PENGEMBANGAN ADSORBEN *MOLECULAR IMPRINTED POLYMER* BERBASIS APTES/TEOS UNTUK ADSORPSI P-CHLOROANILINE PADA LIMBAH CAIR

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diajukan untuk memenuhi Sebagian syarat memperoleh gelar Sarjana Sains

Program Studi Kimia

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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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Menyatakan bahwa skripsi yang berjudul "**PENGEMBANGAN ADSORBEN *MOLECULAR IMPRINTED POLYMER* BERBASIS APTES/TEOS UNTUK ADSORPSI P-CHLOROANILINE PADA LIMBAH CAIR**" ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu pengetahuan yang berlaku di masyarakat. Atas pernyataan ini, saya siap menanggung risiko/sanksi apabila dikemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

Bandung, Agustus 2025

Yang Menyatakan,

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ABSTRAK

P-Chloroaniline (PCA) merupakan senyawa karsinogen yang berasal dari zat warna pada proses industri tekstil, dimana keberadaannya di lingkungan berpotensi menyebabkan Methemoglobinemia pada manusia. *Molecularly Imprinted Polymer* (MIP) menjadi solusi alternatif sebagai adsorben untuk mendeteksi PCA secara spesifik. Penelitian ini bertujuan untuk mensintesis MIP-PCA menggunakan metode polimerisasi sol-gel, mengetahui karakteristik MIP-PCA hasil sintesis, dan kinerjanya sebagai adsorben yang selektif dan spesifik terhadap PCA. MIP-PCA hasil sintesis dikarakterisasi menggunakan FTIR, SEM-EDX, dan BET. Pengujian kinerja MIP-PCA sebagai adsorben dalam proses adsorpsi PCA dilakukan dengan variasi dosis adsorben, kecepatan pengadukan, dan waktu kontak. MIP-PCA berhasil disintesis dengan metode polimerisasi sol gel secara *one-pot* dengan rasio komposisi PCA:APTES:TEOS yaitu 1:4:20, dimana proses *leaching* dilakukan menggunakan metode sonikasi sebanyak 7 kali pengulangan berhasil menghilangkan PCA dalam struktur MIP sebanyak 99.986%. Keberhasilan sintesis MIP-PCA dikonfirmasi oleh spektra IR melalui kemunculan puncak khas C-Cl pada bilangan gelombang 690 cm^{-1} dan hasil SEM melalui morfologi MIP-PCA berbentuk *spherical* dengan ukuran partikel 146 nm. Adsorpsi PCA oleh MIP dalam kondisi optimum (dosis MIP 200 mg, kecepatan pengadukan 60 rpm, dan waktu kontak 60 menit) mengikuti model isoterm Langmuir, menunjukkan kapasitas maksimum adsorpsi sebesar 215 mg/g. Nilai faktor *imprinting* MIP terhadap PCA dan toluena berturut turut 0.972 dan 0.539, dengan nilai koefisien selektifitas 1.803, menunjukkan bahwa MIP memiliki selektivitas tinggi terhadap PCA dibandingkan senyawa lain. MIP-PCA memiliki kapasitas adsorpsi 14 kali lebih besar dibandingkan dengan adsorben komersial *Hydrophilic-Lypophilic Balanced* (HLB). Temuan ini menunjukkan MIP potensial sebagai adsorben selektif dan spesifik.

Kata kunci: p-Chloroaniline, MIP, Adsorpsi, Sintesis, Adsorben

ABSTRACT

P-Chloroaniline (PCA) is a carcinogenic compound derived from dyes in the textile industry, and its presence in the environment has the potential to cause methemoglobinemia in humans. *Molecularly Imprinted Polymer* (MIP) is an alternative solution as an adsorbent to specifically detect PCA. This study aims to synthesize MIP-PCA using the sol-gel polymerization method, determine the characteristics of the synthesized MIP-PCA, and determine its performance as a selective and specific adsorbent against PCA. The synthesized MIP-PCA was characterized using FTIR, SEM-EDX, and BET. Testing the performance of MIP-PCA as an adsorbent in the PCA adsorption process was carried out by varying the adsorbent dosage, stirring speed, and contact time. MIP-PCA was successfully synthesized by one-pot sol gel polymerization method with a composition ratio of PCA:APTES:TEOS of 1:4:20, where the *leaching* process was carried out using the sonication method for 7 repetitions successfully removing PCA in the MIP structure by 99.986%. The success of MIP-PCA synthesis was confirmed by the IR spectra through the appearance of a typical C-Cl peak at a wave number of 690 cm^{-1} and SEM results through the spherical morphology of MIP-PCA with a particle size of 146 nm. The adsorption of PCA by MIP under optimum conditions (MIP dose of 200 mg, stirring speed of 60 rpm, and contact time of 60 minutes) followed the Langmuir isotherm model, showing a maximum adsorption capacity of 215 mg/g. The imprinting factor values of MIP against PCA and toluene were 0.972 and 0.539, respectively, with a selectivity coefficient value of 1.803, indicating that MIP has high selectivity towards PCA compared to other compounds. MIP-PCA has a 14-fold higher adsorption capacity compared to commercial Hydrophilic-Lypophilic Balanced (HLB) adsorbents. This finding demonstrates MIP's potential as a selective and specific adsorbent.

Keywords: p-Chloroaniline, MIP, Adsorption, Synthesize, Adsorbent

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