SINTESIS, KARAKTERISASI DAN KINERJA KATALIS NANOKOMPOSIT ZnO/NiO DALAM FOTODEGRADASI ZAT WARNA

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SINTESIS, KARAKTERISASI DAN KINERJA KATALIS NANOKOMPOSIT ZnO/NiO DALAM FOTODEGRADASI ZAT WARNA

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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul **"Sintesis, Karakterisasi dan Kinerja Katalis Nanokomposit ZnO/NiO dalam Fotodegradasi Zat Warna"** ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas penyataan ini, saya siap menanggung risiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

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KATA PENGANTAR

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Penulis

ABSTRAK

Pencemaran air oleh polutan pewarna organik merupakan masalah lingkungan yang terus berkembang. Fotokatalisis semikonduktor dapat mendegradasi pewarna organik dari air limbah. Penelitian ini bertujuan untuk memperoleh informasi mengenai kondisi optimum sintesis nanokomposit Zink (II) Oxide /Nikel (II) Oxide (ZnO/NiO), karakteristik dan kinerjanya dalam fotodegradasi zat warna Rhodamine B (RB). Tahapan penelitian meliputi (1) sintesis ZnO dan NiO, menggunakan metode hidrotermal (50, 100, 150^{o}C) dan ko-presipitasi (surfaktan PEG 6 kDa, PVP 35 dan 40 kDa), secara berturut-turut (2) sintesis nanokomposit ZnO/NiO menggunakan metode ultrasonikasi dengan variasi komposisi ZnO:NiO (1:1; 1:2, 2:1) dan massa nanokomposit sebesar 0,01; 0,025 dan 0,05 gram (3) Karakterisasi ZnO, NiO dan komposit ZnO/NiO menggunakan XRD, FTIR dan SEM serta (4) pengujian kinerja komposit ZnO/NiO dalam degradasi fotokatalitik RB dengan iradiasi UV-A dan UV-C. Perhitungan sifat elektronik juga dikaji menggunakan *Density Functional Theory* (DFT) dengan fungsional hibrida B3LYP dan basis set LANL2DZ. Difraktogram Sinar-X ZnO, NiO dan ZnO/NiO memiliki kesesuaian dengan data JCPDS untuk puncak difraksi khas (2θ = 36,6; 37,3) menunjukkan keberhasilan sintesis ZnO, NiO dan ZnO/NiO dengan kemurnian tinggi. Hasil SEM nanokomposit ZnO/NiO menunjukkan morfologi gabungan dari metal oksida ZnO dan NiO dengan ukuran partikel komposit 83,363-94,97 nm. Nanokomposit ZnO/NiO (2:1) dengan massa 0,05 gram menunjukkan efisiensi degradasi RB yang paling besar 100% dengan proses fotokatalitik menggunakan sinar UV-C.

Kata kunci: Sintesis, Karakterisasi, Fotokatalisis, Rhodamin B, ZnO/NiO.

ABSTRACT

Water pollution caused by organic dyes constituted a burgeoning environmental concern. Semiconductor photocatalysis offered a means of breaking down organic dyes present in wastewater. The study's primary objective was to gather insights into the optimal conditions for synthesizing Zink (II) Oxide / Nickel (II) Oxide (ZnO/NiO) nanocomposites, comprehending their attributes, and assessing their efficacy in the photodegradation of Rhodamine B (RB) dyes. The research followed these steps: (1) synthesized ZnO and NiO through hydrothermal methods at temperatures of 50, 100, and 150°C and co-precipitation with PEG surfactant 6 kDa, PVP 35 kDa, and PVP 40 kDa, respectively; (2) crafted ZnO/NiO nanocomposites via the ultrasonication method, varying ZnO:NiO compositions (1:1; 1:2; 2:1) and nanocomposite masses of 0.01, 0.025, and 0.05 grams; (3) characterized ZnO, NiO, and ZnO/NiO composites using XRD and FTIR; and (4) assessed ZnO/NiO composites' performance in catalyzing the degradation of RB under UV-A and UV-C irradiation. Additionally, the study delved into electronic property calculations using Density Functional Theory (DFT) with the B3LYP hybrid functional and LANL2DZ basis set. X-ray diffractograms of ZnO, NiO, and ZnO/NiO aligned with JCPDS data, confirming characteristic diffraction peaks (2θ = 36.6; 37.3). This agreement underscored the successful synthesis of highly pure ZnO, NiO, and ZnO/NiO. SEM results of the ZnO/NiO nanocomposites showed the combined morphology of the metal oxides ZnO and NiO with composite particle size of 83.363-94.97 nm. Remarkably, the ZnO/NiO nanocomposite (with 2:1 composition and mass of 0.05 grams) exhibited the highest RB degradation efficiency of 100% through photocatalytic processes under UV-C light.

Key Words: Synthesis, Characterization, Photocatalysis, Rhodamine B, ZnO/NiO.

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