ABSTRAK

PENGEMBANGAN KIT PRAKTIKUM ELEKTROKIMIA MENGGUNAKAN MIKROKONTROLER ESP32

Arnoldus Danang Subakti Watutiba
Universitas Sanata Dharma
Yogyakarta
2026

Elektrokimia dianggap sebagai topik yang sulit dan abstrak, sehingga memerlukan praktikum untuk meningkatkan pemahaman peserta didik. Namun, banyak sekolah menghadapi keterbatasan peralatan laboratorium dan bahan pendukung. Oleh karena itu dikembangkan KIT praktikum elektrokimia berbasis ESP32 (KREBS) disertai alat ukur bernama IonCore di penelitian ini. Tujuan penelitian ini adalah: 1) mengembangkan KIT praktikum disertai alat ukur yang akurat, presisi, linear, serta terjangkau menggunakan mikrokontroler ESP32 dan modul pendukung melalui model pengembangan ADDIE (*Analysis, Design, Development, Implementation, & Evaluation)* ; 2) mengetahui validitas KIT praktikum berdasarkan umpan balik ahli dan responden. Hasil penelitian menunjukkan bahwa: 1) KIT praktikum dikembangkan memiliki alat ukur tegangan dengan akurasi 99,75% (MAE 0,0083 V), presisi yang sangat teliti (RSD *repeatability* 0,0111%; RSD *reproducibility* 0,0106%) dan linearitas yang sangat baik (R^2: 0,9997). Pengukuran kuat arus menunjukkan akurasi 96,83% (MAE 0,0003 V), dengan presisi sedang hingga tinggi (RSD *repeatability* 3,80%; RSD *reproducibility* 1,83% (teliti) ; serta linearitas R^2: 0,9933. 2) KREBS dan buku panduan sebagai kesatuan KIT dinyatakan sangat valid, dengan rata-rata skor validitas masing-masing sebesar 96, 88% dan 96,81%. Berdasarkan uji coba, KREBS dinyatakan sangat valid dan dapat digunakan untuk mendukung praktikum elektrokimia dengan baik.

Kata kunci: elektrokimia, ESP32, kit praktikum

ABSTRACT

DEVELOPMENT OF ELECTROCHEMISTRY PRACTICUM KIT THROUGH THE USE OF ESP32 MICROCONTROLLER

Arnoldus Danang Subakti Watutiba
Universitas Sanata Dharma
Yogyakarta
2026

Electrochemistry is considered a challenging and abstract subject, necessitating practical work to enhance student understanding. However, many schools face limitations regarding laboratory equipment and supporting materials. Therefore, this study developed an ESP32-based electrochemistry practicum kit (KREBS), integrated with a measuring instrument named IonCore. The objectives of this research were: 1) to develop an accurate, precise, linear, and affordable practicum kit using ESP32 microcontrollers and supporting modules through the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model; and 2) to determine the validity of the kit based on expert and respondent feedback. The results indicated that: 1) the developed voltage measuring device achieved 99.75% accuracy (MAE 0.0083 V), high precision (repeatability RSD 0.0111%; reproducibility RSD 0.0106%), and excellent linearity (R^2: 0.9997). Current measurements showed 96.83% accuracy (MAE 0.0003 A), with moderate to high precision (repeatability RSD 3.80%; reproducibility RSD 1.83%), and a linearity R^2 of 0.9933. 2) KREBS and its accompanying guidebook were declared highly valid, with average validity scores of 96.88% and 96.81%, respectively. Based on the trials, KREBS is a highly valid tool and is well-suited to support electrochemistry practicums.

Keywords:, electrochemistry, ESP32, practicum kit