

**Kinetika Proses Kristalisasi Dan Analisis Eksergi
Pada Pembuatan Jahe Instan**
*(Kinetic Process of Crystallization and Exergy Analysis in the Production
of Instant Ginger)*
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ABSTRACT

Ginger is a perishable food commodity due to its high moisture content, requiring proper postharvest handling and advanced processing methods. One of its processed forms is instant ginger powder beverage, which undergoes extraction, heating, stirring, crystallization, and packaging stages. This study aims to evaluate the accuracy of crystallization kinetics models, analyze exergy efficiency, and determine the optimal solution concentration. The evaluation was conducted using statistical indicators, including the coefficient of determination (R^2), Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Bias Error (MBE), and Sum of Squared Error (SSE). The results showed that a solution with a concentration of 1.480 M crystallized in 28 minutes, faster than the 0.504 M solution, which required 36 minutes. The Gompertz model was most suitable for low concentrations (0.504 M) with an R^2 value of 0.984, while the Midilli Kucuk model was more accurate for higher concentrations (0.913 M, 1.128 M, and 1.480 M) with an R^2 of 0.987. Exergy analysis revealed an increase in energy efficiency from 39.90% to 54.57% as concentration increased. This study contributes positively to energy efficiency, crystallization process control, and the selection of appropriate kinetic models, while also enhancing product quality, reducing energy costs, and supporting decision-making in industrial-scale instant ginger production.

Key Words: *Exergy Analysis, Instant Ginger, Crystallization Kinetics*