

ABSTRAK

PEMANFAATAN FILTRAT BELIMBING WULUH (*Averrhoa bilimbi*) DAN JERUK NIPIS (*Citrus aurantifolia*) SEBAGAI ELEKTROLIT ALAMI DALAM PENGEMBANGAN BIO-BATERAI CAIR RAMAH LINGKUNGAN

(Fitri Nur Fadillah, 2026, 49 Halaman, 11 Tabel, 20 Gambar, 3 Lampiran)

Ketergantungan Indonesia terhadap energi fosil mendorong perlunya inovasi energi alternatif yang ramah lingkungan. Penelitian ini bertujuan untuk menganalisis pemanfaatan filtrat belimbing wuluh (*Averrhoa bilimbi*) dan jeruk nipis (*Citrus aurantifolia*) sebagai elektrolit alami dalam pengembangan bio-baterai cair ramah lingkungan serta mengkaji pengaruh penambahan NaCl terhadap kinerja kelistrikan bio-baterai. Penelitian dilakukan dengan memvariasikan komposisi filtrat belimbing wuluh dan jeruk nipis pada konsentrasi NaCl 0,5 M dan 1,0 M menggunakan elektroda tembaga (Cu) dan aluminium (Al). Parameter yang diamati meliputi pH, tegangan, arus, daya, durasi nyala LED, dan kapasitas bio-baterai. Hasil penelitian menunjukkan bahwa peningkatan volume jeruk nipis menyebabkan penurunan pH dan peningkatan kinerja bio-baterai. Penambahan NaCl 1,0 M menghasilkan performa yang lebih baik dibandingkan NaCl 0,5 M karena meningkatkan konduktivitas larutan dan memperlancar perpindahan ion. Kondisi optimum diperoleh pada komposisi 160 mL filtrat belimbing wuluh dan 40 mL jeruk nipis dengan NaCl 1,0 M yang menghasilkan pH 1,15, tegangan 6,95 V, arus 1719 mA, daya 11.947,05 mW, durasi nyala LED selama 51.467 menit (± 858 jam), dan kapasitas bio-baterai sebesar 1.474,90 mAh. Hasil ini menunjukkan bahwa filtrat belimbing wuluh dan jeruk nipis berpotensi sebagai elektrolit alami untuk pengembangan bio-baterai cair yang ramah lingkungan dan berkelanjutan.

Kata Kunci : Sumber Energi Alternatif, Bio-baterai, filtrat Belimbing Wuluh, Jeruk Nipis, Kalium Klorida

ABSTRACT

UTILIZATION OF STAR FRUIT JUICE (*Averrhoa bilimbi*) AND LIME (*Citrus aurantifolia*) FILTRATES AS NATURAL ELECTROLYTES IN THE DEVELOPMENT OF ENVIRONMENTALLY FRIENDLY LIQUID BIO-BATTERIES

(Fitri Nur Fadillah, 2026, 49 Pages, 11 Tables, 20 Pictures, 3 Appendixs)

Indonesia's dependence on fossil fuels has driven the need for environmentally friendly alternative energy innovations. This study aims to analyze the use of starfruit (*Averrhoa bilimbi*) and lime (*Citrus aurantifolia*) filtrate as natural electrolytes in the development of environmentally friendly liquid bio-batteries and to examine the effect of NaCl addition on the electrical performance of the bio-battery. The study was conducted by varying the composition of starfruit and lime filtrate at NaCl concentrations of 0.5 M and 1.0 M using copper (Cu) and aluminum (Al) electrodes. The parameters observed included pH, voltage, current, power, LED light duration, and bio-battery capacity. The results showed that increasing the volume of lime decreased pH and increased bio-battery performance. The addition of 1.0 M NaCl resulted in better performance than 0.5 M NaCl because it increased the conductivity of the solution and facilitated ion transfer. The optimum condition was obtained in the composition of 160 mL starfruit filtrate and 40 mL lime with 1.0 M NaCl which produced a pH of 1.15, a voltage of 6.95 V, a current of 1719 mA, a power of 11,947.05 mW, an LED duration of 51,467 minutes (± 858 hours), and a bio-battery capacity of 1,474.90 mAh. These results indicate that starfruit and lime filtrate have the potential as natural electrolytes for the development of environmentally friendly and sustainable liquid bio-batteries.

Keywords: Alternative Energy Source, Bio-battery, Starfruit filtrate, Lime, Sodium chloride (NaCl)