

ABSTRAK

Inkubator laboratorium konvensional sangat bergantung pada listrik PLN, sehingga sulit dipakai di daerah terpencil atau saat dibawa dalam perjalanan. Penelitian ini bertujuan merancang prototipe alat inkubator portabel menggunakan baterai sebagai sumber daya utama. Perangkat ini menggunakan Arduino Uno R3, sensor suhu dan kelembapan SHT31, sensor daya INA219, baterai litium LiFePO₄ 12,8 V 6 Ah, serta pemanas PTC heater. Daya pemanas diatur otomatis menggunakan nilai PWM berdasarkan kondisi suhu ruangan. Hasil pengujian menunjukkan bahwa dari segi kapasitas baterai, sistem menunjukkan kinerja yang baik karena mampu beroperasi selama 13 jam 45 menit secara stabil. Sistem pengaman baterai juga menunjukkan keandalan yang baik karena berhasil mematikan seluruh komponen saat terjadi penurunan tegangan baterai hingga pada batas kritis 10,5 V. Namun, sistem kontrol suhu belum memenuhi standar medis Kepmenkes RI Nomor 118/MENKES/SK/IV/2014. Hal tersebut disebabkan karena alat masih mencatat nilai penyimpangan suhu terbesar mencapai 3,8 °C dengan error maksimal 18,06% akibat lambatnya respons alat pembanding *thermohygrometer* pada menit-menit awal pengujian.

Kata Kunci: Kontrol Suhu, Ruang Inkubasi, PTC Heater, Baterai LiFePO₄, *Low Voltage Cut-Off*.

ABSTRACT

Conventional laboratory incubators rely heavily on electricity from the power grid, making them difficult to use in remote areas or while traveling. This study aims to design a prototype of a portable incubator device that uses a battery as its primary power source. The device utilizes an Arduino Uno R3, an SHT31 temperature and humidity sensor, an INA219 power sensor, a 12.8 V 6 Ah LiFePO₄ lithium battery, and a PTC heater. The heater power is automatically regulated using PWM values based on the chamber temperature conditions. Test results show that in terms of battery capacity, the system performs well, as it can operate stably for 13 hours and 45 minutes. The battery safety system also demonstrates good reliability as it successfully shuts down all components when a battery voltage drop occurs down to the critical threshold of 10.5 V. However, the temperature control system does not comply with the medical standards stipulated in the Decree of the Ministry of Health of the Republic of Indonesia No. 118/MENKES/SK/IV/2014. This is attributed to the device still recording a maximum temperature deviation of 3.8 °C with a maximum error of 18.06% due to the slow response of the reference thermohygrometer instrument during the initial minutes of testing.

Keywords: *Temperature Control, Incubation Chamber, PTC Heater, LiFePO₄ Battery, Low Voltage Cut-Off.*