

ABSTRAK

Pengolahan limbah zat warna tartrazin perlu dilakukan karena zat warna tartrazin dapat mencemari lingkungan serta memiliki dampak buruk bagi kesehatan makhluk hidup. Salah satu metode pengolahan limbah zat warna adalah adsorpsi. Hidrotalsit merupakan salah satu material yang cukup umum digunakan sebagai adsorben yang memiliki efektifitas baik dalam mengadsorpsi zat warna sintetik. Struktur hidrotalsit yang dimodifikasi dengan suatu interkalan mampu meningkatkan kapasitas adsorpsinya. Penelitian ini bertujuan menjelaskan adsorpsi zat warna tartrazin menggunakan hidrotalsit Ni/Al terinterkalasi polioksometalat $K_4[SiW_{12}O_{40}]$ dengan beberapa parameter uji yang meliputi pH, waktu kontak, dan konsentrasi adsorbat. Selain itu dipelajari juga model kinetika dan isoterm adsorpsinya. Sintesis hidrotalsit dilakukan menggunakan metode kopresipitasi yang dilanjutkan dengan proses hidrotermal pada suhu $100^{\circ}C$ selama 15 jam pada rasio 3:1 (Ni:Al) menghasilkan Ni/Al- NO_3 . Interkalasi senyawa polioksometalat $K_4[SiW_{12}O_{40}]$ terhadap Ni/Al- NO_3 dilakukan dengan metode pertukaran ion pada rasio 1:1 menghasilkan Ni/Al- $[\alpha-SiW_{12}O_{40}]$. Hasil sintesis dikarakterisasi menggunakan *Fourier Transform Infra Red* (FTIR), *X-Ray Diffraction* (XRD), dan *Scanning Electron Microscopy - Energy Dispersive X-Ray Spectroscopy* (SEM-EDX). Kondisi optimum adsorpsi tartrazin oleh hidrotalsit Ni/Al- $[\alpha-SiW_{12}O_{40}]$ diperoleh pada pH 3, waktu kontak 90 menit, serta konsentrasi adsorbat 10 mg/L. Kinetika adsorpsi yang dihasilkan mengikuti model kinetika pseudo orde dua dengan nilai R^2 sebesar 0,9997; konstanta laju adsorpsi sebesar 0,9368 g/mg.menit; dan nilai q_e sebesar 22,0264 mg/g. Isoterm adsorpsi yang dihasilkan mengikuti model Isoterm Langmuir dengan nilai R^2 sebesar 0,9974; K_L sebesar 3,4758 L/mg; dan Q_{maks} sebesar 68,4931 mg/g.

Kata kunci: adsorpsi, hidrotalsit Ni/Al- NO_3 , isoterm, kinetika, polioksometalat, tartrazin

ABSTRACT

The treatment of tartrazine dye waste is necessary because tartrazine can cause harms for the environment as well as to the living organisms. One of the methods of the tartrazine dye treatment is through adsorption process. Hydrotalcite material is commonly used as an adsorbent of synthetic dye due to its effectiveness in adsorption process. The structure of hydrotalcite modified with an intercalant can enhance its adsorption capacity. This study aims to investigate the adsorption of tartrazine dye using Ni/Al hydrotalcite intercalated with polyoxometalate $K_4[SiW_{12}O_{40}]$, with experimental parameters including pH, contact time, and adsorbate concentration. Additionally, the kinetic model and adsorption isotherm are studied. The synthesis of hydrotalcite pristine was performed using the coprecipitation method followed by a hydrothermal process at 100°C for 15 hours with a 3:1 (Ni:Al) ratio, yielding Ni/Al- NO_3 . The intercalation of the polyoxometalate compound $K_4[SiW_{12}O_{40}]$ and Ni/Al- NO_3 was performed using the ion exchange method at a 1:1 ratio, resulting in Ni/Al- $[\alpha\text{-SiW}_{12}\text{O}_{40}]$. The synthesis results were characterized using Fourier Transform Infrared (FTIR), X-Ray Diffraction (XRD), and Scanning Electron Microscopy - Energy Dispersive X-Ray Spectroscopy (SEM-EDX). The optimal conditions for tartrazine adsorption by Ni/Al- $[\alpha\text{-SiW}_{12}\text{O}_{40}]$ hydrotalcite were obtained at pH 3, contact time of 90 minutes, and adsorbate concentration of 10 mg/L. The adsorption kinetics followed the pseudo-second-order kinetic model with an R^2 value of 0.9997; an adsorption rate constant of 0.9368 g/mg·min; and a q_e value of 22.0264 mg/g. The adsorption isotherm followed the Langmuir isotherm model with an R^2 value of 0.9974; a KL value of 3.4758 L/mg; and a Q_{max} value of 68.4931 mg/g.

Keywords: adsorption, Hydrotalcite Ni/Al- NO_3 , Isotherm, Kinetic, Polyoxometalate, Tartrazine