.

Soursop juice cloud contained an average of 10.36% total pectin of which 66.3% soluble pectin, 11% inherently insoluble pectin and 24.4% protopectin. From the 35.5% total cloud protein, 48.7% was inherently insoluble protein, 38.6% complexed with other polymeric constituent and 13% complexed with low molecular weight cloud constituents.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi syarat keperluan untuk Ijazah Doktor Falsafah

PEMPASTEURAN PURI DURIAN BELANDA (*ANNONA MURICATA* L.) DAN KESAN KE ATAS CIRI-CIRI FIZIKO-KIMIA

Oleh

UMME ARA

April 2000

Pengerusi: Prof. Madya Salmah binti Yusof,

Fakulti: Sains Makanan dan Bioteknologi

Satu kajian telah dijalankan untuk memperbaiki keadaan pemproses puri durian belanda. Kajian ini meliputi beberapa bahagian, termasuk penentuan keadaan suhu dan masa yang optima untuk proses pempasteuran; kajian hayat simpanan dengan menggunakan kombinasi bahan pembungkusan dan suhu penyimpanan yang berbeza; pencirian dan pengenalpastian ultrastruktur puri dan keladak jus pada dua keadaan pemprosesan dan penyimpanan; dan pencirian gumpalan pektin-protein dalam keladak jus.

Penilaian fiziko-kimia pulpa durian belanda segar menunjukkan aktiviti PE (32.1 unit/ g) dan kandungan vitamin C (21 mg/ 100 g) yang tinggi. Nilai pH adalah rendah (3.7) dan keasidan (1.02%) adalah tinggi. Ciri-ciri ini boleh dianggap sebagai satu kelebihan untuk pempasteuran puri. Kaedah "Response Surface" (RSM) telah digunakan untuk mencapai keadaan pempasteuran yang optimum bagi menyahaktifkan enzim pectinesterase dengan memaksimumkan pengekalan asid askorbik. Keputusan menunjukkan bahawa keadaan pempasteuran yang optima adalah pada suhu 79°C selama 69 saat, dengan tiada aktiviti PE dan kandungan asid askorbik sebanyak 5.88 mg/ 100 g.

Kestabilan penyimpanan puri telah dikaji selama 12 minggu. Parameter-parameter yang dikaji ialah aktiviti PE, kestabilan keladak, warna, kepekatan, pH, keasidan, pepejal terlarut, kandungan asid askorbik dan gula serta jumlah bilangan mikrob (yis dan mol, *E.coli)* serta ciri-ciri deria. Bahan pembungkusan yang telah digunakan ialah aluminium berlaminat, tin berlapisan logam dan botol-botol polipropilen, dengan suhu penyimpanan pada 15°C, 4°C dan -20°C. Pempasteuran puri durian belanda 79°C selama 69 saat telah menyahaktifkan PE dengan sepenuhya dan menstabilkan keladak dalam jus tanpa menjejaskan kandungan nutrien-nutrien dan kualiti deria. Pembungkusan aluminium berlaminat yang disimpan pada suhu 4°C menunjukkan gabungan yang paling sesuai untuk kestabilan puri durian belanda terpasteur semasa penyimpanan selama 12 minggu. Ia menunjukkan penurunan kehilangan keladak, kepekatan, warna dan nutrien serta pertumbuhan mikrob yang paling rendah.

Kajian kesan pemprosesan dan penyimpanan telah menunjukkan bahawa puri yang disediakan melalui proses pengisaran menggunakan air telah memberikan mendakan pulpa yang rendah dan tinggi dalam kandungan keladak. Kepekatan, °Brix, isipadu pulpa dan kestabilan keladak telah dipengaruhi oleh kerosakan sejukbeku butiran-butiran keladak. Mikrograf penelitian elektron bagi jus segar dan jus terpasteur yang mempunyai keladak yang stabil menunjukkan matriks filamen-filamen protein dan polimer pektik yang berterusan. Pengecutan filamen-filamen protein dan robohnya jaringan dalam jus yang di sejukbeku telah membuktikan kehilangan kepekatan dan kehilangan keladak akibat kesan sejukbeku.

Keladak dalam jus cair durian belanda berwarna putih, tekstur berupa kapas yang halus dan terdiri daripada 0.103% pepejal kering. Kandungan keladak terdiri daripada 35.5% protein, 22.5% karbohidrat, 14.3% lipid dan 0.64%

kandungan polifenol serta ketumpatan 1.08 g/ ml. Mikrograf pancaran elektron jus yang stabil membuktikan bahawa butiran-butiran keladak mempunyai saiz di antara 0.13 μm - 3.0 μm dan menunjukkan kaitan yang rapat dan jelas di antara protein-lipid dan protein-pektin. Gumpalan-gumpalan pektat yang tak terlarut dan pengumpalan butiran-butiran yang terbentuk semasa tindakbalas enzim telah wujud dalam keladak jus yang tidak terpasteur.

Keladak jus durian belanda mengandungi purata 10.36% pektin keseluruhan di mana 66.3% merupakan pektin larut, 11% pektin tak larut dan 24.4% protopektin. Daripada 35.5% keseluruhan protein keladak, 48.7% merupakan protein tak larut semulajadi, 38.6% membentuk kompleks dengan bahan-bahan polimer lain dan 13% membentuk kompleks dengan bahan-bahan keladak berjisim molekul rendah.

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