

MODIFIKASI SELULOSA SERAT KAPUK DENGAN CHPTAC SEBAGAI ADSORBEN ZAT WARNA ANIONIK REMAZOL BRILLIANT BLUE R

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INTISARI

Penelitian ini mengkaji proses adsorpsi zat warna Remazol Brilliant Blue R (RBBR) menggunakan serat kapuk yang dimodifikasi dengan senyawa CHPTAC. Tujuan dari studi ini adalah untuk mensintesis adsorben berbahan dasar serat kapuk termodifikasi CHPTAC, menentukan kondisi optimum adsorpsi RBBR, serta mempelajari kinetika dan model isoterm dari proses adsorpsinya. Tahapan awal penelitian melibatkan penghilangan lignin dari serat kapuk murni melalui pemanasan dalam larutan natrium klorit (NaClO_2) dan asam asetat (CH_3COOH) untuk melarutkan lignin tanpa merusak struktur selulosa. Selanjutnya, serat kapuk dimodifikasi melalui reaksi kationisasi menggunakan CHPTAC dengan bantuan basa NaOH . Studi adsorpsi dilakukan dengan memvariasikan pH, massa adsorben, waktu kontak, dan konsentrasi awal RBBR. Adsorpsi dilakukan pada kondisi optimum, kemudian karakterisasi serat kapuk murni (SKM), serat kapuk pra-perlakuan (SKD), dan serat kapuk termodifikasi CHPTAC (SKT-CHPTAC) dilakukan menggunakan FTIR dan SEM-EDX.

Hasil penelitian menunjukkan bahwa sintesis adsorben SKT-CHPTAC berhasil dilakukan. Hal ini dibuktikan dengan hilangnya serapan karakteristik gugus karbonil ester pada FTIR yang terdapat pada serat kapuk murni, yaitu pada bilangan gelombang 2337 dan 1728 cm^{-1} (untuk gugus C=O) serta 1249 cm^{-1} (untuk gugus C-O), yang tidak lagi terdeteksi pada serat kapuk termodifikasi. Adsorpsi RBBR berlangsung paling efektif pada pH 4, massa adsorben $0,030 \text{ g}$, waktu kontak 90 menit, dan konsentrasi awal RBBR 200 mg L^{-1} . Proses adsorpsi mengikuti model kinetika orde kedua semu dengan konstanta laju $1,04 \times 10^{-2} \text{ g mg}^{-1} \text{ menit}^{-1}$ serta model isoterm Langmuir dengan kapasitas adsorpsi maksimum $153,85 \text{ mg g}^{-1}$.

Kata kunci: adsorpsi, Remazol Brilliant Blue R, serat kapuk, CHPTAC

***MODIFICATION OF KAPOK FIBER CELLULOSE WITH CHPTAC AS
REMAZOL BRILLIANT BLUE R ANIONIC DYES ADSORBENT***

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ABSTRACT

This study investigates the adsorption process of the dye Remazol Brilliant Blue R (RBBR) using kapok fiber modified with CHPTAC. The objectives of this research are to synthesize an adsorbent based on CHPTAC-modified kapok fiber, determine the optimum conditions for RBBR adsorption, and study the kinetics and isotherm models of the adsorption process. The initial stage of the study involved removing lignin from raw kapok fiber by heating it in a solution of sodium chlorite (NaClO_2) and acetic acid (CH_3COOH), which dissolved the lignin without damaging the cellulose structure. Subsequently, the kapok fiber was modified through a cationization reaction using CHPTAC, assisted by NaOH as a base. The adsorption study was conducted by varying pH, adsorbent mass, contact time, and initial RBBR concentration. Adsorption was carried out under optimum conditions, followed by characterization of raw kapok fiber (SKM), pre-treated kapok fiber (SKD), and CHPTAC-modified kapok fiber (SKT-CHPTAC) using FTIR and SEM-EDX.

The results showed that the synthesis of the SKT-CHPTAC adsorbent was successfully achieved. This was evidenced by the disappearance of characteristic ester carbonyl group absorptions in the FTIR spectrum of raw kapok fiber, which appeared at wave numbers 2337 and 1728 cm^{-1} (for the C=O group) and 1249 cm^{-1} (for the C-O group), but was no longer detected in the modified kapok fiber. RBBR adsorption was most effective at pH 4, with an adsorbent mass of 0.030 g , a contact time of 90 minutes, and an initial RBBR concentration of 200 mg L^{-1} . The adsorption process followed a pseudo-second-order kinetic model, with a rate constant of $1,04 \times 10^{-2}\text{ g mg}^{-1}\text{ min}^{-1}$, and was fitted to the Langmuir isotherm model, yielding a maximum adsorption capacity of 153.85 mg g^{-1} .

Keywords: adsorption, Remazol Brilliant Blue R, CHPTAC, kapok fiber