ABSTRAK

SINTESIS DAN KARAKTERISASI KARBON AKTIF DARI LIMBAH KULIT JENGKOL (*Archidendron jiringa*) SEBAGAI ADSORBEN ION LOGAM KADMIUM(II)

Adsorpsi merupakan metode yang efektif dalam mengurangi cemaran logam berat kadmium(II) di perairan. Kulit jengkol berpotensi menjadi adsorben karbon aktif yang efektif karena kaya akan kandungan selulosa, lignoselulosa, saponin, dan tanin. Untuk meningkatkan luas permukaan dan kapasitas adsorpsi, adsorben dari limbah kulit jengkol diaktivasi menggunakan NaOH. Penelitian ini bertujuan untuk mengevaluasi potensi karbon aktif dari limbah kulit jengkol (*Archidendron jiringa*) sebagai adsorben ion logam kadmium(II). Potensi tersebut mencakup karakterisasi material, penentuan kondisi optimum menggunakan *Box Behnken Design,* dan penentuan model isoterm. Sintesis karbon aktif dilakukan dengan proses karbonisasi pada suhu 350°C dan aktivasi menggunakan NaOH 1M. Karakterisasi dilakukan menggunakan FTIR untuk mengidentifikasi gugus fungsi dan SEM untuk mengamati morfologi permukaan. FTIR menunjukkan keberhasilan sintesis dengan munculnya gugus -OH (3440,66 cm^{-1}), gugus eter -CO (1275,89 cm^{-1}), gugus sulfonil S=O (1379,38 cm^{-1}), gugus -CH alifatik (2930,20 cm^{-1}) dan -CH aromatik (1437,50 cm^{-1}). Karakterisasi SEM menunjukkan struktur permukaan yang lebih berpori membentuk rongga pori dengan kedalaman besar. Proses adsorpsi dilakukan menggunakan *Box Behnken Design* dengan memvariasikan massa adsorben, waktu kontak, dan konsentrasi awal ion logam kadmium(II). Kondisi optimum kapasitas adsorpsi pada 0,1 gram karbon aktif, waktu kontak 90 menit, dan konsentrasi awal ion logam kadmium(II) 100 mg/L sebesar 18,78 mg/g. Efisiensi adsorpsi optimum pada 0,3 gram karbon aktif, waktu kontak 90 menit dan konsentrasi 150 mg/L sebesar 99,78%. Data hasil adsorpsi sesuai dengan model Langmuir yang menunjukkan bahwa permukaan adsorben bersifat homogen dan proses adsorpsi berlangsung secara monolayer.

SUNAN GUNUNG DJATI
BANDUNG

Kata-kata kunci: adsorpsi; isoterm; karbon aktif; kulit jengkol; logam berat.

ABSTRACT

SYNTHESIS AND CHARACTERIZATION OF ACTIVATED CARBON FROM JENGKOL PEEL WASTE (Archidendron jiringa) AS AN ADSORBENT FOR CADMIUM(II) IONS

Adsorption is an effective method in reducing cadmium(II) heavy metal contamination in water. Jengkol peel has the potential to be an effective activated carbon adsorbent because it is rich in cellulose, lignocellulose, saponins, and tannins. To increase the surface area and adsorption capacity, the adsorbent from jengkol peel waste was activated using NaOH. This study aims to evaluate the potential of activated carbon from jengkol peel waste (Archidendron jiringa) as an adsorbent of cadmium(II) metal ions. This potential includes material characterization, determination of optimum conditions using Box Behnken Design, and determination of isotherm models. Activated carbon synthesis was carried out by a carbonization process at a temperature of 350°C and activation using 1M NaOH. Characterization was carried out using FTIR to identify functional groups and SEM to observe surface morphology. FTIR showed successful synthesis with the appearance of -OH group (3440.66 cm^{-1}), ether group -CO (1275.89 cm-1), sulfonyl group S=O (1379.38 cm-1), aliphatic -CH group (2930.20 cm-1) and aromatic -CH (1437.50 cm-1). SEM characterization showed a more porous surface structure forming pore cavities with large depths. The adsorption process was carried out using Box Behnken Design by varying the adsorbent mass, contact time, and initial concentration of cadmium(II) metal ions. The optimum condition for adsorption capacity at 0.1 grams of activated carbon, contact time of 90 minutes, and initial concentration of cadmium(II) metal ions of 100 mg/L was 18.78 mg/g. The optimum adsorption efficiency at 0.3 grams of activated carbon, contact time of 90 minutes and concentration of 150 mg/L was 99.78%. The adsorption results data are in accordance with the Langmuir model which shows that the adsorbent surface is homogeneous and the adsorption process takes place in a monolayer.

Keywords: *adsorption; isotherm; activated carbon; jengkol peel; heavy metal.*