

ABSTRAK

PENGARUH SARI BELIMBING WULUH (*Averrhoa bilimbi* L.) DAN KONSENTRASI NATRIUM HIDROKSIDA (NaOH) SEBAGAI ELEKTROLIT TERHADAP KINERJA BIO-BATERAI

(Siti Nur Alisah, 2026, 68 Halaman, 15 Gambar, 9 Tabel, 3 Lampiran)

Penelitian ini bertujuan untuk menganalisis pengaruh variasi volume sari belimbing wuluh (*Averrhoa bilimbi* L.) dan konsentrasi natrium hidroksida (NaOH) sebagai elektrolit terhadap kinerja bio-baterai. Belimbing wuluh dipilih karena mengandung asam organik yang dapat terionisasi dan berfungsi sebagai elektrolit alami, sedangkan NaOH digunakan untuk meningkatkan konduktivitas ionik larutan. Penelitian dilakukan dengan metode eksperimen menggunakan variasi volume sari belimbing wuluh sebesar 300, 350, 400, 450, dan 500 mL serta konsentrasi NaOH 0,1; 0,5; 0,7; dan 1 M. Parameter yang diamati meliputi pH, konduktivitas, tegangan, arus, daya listrik, durasi nyala LED, dan kapasitas bio-baterai. Bio-baterai dirancang menggunakan elektroda aluminium (Al) sebagai anoda dan tembaga (Cu) sebagai katoda yang disusun secara seri dalam *bio chamber*. Hasil penelitian menunjukkan bahwa peningkatan volume sari belimbing wuluh dan konsentrasi NaOH berpengaruh terhadap karakteristik elektrolit dan performa bio-baterai. Nilai pH campuran berada pada rentang 2–6, sedangkan konduktivitas tertinggi diperoleh pada konsentrasi NaOH 1 M dan volume sari belimbing wuluh 350 mL sebesar 19,43 mS/cm. Kinerja listrik terbaik diperoleh pada konsentrasi NaOH 1 M dan volume sari belimbing wuluh 450 mL dengan tegangan 4,67 V, arus 22,40 mA, dan daya 104,61 mW. Pengujian kapasitas menunjukkan bahwa kondisi optimum untuk penyimpanan dan penyaluran energi terjadi pada konsentrasi NaOH 1 M dan volume sari belimbing wuluh 500 mL dengan durasi nyala LED selama 235 menit dan kapasitas maksimum sebesar 85,38 mAh. Hasil penelitian membuktikan bahwa sari belimbing wuluh yang dikombinasikan dengan NaOH berpotensi digunakan sebagai elektrolit alternatif ramah lingkungan dalam pengembangan bio-baterai berbasis biomaterial.

Kata kunci: bio-baterai, belimbing wuluh, natrium hidroksida, elektrolit, kapasitas baterai, energi terbarukan.

ABSTRACT

THE EFFECT OF STAR FRUIT (*Averrhoa bilimbi* L.) JUICE AND SODIUM HYDROXIDE (NaOH) CONCENTRATION AS AN ELECTROLYTE ON BIO-BATTERY PERFORMANCE

(Siti Nur Alisah, 2026, 68 Pages, 15 Pictures, 9 Tables, 3 Appendixs)

*This study aimed to analyze the effect of starfruit (*Averrhoa bilimbi* L.) juice volume and sodium hydroxide (NaOH) concentration as electrolytes on bio-battery performance. Starfruit juice was selected due to its organic acid content, which can ionize and function as a natural electrolyte, while NaOH was added to enhance the ionic conductivity of the solution. An experimental method was employed using starfruit juice volumes of 300, 350, 400, 450, and 500 mL, combined with NaOH concentrations of 0.1, 0.5, 0.7, and 1 M. The observed parameters included pH, conductivity, voltage, current, electrical power, LED illumination duration, and bio-battery capacity. The bio-battery was assembled using aluminum (Al) as the anode and copper (Cu) as the cathode arranged in a series configuration within a bio-chamber system. The results demonstrated that both starfruit juice volume and NaOH concentration significantly influenced the electrolyte characteristics and bio-battery performance. The electrolyte pH ranged from 2 to 6, while the highest conductivity value of 19.43 mS/cm was obtained at a NaOH concentration of 1 M and a starfruit juice volume of 350 mL. The optimum electrical performance was achieved at a NaOH concentration of 1 M and a starfruit juice volume of 450 mL, producing a voltage of 4.67 V, a current of 22.40 mA, and a power output of 104.61 mW. Capacity testing revealed that the optimum condition for energy storage and delivery occurred at a NaOH concentration of 1 M and a starfruit juice volume of 500 mL, resulting in an LED illumination duration of 235 minutes and a maximum capacity of 85.38 mAh. These findings indicate that starfruit juice combined with NaOH has strong potential as an environmentally friendly alternative electrolyte for the development of biomaterial-based bio-batteries.*

Keywords: *bio-battery, starfruit juice, sodium hydroxide, electrolyte, battery capacity, renewable energy.*