

## ABSTRAK

Anam, Hoirul. 2025. *Analisis Pola Pengisian Baterai Lead Acid Menggunakan Panel Surya Tipe Monocrystalline dan Polycrystalline*. Skripsi. Tanjungpinang: Program Studi Teknik Elektro. Fakultas Teknik dan Teknologi Kemaritiman. Universitas Maritim Raja Ali Haji. Pembimbing I : Septia Refly, S.Pd., M.Si. Pembimbing II : Basyaruddin Ismail Harahap S.Pd., M.T.

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Penelitian ini menganalisis pola pengisian baterai *Lead Acid* 12 V menggunakan dua panel surya 50 Wp, yaitu *monocrystalline* dan *polycrystalline*. Kedua jenis panel memiliki perbedaan efisiensi dan karakteristik dalam mengubah energi matahari menjadi energi listrik, sehingga memengaruhi performa pengisian pada sistem PLTS skala kecil. Penelitian yang membandingkan keduanya pada kondisi yang sama masih terbatas, sehingga analisis ini diperlukan untuk mengetahui panel yang lebih efektif. Sistem pemantauan dirancang menggunakan ESP32, sensor INA219, RTC DS3231, dan modul MicroSD untuk merekam arus dan tegangan secara real time. Pengujian dilakukan selama tujuh hari di lingkungan *outdoor* untuk memperoleh data arus, tegangan, daya, dan durasi pengisian. Panel *polycrystalline* menghasilkan tegangan 12,97–13,49 V, arus 1,75–2,39 A, dan daya 23,25–32,31 W, lebih tinggi dibandingkan *monocrystalline* yang menghasilkan 12,82–13,26 V, 1,54–2,10 A, dan 20,02–27,86 W. Panel *polycrystalline* juga mengisi baterai lebih cepat dengan selisih 7–38 menit per hari. Dengan demikian, panel *polycrystalline* lebih efektif untuk aplikasi PLTS skala kecil yang membutuhkan pengisian cepat, sedangkan *monocrystalline* lebih stabil dalam performa pengisian.

Kata kunci: Panel Surya, Polikristalin, Monokristalin, Pengisian Baterai, Asam Timbal

## ABSTRACT

Anam, Hoirul. 2025. *Analysis of Lead Acid Battery Charging Patterns Using Monocrystalline and Polycrystalline Solar Panels*. Thesis. Tanjungpinang: Study Program of Electrical Engineering. Faculty of Engineering and Maritime Technology. University of Maritim Raja Ali Haji. Supervisor I: Septia Refly, S.Pd., M.Si. Supervisor II: Basyaruddin Ismail Harahap, S.Pd., M.T.

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*This study analyzes the charging patterns of a 12 V Lead Acid battery using two 50 Wp solar panels, namely monocrystalline and polycrystalline. The two panel types have different efficiencies and characteristics in converting sunlight into electrical energy, which affects battery charging performance in small-scale PV systems. Research comparing both panels under the same conditions is still limited, making this analysis necessary to determine which panel is more effective. The monitoring system was designed using an ESP32 microcontroller, an INA219 sensor, an RTC DS3231 module, and a MicroSD module to record current and voltage in real time. The tests were conducted over seven days in an outdoor environment to obtain current, voltage, power, and charging duration data. The polycrystalline panel generated higher values with voltages of 12.97–13.49 V, currents of 1.75–2.39 A, and power outputs of 23.25–32.31 W, compared to the monocrystalline panel which produced 12.82–13.26 V, 1.54–2.10 A, and 20.02–27.86 W. The polycrystalline panel also charged the battery faster with a time difference of 7–38 minutes per day. Therefore, the polycrystalline panel is more effective for small-scale PV applications that require faster charging, while the monocrystalline panel offers more stable charging performance.*

**Keywords:** *Solar panel, Polycrystalline, Monocrystalline, Battery charging, Lead Acid*