

## KATIONISASI SELULOSA BERSUMBER SERAT KAPUK DENGAN CHPTAC DAN APLIKASINYA SEBAGAI ADSORBEN ZAT WARNA REMAZOL BRILLIANT VIOLET 5R

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### INTISARI

Telah dilakukan penelitian mengenai kationisasi selulosa bersumber serat kapuk dengan *CHPTAC* dan aplikasinya sebagai adsorben zat warna *Remazol Brilliant Violet 5R* telah dilakukan. Penelitian ini bertujuan untuk mengkaji proses modifikasi serta hasil karakterisasi dari kationisasi selulosa dengan *CHPTAC* untuk pemanfaatan sebagai adsorben. Optimalisasi kondisi adsorpsi, pengkajian kinetika dan isoterm adsorpsi, serta optimalisasi kondisi desorpsi zat warna *Remazol Brilliant Violet 5R* dengan selulosa hasil modifikasi juga telah dilakukan dalam penelitian ini.

Penelitian ini diawali dengan delignifikasi serat kapuk dengan natrium klorit ( $\text{NaClO}_2$ ) dan modifikasi hasil delignifikasi dengan *CHPTAC* atau *3-chloro-2-hydroxypropyltrimethylammonium chloride* ( $\text{C}_6\text{H}_{15}\text{Cl}_2\text{NO}$ ). Hasil delignifikasi dan modifikasi dikarakterisasi dengan *Fourier Transform Infrared Spectroscopy* (*FTIR*) dan *Scanning Electron Microscope-Energy Dispersive X-Ray* (*SEM-EDX*). Serat kapuk terkationisasi *CHPTAC* digunakan sebagai adsorben zat warna *Remazol Brilliant Violet 5R* dan proses adsorpsinya dioptimalisasi pada berbagai faktor, yaitu pH adsorbat, massa adsorben, waktu kontak, dan konsentrasi awal adsorbat. Adsorben hasil adsorpsi pada kondisi optimum dikaji kemampuan desorpsinya pada variasi pelarut dan waktu kontak.

Hasil penelitian menunjukkan bahwa kapuk mengalami *mass loss* setelah proses delignifikasi yang berkisar antara 11,2% hingga 17,0% yang menandakan hilangnya kandungan lignin yang ada dan menghasilkan kapuk berwarna putih. Modifikasi kapuk menghasilkan kemampuan adsorpsi yang baik dengan kapasitas maksimum sebesar  $97,3 \text{ mg g}^{-1}$  pada pH 4, dengan adsorben 0,05 gram selama waktu 30 menit dengan konsentrasi awal adsorbat  $400 \text{ mg L}^{-1}$ . Adsorpsi pada penelitian ini mengikuti kinetika adsorpsi orde 2 semu dan isoterm menurut *Langmuir*. Persen desorpsi maksimum yang diperoleh pada penelitian ini sebesar 94,8% dengan pelarut  $\text{NaSCN}$  1 M selama 120 menit.

**Kata kunci:** adsorpsi, anionik, kapuk, kationik, selulosa

## CATIONIZATION OF CELLULOSE FROM KAPOK FIBERS USING CHPTAC AND ITS APPLICATION AS AN ADSORBENT FOR REMAZOL BRILLIANT VIOLET 5R DYE

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### ABSTRACT

A study on the cationization of cellulose derived from kapok fibers using CHPTAC and its application as an adsorbent for Remazol Brilliant Violet 5R dye has been conducted. This research aimed to investigate the modification process and characterize the cationization of cellulose with CHPTAC for its utilization as an adsorbent. The optimization of adsorption conditions, analysis of adsorption kinetics and isotherms, as well as the optimization of desorption conditions for Remazol Brilliant Violet 5R dye using modified cellulose were also performed in this study.

The research started with the delignification of raw kapok fibers using sodium chlorite ( $\text{NaClO}_2$ ), followed by the modification of the treated fibers with CHPTAC (3-chloro-2-hydroxypropyltrimethylammonium chloride,  $\text{C}_6\text{H}_{15}\text{Cl}_2\text{NO}$ ). The treated and modified fibers were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscope-Energy Dispersive X-Ray (SEM-EDX). The CHPTAC-cationized kapok fibers were utilized as adsorbents for Remazol Brilliant Violet 5R dye, and the adsorption process was optimized by varying factors such as adsorbate pH, adsorbent mass, contact time, and initial adsorbate concentration. The desorption ability of the adsorbents after adsorption under optimum conditions was also evaluated under variations of solvent and contact time.

The results showed that the kapok fibers showed a mass reduction ranging from 11.2% to 17.0% after delignification, indicating lignin removal and yielding white kapok fibers. The modification of kapok fibers resulted in excellent adsorption performance, with a maximum adsorption capacity of  $97.3 \text{ mg g}^{-1}$  at pH 4, using 0.05 grams of adsorbent for 30 minutes with an initial adsorbate concentration of  $400 \text{ mg L}^{-1}$ . The adsorption in this study followed pseudo-second-order kinetics and fitted the Langmuir isotherm model. The maximum desorption percentage achieved was 94.8% using 1 M NaSCN solvent for 120 minutes.

**Keywords:** adsorption, anionic, cationic, cellulose, kapok