# ABSTRAK

## FUNGSIONALISASI KARBON TERMODIFIKASI MAGNETIT ($Fe_3O_4$) DAN SILAN (*Triethoxyphenylsilane*) DARI CANGKANG BUAH KARET (*Hevea brasiliensis*) SEBAGAI ADSORBEN ZAT WARNA *CRYSTAL VIOLET* DAN HERBISIDA *PARAQUAT*

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Pada penelitian ini telah dilakukan modifikasi karbon yang terbuat dari cangkang buah karet melalui pelapisan magnetit dan silanisasi menggunakan *triethoxyphenylsilane* (TEPS). Karbon magnetit (KM), karbon silan (KS) dan karbon magnetit silan (KMS) yang diperoleh dari proses modifikasi digunakan untuk menghilangkan zat warna *crystal violet* (CV) dan herbisida *paraquat* (PQ). Karakterisasi KM, KS, dan KMS menggunakan spektroskopi *fourier transform infrared* (FTIR), *X-ray diffraction* (XRD) dan *scanning electron microscopy-energy dispersive X-ray* (SEM-EDX) menunjukkan bahwa karbon berhasil dimodifikasi oleh magnetit dan TEPS. Beberapa parameter yang berpengaruh terhadap proses adsorpsi diujikan dan didapatkan hasil optimum antara lain dosis adsorben 0,1 g, pH 10, dan waktu kontak 15 menit pada CV. Hasil optimum yang diperoleh pada PQ antara lain dosis adsorben 0,2 g, pH 9, dan waktu kontak 120 menit. Hasil kapasitas adsorpsi tertinggi yang diperoleh pada KM, KS dan KMS terhadap CV dan PQ masing-masing adalah 47,01, 54,63 dan 55,06 mg/g serta 24,37, 24,33 dan 24,39 mg/g. Kinetika adsorpsi terhadap CV dan PQ cenderung mengikuti kinetika pseudo orde dua. Isoterm adsorpsi zat warna CV cenderung mengikuti pola isoterm Freundlich dimana menunjukkan bahwa proses adsorpsi yang terjadi bersifat *multilayer*. Isoterm adsorpsi PQ cenderung mengikuti pola isoterm Langmuir yang menunjukkan bahwa proses adsorpsi yang terjadi bersifat *monolayer*. Mekanisme KMS terhadap CV didominasi oleh interaksi fisika dan pertukaran ion, sedangkan terhadap PQ didominasi oleh ikatan kovalen koordinasi dan ikatan hidrogen. Penggunaan ulang adsorben KMS terhadap CV dan PQ cukup efektif sebanyak 3 kali pengulangan dengan % adsorpsi ≥70%.

Kata kunci : Adsorpsi, kristal violet, *paraquat*, karbon magnetit silan, cangkang buah karet

## ABSTRACT

## FUNCTIONALIZATION OF CARBON MODIFIED WITH MAGNETITE ($Fe_3O_4$) AND SILAN (Triethoxyphenylsilane) FROM RUBBER FRUIT SHELL (*Hevea brasiliensis*) AS ADSORBENT OF CRYSTAL VIOLET AND PARAQUAT HERBICIDE

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In this study, carbon modification from rubber fruit shells was carried out through magnetite coating and silanization using triethoxyphenylsilane (TEPS). Carbon magnetite (KM), carbon silane (KS), and carbon magnetite silane (KMS) obtained from the modification process were used to remove crystal violet dye (CV) and paraquat herbicide (PQ). Characterization of KM, KS, and KMS using fourier transform infrared (FTIR), X-ray diffraction (XRD) spectroscopy and scanning electron microscopy-energy dispersive X-ray (SEM-EDX) showed that carbon was successfully controlled by magnetite and TEPS. Several parameters that affect the adsorption process were tested and the optimum results were obtained, including the adsorbent dose of 0.1 g, pH 10, and a contact time of 15 minutes at CV. The optimum results obtained at PQ include an adsorbent dose of 0.2 g, pH 9, and a contact time of 120 minutes. The results of the highest adsorption capacity obtained on KM, KS, and KMS on CV and PQ were 47.01, 54.63, and 55.06 mg/g and 24.37, 24.33, and 24.39 mg/g, respectively. Adsorption kinetics with respect to CV and PQ tend to follow pseudo second order kinetics. The CV dye adsorption isotherm tends to follow the Freundlich isotherm pattern which indicates that the adsorption process that occurs is multilayer. The PQ adsorption isotherm tends to follow the Langmuir isotherm pattern which indicates that the adsorption process that occurs is monolayer. The mechanism of KMS to CV is dominated by physical interactions and ion exchange, while to PQ is dominated by covalent coordination bonds and hydrogen bonds. The reuse of KMS adsorbent on CV and PQ was quite effective for 3 repetitions with % adsorption ≥ 70%.



Key words: Adsorption, crystal violet, paraquat, carbon magnetite silane, rubber fruit shell