

**CHANGE IN PHYSICAL, MECHANICAL, AND STRESS RELAXATION
BEHAVIOR DURING STORAGE OF TOMATO (*Solanum lycopersicum*)
UNDER THE EFFECT OF MATURITY LEVEL AND FRUIT SIZE**

ABSTRACT

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Tomato is a food commodity that is very sensitive in the process of harvesting, transportation, and processing. Knowledge of the physical and mechanical properties of fruit is an important aspect in post-harvest handling to minimize product damage. The physical properties of tomatoes can affect the mechanical properties of tomatoes, but it also has a relationship to the level of maturity and fruit size. The purpose of this study was to analyze the interaction effect of maturity level and size of tomatoes during the storage process on changes that occur in the parameters of physical properties, mechanical properties, and stress relaxation behavior of tomatoes. The research design used was *repeated measure analysis* by combining the treatment of tomatoes maturity levels, namely green, turning, and red with the treatment of tomato fruit size, namely large, medium, and small. The treatment combination was repeated 3 times. Measurements and analyzes were carried out on parameters of physical properties which included arithmetic and geometric diameters (D_a and D_g), surface area (S), sphericity, and aspect ratio (R_a), weight shrinkage, as well as parameters of mechanical properties which included minimum and maximum surface curvature radii (R and R'), modulus of elasticity (E), maximum contact area (A), maximum pressure (S_{max}), and stress relaxation behavior modeling. The results of repeated measure analysis showed that the interaction between maturity level and fruit size of tomatoes had a significant effect on the parameters D_a and D_g , surface area, weight shrinkage, and modulus of elasticity, and also the Maxwell model constant, namely the value of the constant τ_e , the constant $(\tau_0 - \tau_e)$, and the coefficient λ_{rel} . The constants and coefficients of the Maxwell model were found to have a good fit or suitable for predicting changes in tomato fruit pressure during the stress relaxation process.

Keyword : Physical properties, mechanical properties, stress relaxation

**PERUBAHAN PARAMETER FISIK, MEKANIK, DAN PERILAKU
STRESS-RELAXATION SELAMA PENYIMPANAN BUAH TOMAT
(*Solanum lycopersicum*) DIBAWAH PENGARUH TINGKAT
KEMATANGAN DAN UKURAN BUAH**

INTISARI

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Tomat merupakan komoditas pangan yang sangat sensitif dalam proses pemanenan, pengangkutan, dan pengolahan. Pengetahuan tentang sifat fisik dan mekanik buah merupakan aspek penting dalam penanganan pascapanen untuk meminimalkan kerusakan produk. Sifat fisik buah tomat dapat mempengaruhi sifat mekanik buah tomat, terutama karena dipengaruhi hubungan antara tingkat kematangan dan ukuran buah. Tujuan penelitian ini adalah menganalisis pengaruh interaksi tingkat kematangan dan ukuran buah tomat selama proses penyimpanan terhadap perubahan yang terjadi pada parameter sifat fisik, sifat mekanik, dan perilaku *stress relaxation* buah tomat. Rancangan penelitian yang digunakan yaitu *repeated measure analysis* dengan mengkombinasikan perlakuan tingkat kematangan buah tomat yaitu tingkat kematangan hijau, *turning*, dan merah dengan perlakuan ukuran buah tomat yaitu ukuran besar, sedang, dan kecil. Kombinasi perlakuan dilakukan 3 kali pengulangan. Pengukuran dan analisis dilakukan pada parameter sifat fisik yang meliputi diameter aritmatika dan geometrik (D_a dan D_g), luas area (S), *sphericity*, dan aspek rasio (R_a), susut bobot, serta parameter sifat mekanik yang meliputi jari-jari kelengkungan permukaan minimum dan maksimum (R dan R'), modulus elastisitas (E), maksimum kontak area (A), tekanan maksimum (S_{max}), dan dilakukan pemodelan perilaku *stress relaxation*. Hasil *repeated measure analysis* menunjukkan bahwa interaksi perlakuan tingkat kematangan dan ukuran buah tomat berpengaruh signifikan terhadap parameter D_a dan D_g , luas area, susut bobot, dan modulus elastisitas, dan juga konstanta model Maxwell yaitu nilai konstanta τ_e , konstanta ($\tau_0 - \tau_e$), dan koefisien λ_{rel} . Konstanta dan koefisien model Maxwell ditemukan memiliki kesesuaian yang baik atau cocok untuk memprediksi perubahan tekanan buah tomat selama proses *stress relaxation*.

Kata Kunci : Sifat fisik, sifat mekanik, *stress-relaxation*