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

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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 ºBrix 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 berlansgung sehingga dapat memperpanjang umur simpannya. Namun, pengambilan keputusan mengenai ini harus dilakukan secara bijaksana, jika parameter nutrisi dianggap sebagai tolok ukur, karena kecendrungan 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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Hopefully, this scientific work will be useful for those who need it, as well as for the advancement of science.

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