

ABSTRAK

Najmia Nuri Kamila. 2026. Efektivitas Arang Aktif Daun Bambu (*Dendrocalamus asper*) sebagai Adsorben Logam Berat Kromium Cr(VI) pada Limbah Cair Industri Penyamakan Kulit. Program Studi Teknik Kimia, FT, Universitas PGRI Madiun. Pembimbing (I) Nasrul Rofiah Hidayati, S.T., M.Pd. Pembimbing (II) Dr. Ir. Nur Ihda Farikhatin Nisa, M.T.

Industri penyamakan kulit menghasilkan limbah cair yang mengandung logam berat kromium (Cr), khususnya Cr(VI) yang bersifat toksik dan karsinogenik, sehingga memerlukan metode pengolahan yang efektif, murah, dan ramah lingkungan. Penelitian ini bertujuan mengevaluasi efektivitas arang aktif daun bambu petung (*Dendrocalamus asper*) teraktivasi NaOH 1 M sebagai adsorben Cr(VI), serta mengidentifikasi pengaruh variasi massa adsorben (1, 2, 3, 4, dan 5 g) dan waktu kontak (30, 60, dan 90 menit) terhadap efisiensi dan kapasitas adsorpsi. Uji adsorpsi dilakukan pada larutan kalium dikromat ($K_2Cr_2O_7$) 50 ppm dengan pengulangan tiga kali, dan konsentrasi Cr sisa diukur menggunakan spektrofotometer UV-Vis pada panjang gelombang 538,5 nm. Data dianalisis menggunakan uji Two-Way ANOVA. Hasil karakterisasi menunjukkan kadar air (2%) dan kadar volatil (20,75%) memenuhi standar SNI 06-3730-1995, sedangkan kadar abu (56,99%) dan daya serap metilen biru (98 mg/g) belum memenuhi standar. Efisiensi adsorpsi Cr(VI) tertinggi diperoleh sebesar 51,07%, dengan kapasitas adsorpsi (q_e) tertinggi 2,553 mg/g pada massa adsorben 1 g. Hasil Two-Way ANOVA menunjukkan bahwa massa adsorben (Sig. = 0,599), waktu kontak (Sig. = 0,204), dan interaksi keduanya (Sig. = 0,251) tidak berpengaruh signifikan terhadap efisiensi adsorpsi ($p > 0,05$), mengindikasikan kesetimbangan adsorpsi telah tercapai sebelum 30 menit. Proses adsorpsi lebih sesuai dengan model isoterm Freundlich dibandingkan Langmuir, meskipun nilai R^2 yang diperoleh masih rendah. Arang aktif daun bambu petung dinilai cukup efektif namun belum optimal sebagai adsorben Cr(VI), sehingga masih memerlukan optimasi lebih lanjut agar dapat memenuhi baku mutu lingkungan.

Kata Kunci: arang aktif, daun bambu petung, adsorpsi, kromium (VI), limbah penyamakan kulit

ABSTRACT

Najmia Nuri Kamila. 2026. *Effectiveness of Bamboo Leaf (Dendrocalamus asper) Activated Carbon as an Adsorbent for Heavy Metal Chromium Cr(VI) in Leather Tanning Industry Wastewater*. Department of Chemical Engineering, Faculty of Engineering, Universitas PGRI Madiun. Advisor (I) Nasrul Rofiah Hidayati, S.T., M.Pd. Co-Advisor (II) Dr. Ir. Nur Ihda Farikhatin Nisa, M.T.

The leather tanning industry generates wastewater containing heavy metal chromium (Cr), particularly the toxic and carcinogenic Cr(VI), which requires an effective, low-cost, and environmentally friendly treatment method. This study aimed to evaluate the effectiveness of NaOH 1 M-activated bamboo petung leaf (Dendrocalamus asper) activated carbon as an adsorbent for Cr(VI), as well as to identify the effect of adsorbent mass variation (1, 2, 3, 4, and 5 g) and contact time (30, 60, and 90 minutes) on adsorption efficiency and capacity. Adsorption tests were conducted on a 50 ppm potassium dichromate ($K_2Cr_2O_7$) solution with three replications, and the residual Cr concentration was measured using a UV-Vis spectrophotometer at a wavelength of 538.5 nm. Data were analyzed using Two-Way ANOVA. Characterization results showed that moisture content (2%) and volatile matter content (20.75%) met the SNI 06-3730-1995 standard, while ash content (56.99%) and methylene blue adsorption capacity (98 mg/g) did not meet the standard. The highest Cr(VI) adsorption efficiency obtained was 51.07%, with the highest adsorption capacity (q_e) of 2.553 mg/g at an adsorbent mass of 1 g. The Two-Way ANOVA results showed that adsorbent mass (Sig. = 0.599), contact time (Sig. = 0.204), and their interaction (Sig. = 0.251) had no significant effect on adsorption efficiency ($p > 0.05$), indicating that adsorption equilibrium was reached before 30 minutes. The adsorption process fit the Freundlich isotherm model better than the Langmuir model, although the resulting R^2 values were still low. Bamboo petung leaf activated carbon was found to be reasonably effective yet not optimal as a Cr(VI) adsorbent, so further optimization is still needed to meet environmental quality standards.

Keywords: activated carbon, adsorption, bamboo petung leaf, chromium (VI), tanning wastewater.