

THERMAL ANALYSIS OF AIR IN A LEMPUYANG CHILI DRYING OVEN

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ABSTRACT

The conventional drying process of cabe lempuyang depends on sunlight, requiring a long drying time and being highly influenced by weather conditions. This study aims to design and develop an ESP32-based drying oven using a Proportional Integral Derivative (PID) control system to maintain temperature stability during the drying process. The system utilizes a waste-oil stove as the heat source, a K-type thermocouple with a MAX6675 module for temperature measurement, and an L298N motor driver to regulate the blower speed. The PID parameters were determined through system identification to obtain the transfer function, followed by auto-tuning and fine-tuning using the MATLAB PID Tuner, resulting in the optimal parameters of $K_p = 8$, $K_i = 0.5$, and $K_d = 2$. The drying performance was evaluated using four different sample masses of 2 kg, 3 kg, 5 kg, and 10 kg at a temperature setpoint of 60°C. The results showed that the PID control system was able to reach and maintain the temperature close to the desired setpoint with satisfactory performance. Although temperature stability was still affected by the combustion characteristics of the waste-oil stove, the developed drying oven was able to reduce the drying time compared to the conventional drying method.

Keywords: drying oven, ESP32, PID control, MATLAB PID Tuner, cabe lempuyang.