PEMODELAN MATEMATIS KESEIMBANGAN MASSA AIR, KADAR AIR KRITIS, DAN KINETIKA SIFAT FISIK UNTUK PREDIKSI UMUR SIMPAN BERAS DALAM BERBAGAI KEMASAN

INTISARI

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Beras merupakan bahan pangan pokok yang bersifat higroskopis sehingga kadar airnya dapat berubah selama penyimpanan akibat interaksi dengan kondisi lingkungan. Perubahan kadar air tersebut dapat memengaruhi sifat fisik beras dan mempercepat penurunan mutu produk. Penelitian ini bertujuan untuk menganalisis perubahan kadar air dan sifat fisik beras selama penyimpanan serta memprediksi umur simpan beras menggunakan pendekatan pemodelan matematis meliputi keseimbangan massa air, kadar air kritis, dan kinetika perubahan sifat fisik pada berbagai jenis kemasan. Penelitian dilakukan dengan menyimpan beras pada suhu 27–30°C dan kelembaban relatif 50–60% selama 90 hari menggunakan tiga jenis kemasan, yaitu karung plastik PP polos (K1), karung plastik PP bening (K2), dan plastik PE (K3). Parameter mutu yang diamati meliputi kadar air, aktivitas air (aw), *whiteness, tapped density, hardness,* serta persentase butir patah, menir, dan butir rusak.

Hasil penelitian menunjukkan bahwa kadar air awal beras sebesar 13,4%. Pada kemasan K1, kadar air menurun menjadi sekitar 11,7%. Pada kemasan K2, kadar air menurun menjadi sekitar 11,5%. Sementara itu, pada kemasan K3, kadar air menurun menjadi sekitar 12,4%. Prediksi umur simpan berdasarkan model kinetika perubahan mutu menunjukkan umur simpan untuk kemasan K1 159 hari, kemasan K2 143 hari, dan kemasan K3 221 hari. Berdasarkan pendekatan model keseimbangan massa air, umur simpan beras kemasan K1 mencapai 118 hari, kemasan K2 103 hari, dan kemasan K3 206 hari. Selain itu, umur simpan berdasarkan ALST kadar air kritis untuk kemasan K1 212 hari, kemasan K2 191 hari, dan kemasan K3 338 hari.

Kata kunci: beras, kadar air, kerusakan fisik, umur simpan, model matematis, kemasan

MATHEMATICAL MODELING OF MOISTURE MASS BALANCE, CRITICAL MOISTURE CONTENT, AND PHYSICAL PROPERTY KINETICS FOR PREDICTING RICE SHELF LIFE IN VARIOUS PACKAGING

ABSTRACT

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Rice is a staple food that is hygroscopic, meaning its moisture content can change during storage due to interactions with environmental conditions. Changes in moisture content can affect the physical properties of rice and accelerate quality deterioration. This study aimed to analyze changes in moisture content and physical properties of rice during storage and to predict its shelf life using mathematical modeling approaches, including moisture mass balance, critical moisture content, and kinetics of physical quality changes under different packaging types. The study was conducted by storing rice at a temperature of 27–30°C and relative humidity of 50–60% for 90 days using three types of packaging: woven polypropylene plastic sacks (K1), transparent polypropylene plastic sacks (K2), and polyethylene plastic packaging (K3). The observed parameters included moisture content, water activity (aw), whiteness, tapped density, hardness, and the percentage of broken grains, brewers, and damaged grains.

The results showed that the initial moisture content of rice was 13.4%. During storage, the moisture content decreased to 11.7% in K1 packaging, 11.5% in K2 packaging, and 12.4% in K3 packaging. Shelf-life prediction based on the kinetic model indicated shelf-life values of 159 days for K1, 143 days for K2, and 221 days for K3. Based on the moisture mass balance model, the shelf life reached 118 days for K1, 103 days for K2, and 206 days for K3, while the ASLT critical moisture content method predicted 212 days for K1, 191 days for K2, and 338 days for K3.

Keywords: rice, moisture content, physical quality deterioration, shelf-life, mathematical modeling, packaging