

## **KARBON AKTIF KULIT SINGKONG (*Manihot esculenta*) TERMODIFIKASI ASAM NITRAT SEBAGAI ADSORBEN LOGAM Cr(VI)**

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### **INTISARI**

Sintesis karbon aktif kulit singkong termodifikasi asam nitrat sebagai adsorben logam Cr(VI) dalam larutan telah dilakukan. Adsorben diperoleh dari proses karbonisasi kulit singkong pada suhu 500 °C selama 3 jam, aktivasi karbon menggunakan KOH 3 M dilanjutkan pirolisis pada suhu 650 °C selama 3 jam dan modifikasi karbon aktif dengan HNO<sub>3</sub> 7 M pada suhu 110 °C. Karbon aktif termodifikasi dikarakterisasi menggunakan spektrofotometer FTIR dan *Surface Area and Pore Size Analyzer* (SAA). Pada kajian adsorpsi dipelajari pengaruh pH adsorpsi, waktu kontak dan konsentrasi adsorbat, kinetika adsorpsi, pola isoterm adsorpsi, kapasitas adsorpsi dan energi adsorpsi. Konsentrasi ion Cr(VI) dianalisis menggunakan spektrofotometer UV-Vis.

Rendemen karbon kulit singkong (KKS), karbon aktif kulit singkong (KKS-A) dan karbon aktif kulit singkong termodifikasi (KKS-A-M) masing-masing sebesar 36,51, 81,44 dan 94,79%. Aktivasi karbon kulit singkong berhasil dilakukan dan diperoleh nilai luas permukaan KKS-A sebesar 233,25 m<sup>2</sup> g<sup>-1</sup>, lebih besar dari KKS yaitu 4,81 m<sup>2</sup> g<sup>-1</sup>. KKS-A berhasil dimodifikasi menggunakan asam nitrat melalui reaksi oksidasi menjadi KKS-A-M ditunjukkan dengan nilai luas permukaan sebesar 10,69 m<sup>2</sup> g<sup>-1</sup>. Peningkatan konsentrasi gugus karboksilat terjadi pada KKS-A-M dari 30,70 mmol kg<sup>-1</sup> menjadi 301,86 mmol kg<sup>-1</sup>.

Kondisi optimum adsorpsi Cr(VI) menggunakan KKS-A-M diperoleh pada pH adsorpsi 1 dan waktu kontak selama 240 menit. Adsorpsi Cr(VI) mengikuti kinetika reaksi orde dua semu Ho dengan nilai konstanta laju adsorpsi (k) sebesar 1,93 × 10<sup>-2</sup> mg g<sup>-1</sup> menit<sup>-1</sup> dan mengikuti pola isoterm Freundlich dengan nilai R<sup>2</sup> sebesar 0,9992. Kapasitas adsorpsi KKS-A-M terhadap Cr(VI) pada konsentrasi 50 mg L<sup>-1</sup> sebesar 10,75 mg g<sup>-1</sup> dengan energi adsorpsi sebesar 26,28 kJ mol<sup>-1</sup> yang menunjukkan reaksi terjadi secara fisisorpsi.

Kata kunci: karbonisasi, modifikasi, Cr(VI), adsorpsi.

***NITRIC ACID-MODIFIED CASSAVA PEEL (*Manihot esculenta*) ACTIVATED CARBON AS AN ADSORBENT OF Cr(VI)***

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**ABSTRACT**

Synthesis of nitric acid-modified cassava peel activated carbon as an adsorbent of Cr(VI) has been done. The adsorbent obtained from cassava peel carbonization at 500 °C for 3 hours, activation using KOH 3 M followed by heating at 650 °C for 3 hours and modification with HNO<sub>3</sub> 7 M at 110 °C. The modified activated carbon was characterized using FTIR Spectrophotometer and Surface Area and Pore Size Analyzer (SAA). The effect of pH, contact time and concentration of an adsorbate, adsorption kinetics, adsorption isotherm, adsorption capacity and adsorption energy has been also studied. The concentration of Cr(VI) ion was analyzed using UV-Vis spectrophotometer.

The yield of cassava peel carbon (KKS), cassava peel activated carbon (KKS-A) and modified cassava peel activated carbon (KKS-A-M) were 36.51, 81.44 and 94.79% respectively. The characterization result using the SAA indicated the value of the surface area of cassava peel carbon (KKS) was 4.81 m<sup>2</sup> g<sup>-1</sup> and the surface area of cassava peel activated carbon (KKS-A) was 233.25 m<sup>2</sup> g<sup>-1</sup>. It could be concluded that the carbon had been successfully activated. Modification of KKS-A into KKS-A-M result a surface area that was equal to 10.69 m<sup>2</sup> g<sup>-1</sup>. The carboxyl concentration of KKS-A-M increased from 30.70 mmol kg<sup>-1</sup> (KKS-A) to 301.86 mmol kg<sup>-1</sup>.

The optimum condition of Cr(VI) adsorption was obtained at pH 1 with the contact time of 240 minutes. The kinetics data well correlated with the pseudo second order Ho equation with the value of rate constant (k) was 1.93 × 10<sup>-2</sup> mg g<sup>-1</sup> min<sup>-1</sup> and fitted better Freundlich isotherm with the value of R<sup>2</sup> was 0.9992. The adsorption capacity of KKS-A-M at concentration 50 mg L<sup>-1</sup> Cr(VI) was 10.75 mg g<sup>-1</sup> with the adsorption energy was 26.28 kJ mol<sup>-1</sup> which inferred the adsorption of Cr(VI) with KKS-A-M was under physical adsorption.

Keywords: carbonization, modification, Cr(VI), adsorption.