Nanokomposit CdO-ZnFe2O4/Al2O3 untuk Fotokatalisis Methylene Blue Menggunakan Optimasi Response Surface Methodology (RSM) = CdO-ZnFe2O4/Al2O3 Nanocomposite for Methylene Blue Photocatalysis Using Response Surface Methodology (RSM) Optimization

Elsie Liestiani, author

Abstrak

Pencemaran air yang disebabkan oleh pewarna methylene blue (MB) yang mengandung senyawa azo bersifat karsinogenik yang berbahaya bagi makhluk hidup. Berbagai upaya dilakukan untuk mengembangkan teknologi yang efektif untuk menghilangkan pewarna MB dari lingkungan air, seperti fotokatalisis. Penelitian ini berhasil mensintesis nanokomposit CdO-ZnFe2O4/Al2O3 dengan Al2O3 sebagai support katalis. Nanopartikel CdO dan ZnFe2O4 disintesis dengan metode kopresipitasi dengan ukuran kristal rata-rata 71,81 nm dan 46,29 nm serta memiliki energi band gap sebesar 2,12 eV dan 1,80 eV. Gabungan nanopartikel CdO-ZnFe2O4 memiliki ukuran kristal rata-rata 50,03 nm dengan energi band gap 1,73 eV. Sedangkan, nanokomposit CdO-ZnFe2O4/Al2O3 yang disintesis memiliki energiband gap 1,90 eV dengan karakterisasi TEM diperoleh ukuran rata-rata partikel 22,58 nm. Optimasi degradasi menggunakan response surface methodology (RSM) menunjukkan persen degradasi maksimum didapatkan sebesar 92,79 % dengan kondisi optimal berat katalis 70 mg, konsentrasi awal methylene blue 8 ppm, pH 10, dan waktu degradasi 120 menit di bawah sinar tampak. Studi kinetika mengikuti orde satu semu dengan persamaan laju reaksi v = k[MB]1 (R^2 = 0,99347) dan konstanta laju reaksi yaitu 0,016 menit 1. Berdasarkan hasil penelitian ini, pengembangan nanokomposit CdO-ZnFe2O4/Al2O3 sebagai fotokatalis yang ramah lingkungan mampu digunakan untuk pengolahan limbah zat warna di masa depan.
.....Water pollution caused by methylene blue (MB) dye containing azo compounds is carcinogenic which is harmful to living things. Various attempts are made to develop effective technologies to remove MB dyes from the water environment, such as photocatalysis. This study successfully synthesized CdO-ZnFe2O4/Al2O3 nanocomposite with Al2O3 as catalyst support. CdO and ZnFe2O4 nanoparticles were synthesized by coprecipitation method with average crystal sizes of 71.81 nm and 46.29 nm and have band gap energies of 2.12 eV and 1.80 eV. The combined CdO-ZnFe2O4 nanoparticles have an average crystal size of 50.03 nm with a band gap energy of 1.73 eV. Meanwhile, the synthesized CdO-ZnFe2O4/Al2O3 nanocomposite has a band gap energy of 1.90 eV with TEM characterization obtained an average particle size of 22.58 nm. Degradation optimization using response surface methodology (RSM) showed that the maximum degradation percent was obtained at 92.79% with optimal conditions of catalyst weight of 70 mg, initial methylene blue concentration of 8 ppm, pH 10, and degradation time of 120 minutes under visible light. The kinetics study followed pseudo first order with the reaction rate equation ð£ = v[MB]1 (R^2 = 0.99347) and reaction rate constant of 0.016 min 1. Based on the results of this study, the development of CdO-ZnFe2O4/Al2O3 nanocomposite as an environmentally friendly photocatalyst can be used for dye waste treatment in the future.