

ABSTRAK

Perkembangan industri memberikan dampak negatif bagi lingkungan, salah satunya masalah limbah industri yang mengandung zat warna. Zat warna *malachite green* banyak dimanfaatkan terutama di industri tekstil. Limbah zat warna *malachite green* berbahaya jika masuk ke perairan. Oleh karena itu, keberadaan zat warna dalam limbah industri harus ditangani secara tepat agar tidak membahayakan lingkungan. Salah satu metode yang dapat digunakan pada proses pengolahan limbah zat warna adalah metode adsorpsi. Tujuan penelitian ini adalah untuk mengetahui karakteristik N-metil kitosan magnetik, kinetika adsorpsi, isoterm adsorpsi, serta kemampuan *reuseability*. Sintesis N-metil kitosan magnetik dilakukan dengan menginteraksikan hasil dari sintesis N-metil kitosan dengan Fe_3O_4 yang divariasikan mol perbandingan mol $\text{Fe}^{2+}/\text{Fe}^{3+}$ yaitu (1:2) dan (1:3). Senyawa NMK-M yang dihasilkan berupa padatan berwarna hitam. Senyawa NMK-M kemudian dikarakterisasi dengan instrumen FTIR dan dilakukan studi adsorpsi terhadap *malachite green* dengan Spektrofotometer UV-Vis. Analisis spektrum IR pada NMK-M1 dan NMK-M2 menunjukkan adanya serapan pada bilangan gelombang disekitar 3411 dan 1661 cm^{-1} yang menunjukkan adanya gugus -OH dan -NH serta serapan eter atau vibrasi ulur C-O pada bilangan gelombang 1064 cm^{-1} . Selain itu, terdapat serapan pada bilangan gelombang disekitar 567 cm^{-1} yang merupakan serapan Fe-O. Analisis XRD bahwa hasil sintesis Fe_3O_4 menunjukkan terbentuknya nanopartikel dengan struktur kubik. Berdasarkan penelitian diperoleh panjang gelombang maksimum *malachite green* sebesar 618nm dengan kondisi adsorpsi optimum pada pH 5 dan waktu kontak 30 menit. Adsorpsi zat warna *malachite green* oleh N-metil kitosan magnetik mengikuti persamaan isoterm Langmuir dengan kapasitas adsorpsi optimum berturut-turut sebesar 10,060 dan 3,621 mg/g. Selain itu, dilakukan pengujian pemakaian berulang sebanyak empat kali pengulangan dan memberikan hasil desorpsi pada rentang 8-6%.

Kata kunci: adsorpsi, Fe_3O_4 , kinetika, *malachite green*, N-metil kitosan magnetik

ABSTRACT

Industrial development has a negative impact on the environment, one of which is the problem of industrial waste containing dyes. Malachite green dye is widely used, especially in the textile industry. However, malachite green dye waste is dangerous if it enters the waters. Therefore, the presence of dyes in industrial waste must be handled properly so as not to harm the environment. One method that can be used in the dye waste treatment process is the adsorption method. The purpose of this study was to determine the characteristics of magnetic N-methyl chitosan, adsorption kinetics, adsorption isotherms, and reuseability. Synthesis of magnetic N-methyl chitosan was carried out by interacting the results of the synthesis of N-methyl chitosan with Fe_3O_4 with various mole ratios of Fe^{2+}/Fe^{3+} (1:2) and (1:3). The NMK-M compound produced is a black solid. The NMK-M compound was then characterized by an FTIR instrument and an adsorption study of malachite green was carried out with a UV-Vis Spectrophotometer. IR spectrum analysis on NMK-M1 and NMK-M2 showed absorption at wave numbers around 3411 and 1661 cm^{-1} which indicated the presence of -OH and -NH groups as well as ether absorption or C-O stretching vibration at wave number 1064 cm^{-1} . In addition, there is absorption at wave numbers around 567 cm^{-1} which is Fe-O absorption. XRD analysis showed that the results of the Fe_3O_4 synthesis showed the formation of nanoparticles with a cubic structure. Based on the research, the maximum wavelength of malachite green was 618nm with optimum adsorption conditions at pH 5 and a contact time of 30 minutes. The adsorption of malachite green dye by magnetic N-methyl chitosan followed the Langmuir isotherm equation with the optimum adsorption capacity of 10.060 and 3.621 mg/g, respectively. In addition, repeated use tests were carried out four times and gave desorption results in the range of 8-6%.

Keywords: adsorption, Fe_3O_4 , kinetics, malachite green, N-methyl chitosan magnetic