ABSTRAK

Anisa Dwi Lestari. 2026. Adsorpsi Logam Kromium Heksavalen Cr(VI) dan *Methylene Blue* Menggunakan Bioadsorben Kulit Pisang Kepok Teraktivasi HCl. *Skripsi,* Program Studi Teknik Kimia, Fakultas Teknik, Universitas PGRI Madiun. Pembimbing (I) Ade Trisnawati, S.Pd., M.Pd., (II) Mohammad Arfi Setiawan, S.Si., M.Pd.

Penelitian ini dilakukan untuk mengevaluasi kemampuan bioadsorben kulit pisang kepok *(Musa paradisiaca L.)* teraktivasi HCl dalam menyisihkan dua jenis polutan yang memiliki karakteristik kimia berbeda, yaitu logam kromium heksavalen Cr(VI) dan zat warna methylene blue, menggunakan larutan artifisial. Penelitian bertujuan menganalisis pengaruh massa bioadsorben dan waktu kontak terhadap efisiensi penyisihan Cr(VI) dan *methylene blue*, serta menentukan model kinetika dan isoterm adsorpsi yang paling sesuai. Bioadsorben dibuat melalui proses karbonisasi dan aktivasi kimia menggunakan larutan HCl 3 N, kemudian dikarakterisasi dan diuji secara batch dengan variasi massa adsorben sebesar 0,1; 0,2; 0,4; 0,6; 0,8; 1,0; 1,2; dan 1,4 g, variasi waktu kontak 5, 10, 20, 30, 40, 50, dan 60 menit, serta variasi konsentrasi awal larutan, kemudian dianalisis menggunakan spektrofotometer UV-Vis. Hasil karakterisasi menunjukkan bioadsorben memenuhi standar SNI dengan kadar air sebesar 0,13%, kadar abu sebesar 1,07%, dan bilangan iodin sebesar 1142,37 mg/g. Efisiensi penyisihan tertinggi diperoleh pada massa adsorben 0,6 g dengan efisiensi *methylene blue* sebesar 93,91%, sedangkan pada Cr(VI) diperoleh massa optimum 0,8 g dengan efisiensi penyisihan sebesar 50%, serta waktu kontak optimum selama 60 menit. Kedua polutan mengikuti model kinetika *Pseudo Second Order* dengan nilai koefisien determinasi (R^2) sebesar 0,9993 pada *methylene blue* dan 0,9911 pada Cr(VI), yang mengindikasikan mekanisme kemisorpsi. Adapun model isoterm adsorpsi menunjukkan hasil yang berbeda, yaitu *methylene blue* mengikuti model Langmuir dengan nilai R^2 sebesar 0,9982 dan kapasitas adsorpsi maksimum sebesar 2,109 mg/g, sedangkan Cr(VI) mengikuti model Freundlich dengan nilai R^2 sebesar 0,9891. Perbedaan model isoterm tersebut menunjukkan adanya perbedaan karakter interaksi adsorpsi akibat sifat kimia dan muatan ion kedua polutan. Penelitian ini menyimpulkan bahwa bioadsorben kulit pisang kepok teraktivasi HCl berpotensi sebagai adsorben alternatif yang murah, ramah lingkungan, dan efektif dalam menyisihkan polutan organik maupun anorganik dari larutan artifisial.

Keywords: adsorption isotherm, adsorption kinetics, bioadsorbent, Cr(VI), kepok banana peel, *methylene blue*

ABSTRACT

Anisa Dwi Lestari. 2026. Adsorption of Hexavalent Chromium Cr(VI) and Methylene Blue Using HCl-Activated Kepok Banana Peel Bioadsorbent. Thesis, Chemical Engineering Study Prog, Faculty of Engineering, PGRI University Madiun. Supervisors: (I) Ade Trisnawati, S.Pd., M.Pd., (II) Mohammad Arfi Setiawan, S.Si., M.Pd.

This study was conducted to evaluate the ability of HCl-activated kepok banana peel (Musa paradisiaca L.) bioadsorbent in removing two pollutants with different chemical characteristics, namely hexavalent chromium Cr(VI) and methylene blue dye, using artificial solutions. The research aimed to analyze the effect of bioadsorbent mass and contact time on the removal efficiency of Cr(VI) and methylene blue, as well as to determine the most suitable adsorption kinetics and isotherm models. The bioadsorbent was prepared through carbonization followed by chemical activation using 3 N HCl solution, then characterized and tested through batch experiments with variations in adsorbent mass (0.1, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, and 1.4 g), contact time (5, 10, 20, 30, 40, 50, and 60 minutes), and initial solution concentration, with all measurements analyzed using a UV-Vis spectrophotometer. The characterization results showed that the bioadsorbent met SNI standards, with a moisture content of 0.13%, ash content of 1.07%, and an iodine number of 1,142.37 mg/g. The highest removal efficiency was achieved at an adsorbent mass of 0.6 g, yielding 93.91% efficiency for methylene blue, while the optimum mass for Cr(VI) was found at 0.8 g with a removal efficiency of 50%, along with an optimum contact time of 60 minutes. Both pollutants followed the Pseudo Second Order kinetic model, with determination coefficients (R^2) of 0.9993 for methylene blue and 0.9911 for Cr(VI), indicating a chemisorption mechanism. The adsorption isotherm models, however, differed between the two pollutants, methylene blue followed the Langmuir model with an R^2 value of 0.9982 and a maximum adsorption capacity of 2.109 mg/g, whereas Cr(VI) followed the Freundlich model with an R^2 value of 0.9891. This difference in isotherm models reflects distinct adsorption interaction characteristics resulting from differences in the chemical properties and ionic charge of the two pollutants. The study concludes that HCl-activated kepok banana peel bioadsorbent has potential as an affordable, environmentally friendly, and effective alternative adsorbent for removing both organic and inorganic pollutants from artificial solutions.

***Keywords**: adsorption isotherm, adsorption kinetics, bioadsorbent, Cr(VI), kepok banana peel, methylene blue*