

DESIGN, DEVELOPMENT, AND EVALUATION OF AN IOT-BASED AUTOMATED CENTRALIZED MUSHROOM GROWING MEDIA STERILIZATION UNIT

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Sterilizing the substrate is crucial in artificial mushroom cultivation. In the small-scale mushroom industry in Sri Lanka, a basic steel barrel apparatus is commonly used for this purpose. Despite having more advantages, the Centralized Sterilization System (CSS), involving a central boiler and Lateral Sterilization Units (LSUs) is rarely adopted, as it demands higher attention to sustain the necessary conditions. Hence, the study aimed to improve CSS efficiency by integrating automation and IoT technology. The designed CSS included a boiler, four LSUs, a rice husk furnace, an automated husk feeding mechanism, temperature pressure sensors, with all controlled by an IoT unit. The rate of husk-feeding and airflow to the furnace is regulated based on the pressure and temperature values of LSUs. The IoT unit enables continuous monitoring and remote operation. The evaluation of CSS performance involved varying the number of LSUs, (T1- One LSU, T2- Two LSUs, T3- Three LSUs, T4 - Four LSUs). The maximum temperature and pressure of the system with all the LSUs recorded were 103°C and 68947 Pa, respectively. The duration to reach maximum pressure and temperature, duration for sterilization, and amount of fuel consumption were evaluated. The duration to reach the maximum conditions significantly increased with the number of treatments ($p \leq 0.05$). The duration for sterilization significantly increased with the number of treatments ($p \leq 0.05$). Nevertheless, no significant difference between T3 and T4 ($p \geq 0.05$). Moreover, the fuel consumption was significantly different among all treatments while the lowest and highest fuel consumption was recorded for the T1 (12.78 kg) and T4 (50.85 kg), respectively. Furthermore, the cost-benefit ratio was comparatively lower in T3 than in other treatments. Therefore, it could be concluded that mushroom-growing media sterilization with three LSUs is the most economical method in CSS with IoT technology.

Keywords: Artificial mushroom cultivation, centralized sterilization system, lateral sterilization units