

**Pemodelan Kinetika dan Analisis Eksergi Pada Proses Pengeringan Biji
Kakao Menggunakan *Food Dehydrator*
(*Kinetic Modeling and Exergy Analysis of Cocoa Bean Drying Process Using a
Food Dehydrator*)**

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ABSTRACT

Cocoa (Theobroma cacao L.) is a high-economic-value plantation commodity whose beans are the primary raw material for the chocolate industry, with quality strongly influenced by the post-fermentation drying process. This study aimed to determine the best mathematical model to represent the drying kinetics of cocoa beans and to analyze energy efficiency using an exergy approach with a food dehydrator at 50°C, 60°C, and 70°C. The research was conducted experimentally by recording weight changes every 5 minutes and analyzing moisture content, moisture ratio (MR), drying rate, and effective moisture diffusivity (Deff). The data were evaluated using seven mathematical models—Page, Lewis, Henderson–Pabis, Logarithmic, Flick's, Yagcioglu, and Modified Midili—based on R², SSE, RMSE, AIC, and BIC criteria. The results showed that the drying time required to reach the final moisture content was 310 minutes at 50°C, 205 minutes at 60°C, and 175 minutes at 70°C; the Lewis model was the best at 50°C, while the Henderson–Pabis model was the best at 60°C and 70°C, exhibiting high R² values and the lowest SSE, RMSE, AIC, and BIC values. Exergy analysis revealed that efficiency increased with temperature, reaching 0.6950% at 50°C, 0.9387% at 60°C, and 1.2037% at 70°C, with corresponding energy inputs of 7.8418 MJ, 5.3911 MJ, and 4.4930 MJ, indicating that higher drying temperatures lead to more efficient energy utilization, although overall efficiency remains relatively low..

Keywords: *cocoa beans, drying, exergy, food dehydrator, kinetics*