

SINTESIS ADSORBEN HIBRIDA KALIKSARENA TURUNAN RESORSINOL-KITOSAN DAN UJI ADSORPSINYA TERHADAP KATION Pb(II)

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INTISARI

Telah disintesis dan diuji kemampuan adsorpsi hibrida kaliksarena turunan resorsinol-kitosan terhadap kation Pb(II). Hibrida tersebut diharapkan dapat menjadi salah satu adsorben alternatif dalam pengolahan limbah industri yang mengandung logam berat melalui proses sintesis yang murah.

Penelitian ini diawali dengan sintesis dan karakterisasi hibrida kaliksarena turunan resorsinol-kitosan. Sintesis hibrida dilakukan dari vanilin melalui alilasi, substitusi elektrofilik aromatik diikuti dengan siklisasi, klorometilasi dan substitusi nukleofilik unimolekular. Elusidasi struktur produk dilakukan menggunakan spektrometer IR, ¹H-NMR, ¹³C-NMR dan GC-MS. Uji adsorpsi hibrida terhadap kation Pb(II) dilakukan menggunakan metode *batch* dengan variasi pH, waktu kontak dan konsentrasi kation Pb(II).

Produk hibrida yang dihasilkan berupa padatan berwarna merah tua dengan rendemen 78,08%. Uji adsorpsi hibrida terhadap kation Pb(II) menunjukkan bahwa proses adsorpsi berlangsung optimum pada pH 5 dan waktu kontak 120 menit. Adsorpsi hibrida terhadap kation Pb(II) mengikuti model kinetika adsorpsi pseudo orde kedua dengan konstanta laju adsorpsi (*k*) sebesar $6,86 \times 10^{-2} \text{ g mg}^{-1} \text{ menit}^{-1}$. Hasil kajian kesetimbangan adsorpsi menunjukkan bahwa adsorben hibrida mengikuti model isoterm Freundlich. Kapasitas adsorpsi (X_m) hibrida terhadap kation Pb(II) lebih baik dibandingkan dengan kaliksarena dan kitosan pembentuknya. Kapasitas adsorpsi (X_m) ketiga adsorben tersebut berturut-turut adalah 17,99; 10,14 dan 10,31 mg g^{-1} . Interaksi antara adsorben hibrida dengan kation Pb(II) dapat diklasifikasikan sebagai adsorpsi kimia (kemisorpsi).

Kata kunci: hibrida, kaliksarena, resorsinol, kitosan, adsorben

SYNTHESIS OF RESORCINOL DERIVED CALIXARENE-CHITOSAN HYBRID ADSORBENT AND ITS ADSORPTION ASSAY TOWARD Pb(II) CATION

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ABSTRACT

Synthesis and adsorption assay of resorcinol derived calixarene-chitosan hybrid toward Pb(II) cation has been conducted. The hybrid was expected to be one of the alternative adsorbent for industrial waste treatment that contain of Pb from low cost synthesis process.

This research was started by synthesis and characterization of resorcinol derived calixarene-chitosan hybrid. The synthesis was carried out from vanillin via allylation, aromatic electrophilic substitution-cyclization, chloromethylation and unimolecular nucleophilic substitution reactions. Structure elucidation of products was performed using IR, $^1\text{H-NMR}$, $^{13}\text{C-NMR}$ and GC-MS spectrometers. The adsorption assay of result hybrid toward Pb(II) was carried out using batch method in various of pH, contact time and Pb(II) cation concentration.

The product of hybrid was obtained as dark red solid in 78.08% yield. The adsorption assay of hybrid toward Pb(II) showed optimum adsorption at pH 5 and contact time was 2 hours. Adsorption of hybrid toward Pb(II) followed the adsorption kinetics model with a pseudo second order adsorption and the rate constant (k) was $6.86 \times 10^{-2} \text{ g mg}^{-1} \text{ min}^{-1}$. The result of adsorption equilibrium study showed that the adsorbent hybrid followed the Freundlich isotherm model. The adsorption capacity (X_m) of hybrid better than constituent calixarene and chitosan. Adsorption capacity for three adsorbent were 17.99; 10.14 and 10.31 mg g^{-1} , respectively. The interaction of hybrid adsorbent with Pb(II) cation could be classified as chemisorptions.

Keywords: hybrid, calixarene, resorcinol, chitosan, adsorben