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Adsorpsi Zat Warna Anionik Remazol Brilliant Violet 5R Menggunakan Beads Kitosan Termodifikasi Epoxypropyltrimethylammonium Chloride (EPTAC)
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ADSORPSI ZAT WARNA ANIONIK REMAZOL BRILLIANT VIOLET 5R MENGGUNAKAN *BEADS* KITOSAN TERMODIFIKASI *EPOXYPROPYLTRIMETHYLAMMONIUM CHLORIDE* (EPTAC)

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INTISARI

Penelitian ini bertujuan untuk menyiapkan dan mengkarakterisasi *beads* kitosan termodifikasi *epoxypropyltrimethylammonium chloride* (EPTAC) serta mengevaluasi kemampuannya dalam mengadsorpsi zat warna anionik *Remazol Brilliant Violet 5R* (RBV-5R). Pengaruh pH larutan, massa adsorben, waktu kontak, dan konsentrasi awal RBV-5R dipelajari untuk menentukan kondisi adsorpsi. Kinetika dan isoterm adsorpsi juga dianalisis untuk memahami mekanisme interaksi antara adsorben dan molekul zat warna RBV-5R.

Modifikasi dilakukan dengan mereaksikan *beads* kitosan dengan *3-chloro-2-hydroxypropyl trimethyl ammonium chloride* (CHPTAC) dalam suasana basa. Pada kondisi ini, CHPTAC membentuk EPTAC yang bereaksi dengan kitosan. *Beads* hasil modifikasi dikeringkan dan dikarakterisasi menggunakan FTIR serta SEM-EDX. Percobaan adsorpsi dilakukan dengan memvariasikan pH, massa adsorben, waktu kontak, dan konsentrasi awal RBV-5R. Data yang diperoleh dari variasi waktu kontak digunakan untuk menentukan model kinetika adsorpsi, sedangkan variasi konsentrasi awal RBV-5R digunakan untuk menentukan model isoterm adsorpsi. Analisis kinetika dilakukan menggunakan model orde satu, orde dua, orde satu semu, dan orde dua semu. Sementara itu, data isoterm adsorpsi dianalisis menggunakan model isoterm Langmuir dan Freundlich.

Beads kitosan termodifikasi EPTAC yang mengalami pengikatan silang menunjukkan kapasitas adsorpsi lebih tinggi dibandingkan *beads* kitosan tanpa modifikasi. Kapasitas adsorpsi sebesar 87,94 mg g^{-1} diperoleh pada pH 2, massa adsorben 50 mg, waktu kontak 120 menit, dan konsentrasi awal RBV-5R 500 mg L^{-1}. Data kinetika paling sesuai dengan model orde dua semu, dengan konstanta laju 1,52 $\times 10^{-3}$ g mg^{-1} $menit^{-1}$, sedangkan data isoterm paling sesuai dengan model Langmuir. Hasil ini menunjukkan potensi *beads* kitosan termodifikasi EPTAC sebagai adsorben RBV-5R.

Kata kunci: adsorpsi; *beads* kitosan; *remazol brilliant violet 5R*; zat warna anionik

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ADSORPTION OF THE ANIONIC DYE REMAZOL BRILLIANT VIOLET 5R USING EPOXYPROPYLTRIMETHYLAMMONIUM CHLORIDE (EPTAC)-MODIFIED CHITOSAN BEADS

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ABSTRACT

This study aim to prepared and characterized epoxypropyltrimethylammonium chloride (EPTAC)-modified chitosan beads and evaluated their ability to adsorb the anionic dye Remazol Brilliant Violet 5R (RBV-5R). The effects of solution pH, adsorbent mass, contact time, and initial RBV-5R concentration were studied to determine the adsorption conditions. Adsorption kinetics and isotherms were also analyzed to understand the interaction mechanism between the adsorbent and RBV-5R dye molecules.

The beads were modified by reacting chitosan with 3-chloro-2-hydroxypropyl trimethyl ammonium chloride (CHPTAC) under alkaline conditions, which generated EPTAC *in situ*. The resulting beads were dried and characterized using FTIR and SEM-EDX. Adsorption experiments were carried out by varying pH, adsorbent mass, contact time, and initial RBV-5R concentration. Data obtained from contact time variations were used to determine the adsorption kinetic model, while variations in the initial RBV-5R concentration were used to determine the adsorption isotherm model. Kinetic analysis was carried out using the first-order, second-order, pseudo-first-order, and pseudo-second-order models. Meanwhile, adsorption isotherm data were analyzed using the Langmuir and Freundlich isotherm models.

The modified, crosslinked beads exhibited a higher adsorption capacity than unmodified chitosan beads. An adsorption capacity of 87.94 mg g^{-1} was obtained at pH 2 with an adsorbent mass of 50 mg, a contact time of 120 min, and an initial RBV-5R concentration of 500 mg L^{-1}. The kinetic data were best described by the pseudo-second-order model, with a rate constant of 1.52×10^{-3} g mg^{-1} min^{-1}, while the isotherm data were best described by the Langmuir model. These findings indicate the potential of EPTAC-modified chitosan beads for RBV-5R adsorption.

Keywords: adsorption; anionic dye; chitosan beads; remazol brilliant violet 5R