



OSMOTIC-DEHYDROFREEZING TO IMPROVE THE QUALITY AND SHELF-LIFE OF AVOCADO MESOCARP

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**AGRICULTURAL ENGINEERING SCIENCES
GRADUATE SCHOOL
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SUMMARY

ADIAN RINDANG. Osmotic-dehydrofreezing to Improve the Quality and Shelf-life of Avocado Mesocarp. Supervised by SUTRISNO, EMMY DARMAWATI, EDY HARTULISTIYOSO.

Developing value-added avocados with extended shelf-life is crucial for expanding commercialization opportunities, facilitating efficient transportation and marketing, and contributing to suboptimal conditions upon arrival at the destination market. Osmotic Dehydration (OD) is a method that removes partial water from the cell using a concentrated solution and fills it with soluble solids from the OD solution. The application of this method before the freezing process is called Osmotic-dehydrofreezing (ODF). In general, this study aims to analyze the use of OD treatment on avocado mesocarp by systematically evaluating both the freezing process and frozen storage. To achieve this goal, several critical quality indices such as firmness, total chroma change, vitamin C, and total fat content were examined in three stages of the experimentation process: OD, freezing, and frozen storage.

The first stage of this study provides insight into how mass transfers occur during the OD process in the avocado mesocarp. Four empirical models have been developed to describe this process, namely, Peleg, Azuara, Weibull, and Polynomial. The Akaike Information Criterion (AICc) value shows the Peleg model is superior to three other models. Furthermore, using this model combined with physicochemical properties change, the proper immersion time of avocado in OD solution was determined ($t = 60$ min). Meanwhile, further analysis of water content degradation and sucrose intake led to the selection of 55 °Brix of sucrose concentration as the appropriate OD agent due to stable driving force.

In the second stage of this study, the effect of OD was evaluated not only through the change in quality indices but also through the freezing process parameters. The OD treatment affects the freezing process by shortening the freezing time, increasing the freezing rate, and reducing enthalpy, drip loss, and freezable water content. Meantime, OD treatment helps preserve firmness, total chroma change, vitamin C, and fat content after the freeze-thawed process.

The OD treatment created a stable condition in the avocado cells during the freezing process, and this effect persisted during frozen storage, extending the shelf-life of the avocado mesocarp compared to an untreated one. However, a discreet decision is needed if the nutritional parameter is considered the benchmark of self-life itself since general acceptance by consumers is evaluated by sensory parameters. The third stage of this study concludes that the shelf-life of avocado mesocarp is 116 days when evaluated based on total fat content.

Overall, the results of this study found that OD treatment is an effective method to improve the quality and shelf-life of frozen avocado mesocarp. However, a systematic review of all stages of this study showed that the OD parameters (concentration and immersion time) were an important factor in controlling quality changes during freezing and frozen storage; thus, determining the OD parameters and the limits of quality changes at the end of this process was very important.

Keywords: avocado, freezing, osmotic dehydration, quality indices, shelf-life.

RINGKASAN

ADIAN RINDANG. *Osmotic-dehydrofreezing* untuk Memperbaiki Mutu dan Umur Simpan Daging Buah Alpukat. Dibimbing oleh SUTRISNO, EMMY DARMAWATI, EDY HARTULISTIYOSO.

Pengembangan nilai tambah buah alpukat dengan mutu yang baik dan masa simpan yang lebih lama adalah hal yang penting. Dehidrasi Osmotik (OD) merupakan metode penghilangan sebagian kandungan air dari dalam sel oleh larutan berkonsentrasi tinggi dan mengisinya dengan padatan terlarut yang berasal dari larutan tersebut. Perlakuan OD yang dikenakan pada bahan sebelum proses pembekuan disebut dengan Pembekuan-dehidrasi Osmotik (ODF). Penelitian ini bertujuan untuk menganalisis penggunaan perlakuan OD pada daging buah alpukat melalui evaluasi sistematis. Adapun untuk mencapai tujuan tersebut, beberapa indeks mutu kritis seperti kekerasan, perubahan warna, kandungan vitamin C dan lemak dianalisis dalam tiga tahapan penelitian, yaitu: pada proses perlakuan OD, pembekuan, dan penyimpanan beku.

Hasil penelitian tahap pertama menjelaskan mengenai proses perpindahan massa yang dapat digambarkan melalui empat model empiris, yaitu Peleg, Azuara, Weibull, dan Polinomial. Nilai *Akaike Information Criterion* (AICc) menunjukkan model Peleg yang terbaik. Penggunaan model pindah massa yang dikombinasikan dengan model perubahan sifat fisikokimia daging buah alpukat selama proses OD dapat menduga waktu terbaik perendaman yaitu selama 60 menit. Analisis lebih jauh pada pindah massa menunjukkan bahwa larutan dengan konsentrasi 55 °Brix adalah yang terbaik karena menghasilkan *driving force* yang stabil.

Di tahap kedua, efek OD dievaluasi melalui perubahan indeks mutu dan parameter proses pembekuan. Hasilnya menunjukkan bahwa perlakuan OD dapat menyingkat waktu dan mempercepat laju pembekuan, mengurangi entalpi, *drip loss*, dan *freezable water content*. Perlakuan OD juga dapat menjaga kekerasan, warna, vitamin C, dan kadar lemak daging buah alpukat setelah proses pembekuan-pencairan kembali.

Perlakuan OD menciptakan kondisi sel yang stabil selama proses pembekuan, dan efek ini bertahan selama penyimpanan beku berlangsung sehingga dapat memperpanjang umur simpannya. Namun, pengambilan keputusan mengenai ini harus dilakukan secara bijaksana, jika parameter nutrisi dianggap sebagai tolok ukur, karena kecenderungan konsumen mengevaluasi umur simpan berdasarkan parameter sensori. Ketika dievaluasi berdasarkan kandungan lemak total, umur simpan daging buah alpukat beku adalah 116 hari.

Secara keseluruhan, hasil penelitian ini menemukan bahwa perlakuan OD merupakan metode yang efektif untuk meningkatkan kualitas dan umur simpan daging alpukat beku. Namun, tinjauan sistematis dari seluruh tahap penelitian ini menunjukkan bahwa parameter OD (kombinasi konsentrasi dan waktu perendaman) merupakan faktor penting dalam menjaga kualitas selama proses pembekuan dan penyimpanan beku, oleh karena itu penentuan parameter OD dan batas perubahan mutu produk pada akhir proses ini sangat penting.

Kata Kunci: alpukat, dehidrasi osmotik, indeks mutu, pembekuan, umur simpan.

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Bogor, December 2024

Adian Rindang

LIST OF CONTENT

LIST OF TABLES	xi
LIST OF FIGURES	xii
I INTRODUCTION.....	1
1.1 Background	1
1.2 Research Question	4
1.3 Objectives	4
1.4 Benefits	5
1.5 Research scope	5
1.6 Novelty	6
II LITERATURE REVIEW.....	7
2.1 Research Gap on Osmotic-dehydrofreezing	7
2.2 Osmotic Dehydration Parameters	7
2.3 Modeling Mass Transfer during Osmotic Process	10
2.4 Freezing Process and ODF	12
2.5 Frozen Storage and Shelf-life Indices	15
III METHOD.....	20
3.1 Time and Research Location	20
3.2 Materials, Tools and Instruments	20
3.3 Research Procedure	21
3.3.1 Osmotic Dehydration set up	21
3.3.2 Freezing procedure	21
3.3.3 Frozen storage procedure	23
3.3.4 Physical analysis	23
3.3.5 Chemical analysis	24
3.3.6 Thermal analysis	24
3.3.7 Structures characterisation	24
3.4 Data Analysis	25
3.4.1 Modeling of mass transfer parameters and statistical analysis	25
3.4.2 Determination of immersion time on OD process	25
3.4.3 Shelf-life kinetic	25
IV RESULTS AND DISCUSSION	26
4.1 Mass Transfer Kinetics of Osmo-dehydrated Avocado	26
4.2 Modeling The Mass Transfer Kinetics of Osmo-dehydrated Avocado	30
4.3 Effect of Mass Transfer on Physicochemical Properties of Osmo-dehydrated Avocado	34
4.4 Determining the Immersion Time on the OD	41
4.5 OD Effect on the Freezing Process	41
4.6 OD Effect on Frozen Avocado Quality	44
4.6.1 OD Effect on Firmness	44
4.6.2 OD Effect on Chroma change.....	46
4.6.3 OD Effect on Vitamin C	47
4.6.4 OD Effect on Total fat	50
4.6.5 OD Effect on Microstructure Change	53
4.7 OD Effect on Frozen Storage	55

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4.7.1	Water Content	55
4.7.2	Shelf Life of Avocado Mesocarp	56
4.7.3	OD Effect on Chroma Change	59
4.7.4	OD Effect on Texture Alteration.....	61
4.7.5	ODF Effect on Loss of Vitamin C	64
4.7.6	Effect ODF on Loss of Fat Content	66
	CONCLUSION AND RECOMENDATION	69
5.1	Conclusions	69
5.2	Recommendations	70
	ABBREVIATIONS	71
	REFERENCES	72
	APPENDICES	80
	CURRICULUM VITAE	96

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LIST OF TABLES

2.1	Research on OD and ODF	8
2.2	Details of carbohydrate use in OD solutions	9
2.3	Mathematical equations for mass transfer during the OD process	11
2.4	Effect of ODF on freezing process and properties	14
2.5	The untreated and ODF – frozen storage condition and quality indices on fruits and vegetables	17
3.1	Time and research location	20
4.1	OD effect on WC and TSS	26
4.2	Effect of OD process on WR, SSG, and WL of avocado	27
4.3	Peleg's parameters model	30
4.4	Azuara's parameters model	30
4.5	Weibull's parameters model	31
4.6	Polynomial's parameters model	33
4.7	Mass transfer kinetics evaluation model of OD process in avocado	33
4.8	Effect of OD parameters on physicochemical properties	34
4.9	Pearson correlation between mass transfer parameters and physicochemical properties during OD process	35
4.10	Regression model from mass transfer parameters and physicochemical properties during OD process	35
4.11	Simulation of physicochemical properties based on WR prediction and vitamin C loss. The initial amount of vitamin C is 9,570 mg 100 mL ⁻¹	41
4.12	Effect of OD on freezing parameters	42
4.13	Effect of OD on FWC and drip loss	43
4.14	Effect of OD on frozen avocado quality	44
4.15	Pearson correlation between firmness and freezing parameters	45
4.16	Pearson correlation between chroma change and freezing parameters	47
4.17	Pearson correlation between vitamin C and freezing parameters	49
4.18	Pearson correlation between vitamin C and quality indices	50
4.19	Pearson correlation between total fat content and freezing parameters	52
4.20	Pearson correlation between total fat content and quality indices	53
4.21	OD parameters through osmotic-freezing-storage processes	55
4.22	Kinetic parameters of avocado during frozen storage	57
4.23	Shel life prediction for frozen avocado mesocarp based on different quality indicators	58
4.24	Degradation rate prediction equation for frozen avocado mesocarp based on different quality indicators at selected OD treatment	58

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LIST OF FIGURES

1.1	Mechanism of mass transfer in cells during the OD process	3
1.2	Illustration of cell wall disintegration after freezing	4
2.1	Schematic of possible freezing mechanisms on plant cells	14
3.1	Research procedure	22
3.2	Illustration of sensor placement in the avocado cube sample	23
4.1	WC gradation (g g^{-1}) based on time of immersion (h) and number of slice	28
4.2	SG gradation (mol cm^{-3}) based on time of immersion (h) and number of slice	29
4.3	Peleg's mass transfer parameters, water removal (a), soluble solid gain (b), and weight reduction (c)	31
4.4	Azuara's mass transfer parameters, water removal (a), soluble solid gain (b), and weight reduction (c)	32
4.5	Weibull's mass transfer parameters, water removal (a), soluble solid gain (b), and weight reduction (c)	32
4.6	The change of firmness through mass transfer parameters	36
4.7	The change of lightness values on avocado mesocarp during OD process	37
4.8	The change of ΔC on avocado mesocarp during OD process	38
4.9	Browning indeks (BI) on avocado mesocarp during OD process	38
4.10	A vertical slice (2 mm) of avocado cubes after OD processing	38
4.11	The change of vitamin C through mass transfer parameters	39
4.12	The change of total fat content through mass transfer parameters	40
4.13	Correlation between water content vs. temporal freezing rate (a) and spatial freezing rate (b)	43
4.14	Correlation between enthalpy of ice crystalization vs. watercontent (a) and enthalpy of melting point vs. total soluble solid (b)	43
4.15	Regression correlation between drip loss vs. freezable water content (a) and freezable water content vs. water content (b)	44
4.16	Correlation of firmness vs. freezing parameters	46
4.17	CIELab color chart for osmo-dehydrofrozen avocado. C = concentration, D = duration. Sample name = a*, b* coordinate: Control = 1,95; 52,79. C45D60 = 2,22; 61,97. C55D60 = 2,77; 60,03. C65D60 = 2,65; 58,33.	47
4.18	Correlation of chroma change vs. drip loss (a) and water content (b)	47
4.19	Alternative degradation mechanisms of L-ascorbic acid (Giannakourou and Taoukis 2021)	49
4.20	Correlation between vitamin C and freezable water content (FWC)	49
4.21	Correlation between vitamin C and freezing rate: temporal freezing rate (a), spatial freezing rate (b)	50
4.22	Correlation between vitamin C and total fat content	50
4.23	The image of lipid droplets in avocado mesocarp through the confocal microscopy images during fruit development; at 65 (a),	

85 (b), 105 (c) and 125 (d) days after pollination (DAP) (Ge <i>et al.</i> 2018)	51
4.24 Correlation between total fat content and freezing rate: temporal freezing rate (TFR) (a) and spatial freezing rate (SFR) (b)	52
4.25 Correlation between total fat content and freezable water content (FWC) (a), and drip loss (b)	52
4.26 Correlation between total fat and firmness (a), and water content (b)	52
4.27 Microstructure images by SEM for normal sample (a), normal-thawing (b), osmo-dehydrofrozen samples; C45D30 (C), C55D45 (d), C65D45 (e), C65D60 (f), C45D60 (g), C55D30 (h). CW = cell wall, C = cell, CR = cell rupture, IS = intercellular space	54
4.28 Water content of frozen avocado mesocarp during storage	55
4.29 Total solid of frozen avocado mesocarp during storage	56
4.30 Total soluble solids of frozen avocado mesocarp during storage	56
4.31 Sensory evaluation corresponding to total scores of frozen avocado slice during frozen storage (Geethu <i>et al.</i> 2023)	59
4.32 Chroma change of control (a), C45D60 (b), C55D60 (c), and C65D60 (d) samples during frozen storage at four temperature ranges examined	60
4.33 Arrhenius plot of the chroma change of control and osmo dehydrofrozen samples at four temperature ranges examined	60
4.34 Image of frozen avocado during frozen storage at -18 °C	61
4.35 Firmness change of control (a), C45D60 (b), C55D60 (c), and C65D60 (d) samples during frozen storage at four temperature ranges examined	62
4.36 Arrhenius plot of the firmness change of control and osmo-dehydrofrozen samples at four temperature ranges examined	62
4.37 Browning effect and loss of texture on osmo-dehydrofrozen avocado at 1 month of frozen storage	63
4.38 Refrigerator temperature record of frozen avocado during storage	63
4.39 Recrystallization of frozen avocado samples (marked with red arrow) for 3 months of storage of control (a), C45D60 (b), and samples without recrystallization in C55D60 (c)	64
4.40 Change of vitamin C content of control (a), C45D60 (b), C55D60 (c), and C65D60 (d) samples during frozen storage at four temperature ranges examined	65
4.41 Arrhenius plot of the vitamin C change of control and osmo-dehydrofrozen samples at four temperature ranges examined	66
4.42 Change of total fat content of control (a), C45D60 (b), C55D60 (c), and C65D60 (d) samples during frozen storage at four temperature ranges examined	67
4.43 Arrhenius plot of the total fat change of control and osmo-dehydrofrozen samples at four temperature ranges examined	68
4.44 The color of extracted lipid from fresh avocado (a), osmo dehydrofrozen avocado (b), oxidative rancidity in lipid of C45D60 (c), C55D60 (d), and C65D60 (e) samples during frozen storage	68



APPENDICES

1	Calcualtion of mass transfer parameters	81
2	Calculation of mass transfer models coefficient and its validation	82
3	Example of ANOVA calculation using SPSS	84
4	Summary of all mass transfer empirical models	86
5	Calculation of physicochemical properties and freezing parameters	88
6	Calculation of shelf-life model vs. quality indices of frozen avocado	91
7	Documentation of research process	92