ABSTRAK

PENGARUH SARI JERUK KASTURI (*CITRUS MICROCARPA*) DAN KONSENTRASI KCL TERHADAP KINERJA BIO-BATERAI SEBAGAI ALTERNATIF ENERGI RAMAH LINGKUNGAN

(Tarissa Agustina, 2026, 72 Halaman, 13 Tabel, 16 Gambar)

Penelitian ini dilatar belakangi oleh meningkatnya kebutuhan energi listrik serta dampak negatif penggunaan baterai konvensional yang mengandung bahan kimia berbahaya dan sulit terurai, sehingga diperlukan pengembangan sumber energi alternatif ramah lingkungan, salah satunya melalui pemanfaatan bio-baterai berbasis bahan alami. Jeruk kasturi (*Citrus microcarpa*) berpotensi elektrolit alami karena mengandung asam organik yang dapat menghasilkan ion dalam larutan, sedangkan penambahan kalium klorida (KCl) diharapkan mampu meningkatkan konduktivitas larutan. Penelitian ini bertujuan untuk menganalisis pengaruh variasi volume sari jeruk kasturi dan konsentrasi KCl terhadap karakteristik elektrokimia dan performa bio-baterai. Metode penelitian yang digunakan adalah eksperimen laboratorium dengan variasi volume sari jeruk kasturi 250, 300, 350, dan 400 mL serta variasi konsentrasi KCl 0; 0,5; 1; 1,5; dan 2 M. Elektroda yang digunakan adalah seng (Zn) sebagai anoda dan tembaga (Cu) sebagai katoda, dalam rangkaian seri biochamber. Parameter yang diamati meliputi pH, tegangan, arus, daya, konduktivitas, kapasitas, serta uji aplikasi pada lampu LED. Hasil penelitian menunjukkan bahwa sari jeruk kasturi murni memiliki pH konstan 2, tegangan 4,14–4,28 V dan konduktivitas 4,77–5,05 mS/cm. Performa optimum diproleh pada kombinasi 250 mL sari jeruk kasturi dan konsentrasi KCl 0,5 M, dengan tegangan 7,59 V, arus 13,98 mA, daya 106,11 mW, serta mampu menyalakan lampu LED selama 430 menit. Peningkatan volume di atas 250 mL menyebabkan efek pengenceran yang menurunkan kerapatan ion, sedangkan konsentrasi KCl di atas 0,5 M pada volume konstan cenderung menghambat mobilitas ion sehingga menurunkan tegangan dan daya meskipun arus dan konduktivitas terus meningkat. Dengan demikian Variasi volume sari jeruk kasturi dan konsentrasi KCl terbukti memengaruhi kinerja bio-baterai. Kombinasi 250 mL sari jeruk kasturi dan 0,5 M KCl menghasilkan performa terbaik, sehingga sari jeruk kasturi berpotensi dimanfaatkan sebagai elektrolit alami bio-baterai yang sederhana, dan ramah lingkungan.

Kata Kunci: Bio-baterai, Jeruk Kasturi, Kalium Klorida, Elektrolit Alami, Energi Alternatif.

ABSTRACT

THE EFFECT OF CITRUS MICROCARPA (CITRUS MICROCARPA) JUICE AND KCL CONCENTRATION ON BIO-BATTERY PERFORMANCE AS AN ENVIRONMENTALLY FRIENDLY ENERGY ALTERNATIVE

(Tarissa Agustina, 2026, 72 Pages, 13 Tables, 16 Figures)

This research is motivated by the increasing need for electrical energy and the negative impacts of using conventional batteries that contain hazardous chemicals and are difficult to decompose, so it is necessary to develop environmentally friendly alternative energy sources, one of which is through the use of bio-batteries based on natural materials. Musk orange (Citrus microcarpa) has the potential to be a natural electrolyte because it contains organic acids that can produce ions in solution, while the addition of potassium chloride (KCl) is expected to increase the conductivity of the solution. This study aims to analyze the effect of variations in the volume of musk orange juice and KCl concentration on the electrochemical characteristics and performance of bio-batteries. The research method used is a laboratory experiment with variations in the volume of musk orange juice of 250, 300, 350, and 400 mL and variations in KCl concentrations of 0; 0.5; 1; 1.5; and 2 M. The electrodes used are zinc (Zn) as the anode and copper (Cu) as the cathode, in a series of biochambers. The parameters observed include pH, voltage, current, power, conductivity, capacity, and application tests on LED lamps. The results showed that pure musk lime juice had a constant pH of 2, a voltage of 4.14–4.28 V and a conductivity of 4.77–5.05 mS/cm. Optimum performance was obtained in a combination of 250 mL musk lime juice and 0.5 M KCl concentration, with a voltage of 7.59 V, a current of 13.98 mA, a power of 106.11 mW, and was able to light an LED lamp for 430 minutes. Increasing the volume above 250 mL caused a dilution effect that decreased ion density, while KCl concentration above 0.5 M at a constant volume tended to inhibit ion mobility, thereby decreasing voltage and power even though the current and conductivity continued to increase. Thus, variations in musk lime juice volume and KCl concentration were shown to affect bio-battery performance. The combination of 250 mL musk lime juice and 0.5 M KCl produced the best performance, so musk lime juice has the potential to be used as a simple and environmentally friendly natural electrolyte for bio-batteries.

Keywords: *Bio-battery, Mandarin orange, Potassium chloride, Natural electrolyte, Alternative energy.*