

PROCESS AND FORMULA OPTIMIZATION OF OVERRIPE TEMPE STOCK TO ENHANCE QUALITY AND STORAGE STABILITY

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**FOOD SCIENCE STUDY PROGRAM
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RINGKASAN

STACIA ANDANI FORTUNATA. Optimasi Proses dan Formula Kaldu Tempe Semangit untuk Meningkatkan Stabilitas Mutu Penyimpanan. Dibimbing oleh C. HANNY WIJAYA, NUGRAHA EDHI SUYATMA, dan MARIA DEWI PUSPITASARI TIRTANINGTYAS GUNAWAN PUTERI.

Tempe semangit memiliki keunikan sebagai penyedap rasa, namun pemanfaatannya secara segar memiliki keterbatasan dalam umur simpan. Perluasan pemanfaatan potensi tempe semangit sebagai bahan baku kaldu nabati dalam bentuk bubuk kering telah dilakukan. Tujuan penelitian ini adalah memperoleh proses pengeringan tempe semangit yang memenuhi standar parameter kualitas kadar air $< 4\%$ serta produk kaldu nabati dengan penerimaan sensori yang baik dan stabilitas mutu produk terkemas hingga 9 bulan.

Tahap awal penelitian yaitu pemilihan desain pengeringan tempe semangit menggunakan *Response Surface Methodology* (RSM) dengan variabel suhu ($60-80\text{ }^{\circ}\text{C}$), waktu pengeringan (180-240 menit), dan bentuk tempe semangit (iris dan pelet). Respon yang diuji berupa kadar air, sudut repose, *browning index*, *whiteness index*, dan uji sensori (intensitas warna, kegumpalan, aroma, dan rasa). Suhu dan waktu pengeringan yang lebih tinggi menghasilkan aroma lebih kuat dengan kadar air dan intensitas gumpalan lebih rendah. Desain pengeringan terpilih yaitu tempe semangit giling pada $80\text{ }^{\circ}\text{C}$ selama 240 menit dengan kadar air 2,3% dan daya alir yang baik (sudut repose: 27.78°).

Tahap kedua yaitu pemilihan ukuran partikel bubuk tempe semangit dan optimasi formula kaldu nabati menggunakan *Mixture Design* dengan variabel maltodekstrin (0-30%), gula aren (6,5-19,5%), dan garam laut (0-19,5%). Respon uji berupa kadar air, sudut repose, uji hedonik, dan *just-about-right* (JAR) aroma, warna, dan tingkat keasinan. Bubuk tempe semangit tanpa diayak terpilih dan dioptimasi dengan bahan lainnya sehingga didapatkan kombinasi formula terbaik dari maltodekstrin (6,08%), gula aren (14,72%), dan garam laut (18,20%). Hasilnya memenuhi standar kadar air ($< 4\%$) dengan penerimaan sensori yang baik (skor hedonik: 6,00) dan memiliki profil sensorik yang lebih seimbang, sehingga cocok diaplikasikan sebagai bumbu masak.

Tahap terakhir dalam penelitian yaitu penentuan kemasan (*metallized plastic* atau *aluminum foil*) berdasarkan nilai *water vapor transmission rate* (WVTR) dan permeabilitas kemasan, serta pengujian masa simpan dengan model Labuza. Kemasan terpilih yaitu *aluminum foil* dengan nilai WVTR $0,2259\text{ g/m}^2\cdot\text{hari}$ dan permeabilitas $0.0016\text{ g/m}^2\cdot\text{hari}\cdot\text{mmHg}$. Kaldu nabati yang dikemas dengan *aluminum foil* pada suhu $30\text{ }^{\circ}\text{C}$ dengan RH 75% memiliki masa simpan hingga 8,5 bulan (berdasarkan SNI) dan 15 bulan (berdasarkan uji sensorik).

Studi ini menyajikan wawasan berharga bagi industri pangan dalam mengembangkan kaldu tempe semangit komersial yang dapat diterima secara sensorik. Hasil temuan dapat bermanfaat untuk pengembangan produk, formulasi, dan perpanjangan masa simpan produk pangan berbentuk bubuk.

Kata kunci: kaldu tempe semangit, pengeringan, formulasi, umur simpan, *response surface methodology*

SUMMARY

STACIA ANDANI FORTUNATA. Process and Formula Optimization of Overripe Tempe Stock to Enhance Quality and Storage Stability. Supervised by C. HANNY WIJAYA, NUGRAHA EDHI SUYATMA, and MARIA DEWI PUSPITASARI TIRTANINGTYAS GUNAWAN PUTERI.

Overripe tempe has a unique flavor as a flavor enhancer; however, the use of overripe tempe in its fresh form has limitations in its shelf life. This study expands the potential of overripe tempe as a stock in dried powder form. The objectives of this study are to develop the drying process for overripe tempe that meets quality parameter standards of moisture content $< 4\%$ and to formulate an overripe tempe stock with good sensory acceptance and product stability of up to 9 months.

The initial stage involved selecting an overripe tempe drying design using Response Surface Methodology (RSM) with variables of temperatures (60-80 °C), drying time (180-240 minutes), and sample shape (slices or pellets). The evaluated responses included moisture content, angle of repose, browning index, whiteness index, and sensory tests (color, clumpiness, aroma, and taste intensity). High temperature and long drying time significantly resulted in a stronger aroma with a lower moisture content and a lower clumpiness level. The best drying design was determined to be overripe tempe pellets dried at 80 °C for 240 minutes, with a moisture content of 2.30% and good flowability (angle of repose: 27.78°).

The second stage involved selecting the particle size for the overripe tempe powder and optimizing the plant-based stock formula using a Mixture Design with variables of maltodextrin (0-30%), palm sugar (6.5-19.5%), and sea salt (0-19.5%). The tested responses included moisture content, angle of repose, hedonic tests, and just-about-right (JAR) ratings for aroma, color, and saltiness level. An unsieved overripe tempe powder was selected and optimized with other ingredients, resulting in a formula combination of maltodextrin (6.08%), palm sugar (14.72%), and sea salt (18.20%). This formula successfully met the moisture content standard ($< 4\%$) with improved sensory acceptance (hedonic score: 6.00) and a more balanced sensory profile (JAR ≈ 4), allowing for broader application as a cooking seasoning.

The final stage of the research involved selecting packaging materials (metallized plastic or aluminum foil) based on the water vapor transmission rate (WVTR) and packaging permeability, as well as conducting shelf-life testing using the Labuza model. The selected packaging was aluminum foil, with WVTR and permeability values of 0.2259 g/m².day and 0.0016 g/m².day.mmHg, respectively. The plant-based stock packed with aluminum foil and stored at 30 °C with 75% RH has a shelf-life of up to 8.5 months (SNI-based) and up to 15 months (sensory-based).

This study provides valuable insights for the food industry to develop commercial overripe tempe stocks with good stability and sensory acceptance. The findings are helpful for product development, formulation, and extending the shelf life of food-related powders.

Keywords: drying, formulation, overripe tempe stock, response surface methodology, shelf-life



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STACIA ANDANI FORTUNATA

Thesis
in partial fulfillment of the requirements for obtaining a
Magister of Science degree in
Food Science

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Bogor, July 2025
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