

ABSTRAK

Alinda Nur Rohmah. 2026. Efektivitas Penurunan Konsentrasi Logam Tembaga (Cu) Pada Limbah Pencucian Elektronik Dengan Metode Elektrokoagulasi-Adsorpsi Arang Tempurung Kelapa. *Skripsi*. Program Studi Teknik Kimia, FT, Universitas PGRI Madiun. Pembimbing (I) Ade Trisnawati, S.Pd., M.Pd., (II) Dyan Hatining Ayu S, S.ST., M.T

Limbah cair pencucian elektronik mengandung logam berat, khususnya tembaga (Cu), yang berpotensi mencemari lingkungan apabila tidak diolah sebelum dibuang. Penelitian ini bertujuan untuk mengetahui efektivitas metode kombinasi elektrokoagulasi-adsorpsi menggunakan adsorben arang tempurung kelapa dalam menurunkan konsentrasi logam Cu pada limbah cair pencucian elektronik, serta mengetahui pengaruh variasi tegangan dan waktu terhadap efisiensi penyisihan logam Cu. Penelitian dilakukan menggunakan metode eksperimen dengan proses pengolahan dua tahap, yaitu elektrokoagulasi menggunakan elektroda aluminium yang divariasikan pada tegangan 3, 6, dan 9 Volt dengan waktu kontak 30 dan 60 menit, kemudian dilanjutkan proses adsorpsi menggunakan arang tempurung kelapa sebanyak 0,5 gram selama 2 jam. Konsentrasi Cu dianalisis menggunakan spektrofotometer UV-Vis pada panjang gelombang maksimum 724,5 nm. Karakteristik adsorben yang diuji meliputi kadar air, kadar abu, dan daya serap iodin. Hasil penelitian menunjukkan bahwa arang tempurung kelapa memiliki kadar air sebesar 2,30%, kadar abu sebesar 16,62%, dan daya serap iodin sebesar 1078,91 mg/g. Metode elektrokoagulasi mampu menurunkan kadar Cu dengan efektivitas sebesar 42–85%, sedangkan kombinasi elektrokoagulasi-adsorpsi meningkatkan efektivitas penyisihan menjadi 67–97%. Kondisi optimum metode elektrokoagulasi diperoleh pada tegangan 6 Volt dengan waktu 60 menit, yaitu mampu menurunkan konsentrasi Cu dari 7869 mg/L menjadi 1034 mg/L dengan efektivitas penyisihan sebesar 85%. Metode elektrokoagulasi-adsorpsi diperoleh kondisi optimum pada tegangan 6 volt dengan waktu 60 menit menjadi 219 mg/L dengan efektivitas penyisihan sebesar 97%. Hasil penelitian menunjukkan bahwa penambahan proses adsorpsi menggunakan arang tempurung kelapa mampu meningkatkan efisiensi pengolahan dibandingkan metode elektrokoagulasi saja.

Kata kunci: adsorpsi, arang tempurung kelapa, elektrokoagulasi, limbah pencucian elektronik, tembaga (Cu).

ABSTRACT

Alinda Nur Rohmah. 2026. Effectiveness of Reducing Copper (Cu) Concentration in Electronic Washing Wastewater Using the Electrocoagulation-Coconut Shell Charcoal Adsorption Method. Undergraduate *Thesis*. Chemical Engineering Study Program, Faculty of Engineering, Universitas PGRI Madiun. Supervisors: (I) Ade Trisnawati, S.Pd., M.Pd., (II) Dyan Hatining Ayu S, S.ST., M.T.

Wastewater from electronic component washing contains heavy metals, particularly copper (Cu), which pose a risk of environmental contamination if discharged without treatment. This study aimed to evaluate the effectiveness of a combined electrocoagulation-adsorption method—utilizing coconut shell charcoal as an adsorbent—in reducing Cu concentrations in this wastewater, as well as to determine the influence of voltage and contact time variations on Cu removal efficiency. An experimental approach involving a two-stage treatment process was employed: first, electrocoagulation using aluminum electrodes at voltages of 3, 6, and 9 V and contact times of 30 and 60 minutes; followed by adsorption using 0.5 g of coconut shell charcoal for 2 hours. Cu concentrations were analyzed using a UV-Vis spectrophotometer at a maximum wavelength of 724.5 nm. Adsorbent characteristics tested included moisture content, ash content, and iodine adsorption capacity. The results indicated that the coconut shell charcoal had a moisture content of 2.30%, an ash content of 16.62%, and an iodine adsorption capacity of 1078.91 mg/g. Electrocoagulation alone achieved a Cu reduction efficiency of 42–85%, whereas the combined electrocoagulation-adsorption method increased removal efficiency to 67–97%. The optimum conditions for electrocoagulation were a voltage of 6 V and a duration of 60 minutes, reducing the Cu concentration from 7869 mg/L to 1034 mg/L (85% removal efficiency). For the combined electrocoagulation-adsorption method, the optimum conditions were also a voltage of 6 V and a duration of 60 minutes, resulting in a final concentration of 219 mg/L and a removal efficiency of 97%. The findings demonstrate that incorporating an adsorption step using coconut shell charcoal enhances treatment efficiency compared to electrocoagulation alone.

Keywords: adsorption, coconut shell charcoal, copper (Cu), electrocoagulation, electronic washing wastewater.