

**Pemodelan Kinetika dan Analisa Energi Proses Pencampuran Bumbu  
Penyedap Berbasis Tempe dan Jamur Tiram**  
*(Kinetics Modeling and Energy Analysis of Tempeh and Oyster Mushroom-Based  
Flavoring Seasoning Blending Process)*  
Ir. Didiek Hermanuadi, M.T.

**Moch. Sarifudin Hidayatulloh**  
Food Engineering Technology Study Program  
Department of Agriculture Technology

***ABSTRACT***

*Seasoning mixes are food products that require a high degree of homogeneity to ensure quality and flavor consistency. This study aims to analyze the mixing kinetics and energy efficiency of the mixing process for seasoning mixes at various rotational speeds of a planetary mixer. The kinetic model was evaluated using statistical indicators such as the coefficient of determination ( $R^2$ ), Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Bias Error (MBE), Sum of Squared Error (SSE), as well as the Akaika Information Criterion (AIC) and Schwarz Information Criterion (SIC). The results showed that the samples achieved homogeneity ( $CV \leq 5\%$ ), with the salt content indicator reached at 40.48 minutes (150 rpm), 27.09 minutes (280 rpm), and 17.55 minutes (635 rpm), while the sugar content indicators reached their values at 45.72 minutes (150 rpm), 35.76 minutes (280 rpm), and 26.44 minutes (635 rpm). The validation results at low speed (150 rpm) indicate that the Exponential Asymptotic model is more suitable with an  $R^2$  value of 0.998, while the Pseudo-second-order model performs better at medium and high speeds (280 and 635 rpm) with  $R^2$  values of 0.991 and 0.996. The energy analysis results show that increasing the rotational speed improves energy efficiency, as indicated by a 51% reduction in specific energy (from 528.14 kJ/kg to 256.68 kJ/kg) and a 2.04-fold increase in the energy quality index (from 0.002 to 0.004 kg/kJ), although instantaneous clean power increases. Although high speeds are the most efficient, operation at 280 rpm offers an optimal balance between energy productivity, product quality, and equipment reliability with 87% motor utilization. This study makes a positive contribution regarding the influence of mixer rotational speed on mixing kinetic parameters and energy efficiency, a statistically validated kinetic model, and serves as a scientific basis for the design, optimization, and scaling-up of industrial-scale seasoning production processes.*

**Keywords:** *Flavoring Seasoning, Tempeh, Oyster Mushroom, Mixing Kinetics, Energy*