

ABSTRAK

DEGRADASI SENYAWA ORGANIK PADA AIR LIMBAH TEKSTIL MENGUNAKAN FOTOKATALIS $\text{ZnO-NiFe}_2\text{O}_4$ DITINJAU DARI INTENSITAS CAHAYA DAN WAKTU KONTAK

(Aisyah Yuniar, 2026, 63 Halaman, 8 Tabel, 15 Gambar)

Air limbah tekstil mengandung senyawa organik yang dapat menurunkan kualitas lingkungan apabila dibuang tanpa pengolahan yang memadai. Salah satu metode yang dapat digunakan untuk mengurangi kandungan senyawa organik dalam limbah tekstil adalah fotokatalisis menggunakan komposit $\text{ZnO-NiFe}_2\text{O}_4$. Penelitian ini bertujuan untuk mengetahui karakteristik fotokatalis $\text{ZnO-NiFe}_2\text{O}_4$ berdasarkan analisis XRD dan FTIR serta mengetahui pengaruh variasi intensitas cahaya dan waktu kontak terhadap pH, TSS, dan efektivitas degradasi senyawa organik pada limbah tekstil. Fotokatalis $\text{ZnO-NiFe}_2\text{O}_4$ disintesis dan dikarakterisasi menggunakan *X-Ray Diffraction* (XRD) dan *Fourier Transform Infrared Spectroscopy* (FTIR). Proses fotodegradasi dilakukan dengan variasi sumber cahaya berupa tanpa cahaya, cahaya matahari, sinar UV 20 Watt, dan lampu LED 15 Watt serta variasi waktu kontak 0, 60, 120, dan 180 menit. Parameter yang dianalisis meliputi pH, TSS, fenol, dan *Chemical Oxygen Demand* (COD). Hasil karakterisasi menunjukkan bahwa komposit $\text{ZnO-NiFe}_2\text{O}_4$ berhasil terbentuk dengan ukuran kristalit rata-rata sebesar 24,98 nm. Hasil FTIR menunjukkan adanya ikatan Fe-O pada 580 cm^{-1} serta Ni-O/Zn-O pada 455 cm^{-1} . Hasil penelitian menunjukkan bahwa variasi intensitas cahaya dan waktu kontak berpengaruh terhadap efektivitas degradasi senyawa organik. Kondisi optimum diperoleh pada penyinaran UV 20 Watt selama 180 menit dengan nilai pH 6,73, TSS 25,18 mg/L, kadar fenol 0,051 mg/L, dan COD 46,6 mg/L. Efisiensi penurunan fenol dan COD masing-masing mencapai 98,43% dan 88,97%.

Kata Kunci: $\text{ZnO-NiFe}_2\text{O}_4$, Fotokatalisis, Limbah Tekstil, Degradasi, Senyawa Organik

ABSTRACT

DEGRADATION OF ORGANIC COMPOUNDS IN TEXTILE WASTE WATER USING ZnO–NiFe₂O₄ PHOTOCATALYST AS A FUNCTION OF LIGHT INTENSITY AND CONTACT TIME

(Aisyah Yuniar, 2026, 63 Pages, 8 Tables, 15 Figures)

Textile wastewater contains organic compounds that can degrade environmental quality if disposed of without adequate treatment. One method that can be used to reduce the content of organic compounds in textile waste is photocatalysis using ZnO–NiFe₂O₄ composite. This study aims to determine the characteristics of ZnO–NiFe₂O₄ photocatalysts based on XRD and FTIR analysis and to determine the effect of variations in light intensity and contact time on pH, TSS, and the effectiveness of organic compound degradation in textile waste. ZnO–NiFe₂O₄ photocatalysts were synthesized and characterized using X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR). The photodegradation process was carried out with various light sources such as no light, sunlight, 20 Watt UV light, and 15 Watt LED lights as well as variations in contact time of 0, 60, 120, and 180 minutes. The parameters analyzed included pH, TSS, phenol, and Chemical Oxygen Demand (COD). The characterization results showed that the ZnO–NiFe₂O₄ composite was successfully formed with an average crystallite size of 24.98 nm. The FTIR results showed the presence of Fe–O bonds at 580 cm⁻¹ and Ni–O/Zn–O at 455 cm⁻¹. The results showed that variations in light intensity and contact time affected the effectiveness of organic compound degradation. The optimum conditions were obtained at 20 Watt UV irradiation for 180 minutes with a pH value of 6.73, TSS 25.18 mg/L, phenol content of 0.051 mg/L, and COD 46.6 mg/L. The phenol and COD reduction efficiencies reached 98.43% and 88.97%, respectively.

Keywords: ZnO–NiFe₂O₄, Photocatalysis, Textile Wastewater, Degradation, Organic Compounds.