ABSTRAK

RANCANG BANGUN ALAT PENGENDALI SUHU DAN KELEMBAPAN SERTA MONITORING GAS AMONIA PADA FERMENTASI TEMPE BERBASIS INTERNET OF THINGS

(Rista Putri 2026: 55 halaman)

Proses fermentasi tempe sangat dipengaruhi oleh kondisi lingkungan, terutama suhu dan kelembapan, yang berperan penting dalam mendukung pertumbuhan kapang *Rhizopus oligosporus*. Selain itu, perubahan konsentrasi gas amonia selama fermentasi juga dapat digunakan sebagai indikator kondisi fermentasi yang berlangsung. Pada usaha tempe skala rumah tangga, proses fermentasi umumnya masih dilakukan secara tradisional sehingga kondisi suhu, kelembapan, dan gas amonia sulit dipantau. Penelitian ini bertujuan merancang dan membangun alat pengendali suhu dan kelembapan serta monitoring gas amonia pada fermentasi tempe berbasis Internet of Things. Sistem menggunakan mikrokontroler ESP32 sebagai pusat pengendali, sensor DHT21 untuk mengukur suhu dan kelembapan, sensor MQ-135 untuk mendeteksi gas amonia, serta relay yang mengendalikan lampu pijar, kipas DC, dan mist maker. Data hasil pengukuran ditampilkan pada LCD dan dikirimkan ke aplikasi Blynk untuk monitoring. Hasil pengujian menunjukkan bahwa sistem mampu membaca suhu pada rentang 30°C–35°C, kelembapan 60%–80% RH, dan konsentrasi gas amonia 0,13–0,32 ppm selama proses fermentasi. Sistem juga mampu mengendalikan suhu dan kelembapan secara otomatis sesuai parameter yang telah ditentukan. Hasil fermentasi menggunakan inkubator menunjukkan pertumbuhan jamur yang lebih cepat dan merata dibandingkan metode fermentasi konvensional. Dengan demikian, sistem yang dirancang dapat membantu menjaga kondisi fermentasi tetap optimal serta memudahkan proses monitoring.

Kata Kunci : Fermentasi Tempe, Internet of Things, ESP32, DHT21, MQ-135.

ABSTRACT

DESIGN AND DEVELOPMENT OF A TEMPERATURE AND HUMIDITY CONTROL SYSTEM WITH AMMONIA GAS MONITORING FOR TEMPEH FERMENTATION BASED ON THE INTERNET OF THINGS

(Rista Putri 2026: 55 pages)

The tempeh fermentation process is highly influenced by environmental conditions, particularly temperature and humidity, which play an important role in supporting the growth of Rhizopus oligosporus. In addition, changes in ammonia gas concentration during fermentation can be used as an indicator of the fermentation condition. In small-scale tempeh production, the fermentation process is generally carried out conventionally, making temperature, humidity, and ammonia gas conditions difficult to monitor. This study aims to design and develop a temperature and humidity control system with ammonia gas monitoring for tempeh fermentation based on the Internet of Things (IoT). The system utilizes an ESP32 microcontroller as the main controller, a DHT21 sensor to measure temperature and humidity, an MQ-135 sensor to detect ammonia gas, and relays to control an incandescent lamp, DC fan, and mist maker. Measurement data are displayed on an LCD and transmitted to the Blynk application for monitoring. The test results show that the system is capable of maintaining temperature within the range of 30°C–35°C, humidity between 60%–80% RH, and detecting ammonia gas concentrations ranging from 0.13 to 0.32 ppm during the fermentation process. The system is also able to automatically control temperature and humidity according to predetermined parameters. Fermentation results using the incubator showed faster and more uniform mold growth compared to the conventional fermentation method. Therefore, the developed system can help maintain optimal fermentation conditions and facilitate the monitoring process.

***Keywords**: Tempeh Fermentation, Internet of Things, ESP32, DHT21, MQ-135.*