

PENGGUNAAN ADSORBEN BIAYA MURAH ABU LAYANG BATU BARA UNTUK PENGHILANGAN ZAT WARNA METILEN BIRU DAN KONGO MERAH

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INTISARI

Telah dilakukan adsorpsi zat warna metilen biru dan kongo yang biasa digunakan dalam industri tekstil menggunakan abu layang batu bara teraktivasi HCl dan tanpa aktivasi. Abu layang batu bara yang berasal dari PT. Petrokimia Gresik diaktivasi dengan cara direfluks menggunakan HCl 6 M kemudian digunakan sebagai adsorben dan hasilnya dibandingkan dengan abu layang tanpa aktivasi. Abu layang hasil aktivasi dikarakterisasi menggunakan spektrofotometer serapan atom (AAS), difraksi sinar-X (XRD) dan spektrofotometer inframerah (FTIR). Parameter yang mempengaruhi adsorpsi seperti pengaruh pH, massa adsorben, waktu interaksi, dan konsentrasi awal zat warna telah dioptimisasi. Penentuan konsentrasi zat warna sebelum dan sesudah adsorpsi dilakukan dengan spektrofotometer UV-Vis. Kinetika dan isoterm adsorpsi zat warna pada abu layang batu bara juga telah ditentukan.

Hasil karakterisasi AAS terhadap abu layang baru bara menunjukkan komponen utama abu layang SiO_2 dan Al_2O_3 . Abu layang teraktivasi HCl memiliki kandungan pengotor oksida logam lebih rendah disertai peningkatan SiO_2 dibandingkan abu layang tanpa aktivasi. Data FTIR dan XRD menunjukkan bahwa proses aktivasi tidak merusak gugus fungsi dan kristalinitas abu layang. Kondisi optimum adsorpsi metilen biru tercapai pada pH 8 menggunakan abu layang teraktivasi HCl sebanyak 0,2 gram dengan waktu kontak 30 menit dan konsentrasi awal 50 ppm untuk kongo merah kondisi optimum tercapai pada pH 5 menggunakan abu layang tanpa aktivasi sebanyak 0,15 gram dengan waktu kontak 200 menit sedangkan konsentrasi awal belum mencapai optimum sampai pada 200 ppm. Adsorpsi kedua zat warna mengikuti kinetika orde kedua semu dengan studi adsorpsi menunjukkan bahwa model isoterm Langmuir paling sesuai untuk data eksperimen adsorpsi kedua zat warna dibandingkan model isoterm Freundlich.

Kata kunci: abu layang, adsorpsi, kongo merah, metilen biru

THE USE OF LOW-COST COAL FLY ASH ADSORBENT FOR REMOVAL OF METHYLENE BLUE AND CONGO RED

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ABSTRACT

The adsorption of methylene blue and congo red which are usually for the textile industry has been done conducted by coal fly ash with activated HCl and without activated. The coal fly ash from PT. Petrokimia Gresik was activated by refluxing used HCl 6 M and then used as an adsorbent and the results were compared with non activated coal fly ash. Activated fly ash was characterized by Atomic Adsorption Spectrometry (AAS), X-Ray Diffraction (XRD) and Fourier Transform Infrared (FT-IR) spectroscopy. Parameters that affect adsorption such as the effect of pH, adsorbent mass, interaction time, and initial concentration of dyes has been optimized. To determine the concentration of dyes before and after adsorption by UV-Vis spectrophotometer. The kinetic and adsorption isotherms of dyes with coal fly ash were also determined.

The results of AAS characterization of coal fly ash showed that the main components are SiO₂ and Al₂O₃. Fly ash activated HCl has a lower metal oxide composition and active site of SiO₂ was increase compared with fly ash without activated. FTIR and XRD's data showed that the activation process did not damage the functional group and crystallinity of fly ash. The optimum conditions of methylene blue adsorption were reached at pH 8 used fly ash activated HCl in 0,2 grams with a contact time in 30 minutes and an initial concentration of 50 ppm for congo red reached the optimum conditions at pH 5 used fly ash without activated in 0,15 grams with a contact time in 200 minutes while the initial concentration has not reached up to 200 ppm. Adsorption of the both of dyes best describe by pseudo second-order and the adsorption study showed that the Langmuir isotherm model is the best fit for experimental data adsorption of the two dyes compared than Freundlich isotherm model.

Keywords: adsorption, congo red, fly ash, methylene blue