# ABSTRAK

## Pengaruh Sumber Cahaya dan Waktu Kontak untuk Fotodegradasi Lignin pada Limbah Industri *Pulp* dan Kertas menggunakan Fotokatalis $ZnO\text{-}NiFe_2O_4$

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(Nursilvia Syahnaz, 76 halaman, 21 tabel, 19 gambar)

Industri *pulp* dan kertas memegang peran penting dalam perekonomian, namun industri ini menjadi penyumbang limbah cair dalam volume besar dengan karakteristik kimia yang kompleks. Sebagai alternatif yang lebih efektif dan ramah lingkungan, pemanfaatan teknologi fotokatalis salah satunya $ZnO\text{-}NiFe_2O_4$ dapat mendegradasi polutan organik dan anorganik yang berbahaya bagi lingkungan. fotokatalis $ZnO\text{-}NiFe_2O_4$ disintesis dengan metode ko-presipitasi melalui proses pengendapan, pencampuran dan pengujian aktivasi fotokatalis dengan variasi sumber cahaya (tanpa cahaya, cahaya matahari, cahaya lampu UV dan cahaya lampu LED) selama waktu kontak 0, 60,120 dan 180 menit. Hasil karakteristik fotokatalis $ZnO\text{-}NiFe_2O_4$ menunjukkan struktur kristal *heksagonal wurtzite – cubic spinel* dengan ukuran kristal 11,86 nm serta adanya ikatan Fe–O, Ni–O, dan Zn–O yang merupakan karakteristik utama nanokomposit $ZnO–NiFe_2O_4$. Dalam mengevaluasi pengaruh fotokatalis $ZnO\text{-}NiFe_2O_4$, dilakukan analisis konsentrasi lignin dengan spektrofotometri UV-Vis, analisis nilai *Chemical Oxygen Demind* (COD), *Total Suspended Solid* (TSS) serta nilai pH. Hasil penelitian menunjukkan penurunan kadar lignin dengan efektivitas degradasi sebesar 91,94 % dan penurunan COD sebesar 60,86% pada variasi penyinaran cahaya UV 20 watt dalam waktu kontak 120 menit.



**Kata Kunci :** fotokatalis, $ZnO\text{-}NiFe_2O_4$, fotodegradasi lignin, limbah industri *pulp* dan kertas, sumber cahaya, metode ko-presipitasi.

## *ABSTRACT*

***The Effect of Light Source and Contact Time on Lignin Photodegradation in Pulp and Paper Industrial Wastewater using ZnO-$NiFe_2O_4$ Photocatalyst***

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(Nursilvia Syahnaz, 76 *pages*, 21 *tables*, 19 *figures*)

*The pulp and paper industry plays an important role in the economy, yet it contributes a large volume of wastewater with complex chemical characteristics. As a more effective and environmentally friendly alternative, the utilization of photocatalytic technology, specifically using ZnO-$NiFe_2O_4$, an degrade organic and inorganic pollutants that are hazardous to the environment. The ZnO-$NiFe_2O_4$ photocatalyst was synthesized via the co-precipitation method through processes of precipitation, mixing, and photocatalytic activation testing under various light sources (dark/no light, sunlight, UV light, and LED light) for contact times of 0, 60, 120, and 180 minutes. The characterization results of the ZnO-$NiFe_2O_4$ photocatalyst showed a hexagonal wurtzite – cubic spinel crystal structure with a crystal size of 11.86 nm, alongside the presence of Fe-O, Ini-O, and Zn-O bonds, which are the main characteristics of the ZnO-$NiFe_2O_4$ nanocomposite. To evaluate the effect of the ZnO-$NiFe_2O_4$ photocatalyst, analyses were conducted on lignin concentration using UV-Vis spectrophotometry, Chemical Oxygen Demand (COD) values, Total Suspended Solids (TSS), and pH values. The results showed a reduction in lignin content with a degradation efficiency of 91.94% and a decrease in COD by 60.86% under 20-watt UV light irradiation 120 minutes contact time.*



***Keywords*** **:** *photocatalyst,* ZnO-$NiFe_2O_4$, *lignin photodegradation, pulp and paper industrial wastewater, light source, co-precipitation method*.