

INTISARI

FABRIKASI *BEADS* KITOSAN/ALGINAT-KARBON AKTIF DARI KULIT PISANG KEPOK (*Musa acuminata*) UNTUK ADSORPSI METILEN BIRU

*FABRICATION OF CHITOSAN/ALGINATE BEADS WITH ACTIVATED CARBON FROM KEPOK BANANA PEEL (*Musa acuminata*) FOR METHYLENE BLUE ADSORPTION*

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Pada penelitian ini, *beads* komposit kitosan/alginat-karbon aktif (CSA-AC) dari kulit pisang kepok (*Musa acuminata*) difabrikasi serta karakteristik dan kinerjanya dalam adsorpsi metilen biru (MB) dianalisis. AC disintesis melalui karbonisasi pada suhu 500°C setelah aktivasi ZnCl₂ 15%, kemudian diimobilisasi dalam matriks CSA melalui metode *ionotropic gelation* dengan CaCl₂ 4%. Variabel yang dikaji meliputi konsentrasi AC dalam *beads* (2%, 4%, dan 6%) serta massa *beads* (0,1 g, 0,3 g, dan 0,5 g). Uji adsorpsi dilakukan secara *batch* menggunakan larutan MB 10 mg/L selama 60 menit, dan konsentrasi sisa dianalisis menggunakan *UV-Visible Spectrophotometer* (UV-Vis) pada λ_{maks} 664 nm. Hasil karakterisasi *Scanning Electron Microscopy* (SEM) menunjukkan morfologi permukaan *beads* CSA-AC yang kasar, heterogen, dan berongga. Persentase adsorpsi tertinggi diperoleh pada variasi CSA-AC 6% sebesar 85,60%, sedangkan pada uji variasi massa diperoleh sebesar 89,44% pada massa 0,5 g. Berdasarkan analisis kinetika, model *pseudo-second order* (PSO) lebih sesuai dibandingkan *pseudo-first order* (PFO), ditunjukkan oleh nilai R² PSO yang mendekati 1 dan q_e teoritis yang mendekati q_e eksperimen. Nilai R² PFO yang juga mendekati 1 mengindikasikan mekanisme adsorpsi fisika dan kimia berperan bersamaan, dengan interaksi kimia sebagai tahap penentu laju.

Kata kunci: Adsorpsi, *Beads* kitosan/alginat, Karbon aktif, Kulit pisang kepok, Metilen biru

ABSTRACT

FABRICATION OF CHITOSAN/ALGINATE BEADS WITH ACTIVATED CARBON FROM KEPOK BANANA PEEL (*Musa acuminata*) FOR METHYLENE BLUE ADSORPTION

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In this study, chitosan/alginate-activated carbon (CSA-AC) composite beads from kepok banana peel (*Musa acuminata*) were fabricated, and their characteristics and performance in methylene blue (MB) adsorption were analyzed. The AC was synthesized through carbonization at 500°C following ZnCl₂ 15% activation, and subsequently immobilized in the CSA matrix via the ionotropic gelation method using CaCl₂ 4%. The variables examined included AC concentration within the beads (2%, 4%, and 6%) and bead mass (0.1 g, 0.3 g, and 0.5 g). The adsorption test was conducted in batch mode using a 10 mg/L MB solution for 60 minutes, and the residual concentration was analyzed using a UV-Visible Spectrophotometer (UV-Vis) at λ_{max} 664 nm. Scanning Electron Microscopy (SEM) characterization revealed that the CSA-AC beads exhibited a rough, heterogeneous, and porous surface morphology. The highest adsorption percentage was obtained at the CSA-AC 6% variation, reaching 85.60%, while the mass variation test yielded the highest value of 89.44% at 0.5 g. Based on kinetic analysis, the pseudo-second order (PSO) model fitted the data better than the pseudo-first order (PFO) model, as indicated by the R² PSO value approaching 1 and the theoretical q_e closely matching the experimental q_e . The R² PFO value, which also approached 1, indicates that both physical and chemical adsorption mechanisms occurred simultaneously, with chemical interaction acting as the rate-determining step.

Keywords: Adsorption, *Beads* chitosan/alginate, Activated carbon, Kepok banana peel, Methylene blue