

STUDI ADSORPSI KRISTAL VIOLET PADA ADSORBEN SELULOSA DARI LIMBAH DAUN NANAS TERMODIFIKASI POLIETILENIMINA TERTAUT SILANG GLUTARALDEHIDA

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INTISARI

Adsorpsi zat warna kristal violet menggunakan adsorben selulosa-polietilenimina tertaut silang glutaraldehida telah dilakukan. Penelitian ini bertujuan untuk melakukan sintesis adsorben dengan selulosa, yang berasal dari daun nanas dan polietilenimina tertaut silang glutaraldehida (SEL-GTA-PEI). Adsorben yang telah disintesis digunakan untuk menentukan pH optimum, model isotherm, dan kinetika adsorpsi dari adsorpsi kristal violet. Selulosa diisolasi dari daun nanas melalui proses hidrolisis, delignifikasi, dan pemutihan kemudian disintesis dengan menautsilangkan selulosa dengan polietilenimina menggunakan agen penaut silang glutaraldehida sehingga terbentuk adsorben SEL-GTA-PEI. Adsorben hasil sintesis dikarakterisasi menggunakan FT-IR, SEM-EDX, dan XRD. Kajian adsorpsi kristal violet oleh adsorben SEL-GTA-PEI dilakukan melalui variasi pH, konsentrasi larutan zat warna, dan waktu kontak adsorpsi. Adsorben SEL-GTA-PEI yang telah digunakan untuk adsorpsi (ADS-KV) diuji kemampuan desorpsinya dengan menggunakan akuades, HCl 0,1 M, NaOH 0,1 M, KNO₃ 0,1M, NH₃OHCl 0,1 M, Na₂EDTA 0,1 M, dan etanol 60%.

Uji kestabilan SEL-GTA-PEI menunjukkan adsorben SEL-GTA-PEI bersifat stabil dalam variasi pH 2-12. Adsorpsi kristal violet menggunakan adsorben SEL-GTA-PEI berlangsung optimum pada pH 6. Model isotherm adsorpsi mengikuti model isotherm adsorpsi Freundlich dengan nilai $1/n$ dan K_F sebesar 0,681 dan 6,697 L mol⁻¹. Model kinetika adsorpsi kristal violet oleh adsorben SEL-GTA-PEI mengikuti model kinetika adsorpsi Ho dan McKay dengan nilai konstanta laju adsorpsi sebesar $6,2 \times 10^{-4}$ g mg⁻¹menit⁻¹. Persen desorpsi paling tinggi terjadi pada desorpsi dengan pelarut NH₃OHCl. Hasil yang dilaporkan mengungkapkan bahwa adsorben SEL-GTA-PEI dapat digunakan sebagai adsorben untuk mengadsorpsi kristal violet.

Kata kunci: adsorpsi, glutaraldehida, kristal violet, polietilenimina, selulosa.

**STUDY OF ADSORPTION CRYSTAL VIOLET DYE ON ON
CELLULOSE ADSORBENT FROM PINEAPPLE LEAF WASTE
MODIFIED WITH POLYETHYLENIMINE CROSSLINKED WITH
GLUTARALDEHYDE**

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ABSTRACT

Adsorption of crystal violet dye using cellulose-polyethyleneimine crosslinked with glutaraldehyde adsorbent has been carried out. This research aims to synthesize cellulose adsorbent derived from pineapple leaves with cross-linked polyethyleneimine using glutaraldehyde (SEL-GTA-PEI). The synthesized adsorbent was utilized to identify the optimum pH, isotherm model, and adsorption kinetics of crystal violet adsorption. Cellulose is isolated from pineapple leaves through hydrolysis, delignification and bleaching processes. The isolated cellulose was then cross-linked with polyethyleneimine with glutaraldehyde, as a cross-linking agent, to generate the SEL-GTA-PEI adsorbent. The synthesized adsorbent was characterized using FT-IR, SEM-EDX, and XRD. The study of crystal violet adsorption by the SEL-GTA-PEI adsorbent was carried out by varying pH, dye solution concentration, and adsorption contact time. The SEL-GTA-PEI adsorbent that was used for adsorption (ADS-KV) was tested for its desorption ability using distilled water, HCl 0.1 M, NaOH 0.1 M, KNO₃ 0.1M, NH₃OHCl 0.1 M, Na₂EDTA 0.1 M, and 60% ethanol

The SEL-GTA-PEI stability test shows that synthesized adsorbent is stable throughout pH ranges 2-12. Adsorption of crystal violet using the SEL-GTA-PEI adsorbent was most effective at pH 6. The adsorption isotherm model followed the Freundlich adsorption isotherm model with a value of $1/n$ and K_F of 0.681 and 6.697 L mol⁻¹. The adsorption kinetic model for crystal violet by the SEL-GTA-PEI adsorbent is based on the Ho and McKay adsorption kinetic model with an adsorption rate constant value of 6.2×10^{-4} g mg⁻¹ minute⁻¹. The highest desorption percentage occurred in desorption with NH₃OHCl solvent. The reported results suggest that the SEL-GTA-PEI adsorbent can be used as an adsorbent to degrade crystal violet

Keywords: adsorption, cellulose, crystal violet, glutaraldehyde, polyethyleneimine.