

## ABSTRACT

This research on “Electrochemical Characterization of Amarella Peel Waste Utilization as Liquid Electrolyte in Bio-Battery” focuses on the electrochemical characterization of Zn-Cu bio-battery cells utilizing electrolytes derived from ambarella peel waste. The primary objectives are to determine the characteristics of the chemical content of the ambarella peel that plays a role in the performance of bio-battery cells, to determine the half-cell and full-cell characteristics of these bio-batteries at various concentration ratios and to identify the optimal concentration ratio for maximum performance in bio-batteries. The results of the characterization of the chemical content of the ambarella obtained there are chemical compounds that have acidic characterization in the electrolyte solution of ambarella that can support electrochemical activity. Cyclic voltammetry analysis of the half-cells revealed an oxidation peak at 0.5 V vs Ag/AgCl. Additionally, two reduction peaks were observed: hydrogen ion reduction to H<sub>2</sub> at 0 V vs Ag/AgCl and water reduction at -0.42 V vs Ag/AgCl. The rate-determining step analysis indicated that the redox reactions in the ambarella peel electrolyte solution were surface reactions. The highest rate constant ( $k_s$ ) of  $0.722 \pm 0.05 \text{ s}^{-1}$  was observed at a 1:2 concentration ratio. This ratio also resulted in the highest battery capacity of 0.0816 mAh and the maximum power density of 16.13 mW/m<sup>2</sup>. The study concluded that the 1:2 concentration ratio of ambarella peel waste electrolyte solution is optimal, outperforming the 1:1 and 1:3 ratios in terms of battery capacity and power density.

**Keywords:** Bioenergy, Biomass, Ionization Degree Waste-to-Energy, Zn-Cu