

KATALIS HEMATIT Fe₂O₃ BERBASIS PASIR BESI PADA PROSES FOTO-FENTON HETEROGEN UNTUK DISINFEKSI BAKTERI *ESCHERICHIA COLI* DALAM AIR

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INTISARI

Pada penelitian ini telah dilakukan pengembangan metode foto-Fenton heterogen dengan menggunakan katalis hematit Fe₂O₃ berbasis pasir besi dari Pantai Glagah untuk disinfeksi bakteri *Escherichia coli* dalam air. Katalis oksida besi dibuat dengan melarutkan pasir besi melalui metode pengendapan. Katalis yang dihasilkan dikarakterisasi menggunakan X-Ray Fluorescence Spectrometry (XRF), X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscope (SEM) dan Energy Dispersive X-Ray (EDX). Kinerja katalis oksida besi dalam proses foto-Fenton heterogen dievaluasi untuk disinfeksi bakteri *E. coli* dalam air limbah peternakan di bawah paparan UV. Jumlah *E. coli* ditentukan menggunakan metode *count*. Pengaruh rasio mol H₂O₂:Fe²⁺, massa katalis, pH dan waktu penyinaran dipelajari dalam proses foto-Fenton untuk mendapatkan kondisi disinfeksi terbaik.

Hasil penelitian menunjukkan bahwa kandungan total Fe dalam pasir besi adalah 56,7% dapat membentuk Fe₂O₃ (hematit) sebesar 20,3%. Ukuran partikel katalis hematit hasil sintesis berada pada rentang antara 10,67 hingga 21,33 nm, dengan komposisi dominan atom Fe sebesar 57,77%. Uji disinfeksi menunjukkan bahwa jumlah awal koloni *E. coli* dalam sampel air, 1,14×10⁴ CFU/mL, berkurang secara signifikan, setelah proses foto-Fenton heterogen mencapai efisiensi 99%. Kondisi yang menghasilkan disinfeksi tertinggi adalah rasio mol H₂O₂:Fe²⁺ sebesar 10:1, massa katalis 0,1 gram dalam 25 mL sampel air pada pH 7 dan waktu penyinaran 60 menit mencapai efisiensi 99,99%. Dengan demikian, katalis hematit Fe₂O₃ dari pasir besi berpotensi menjadi alternatif ekonomis dalam proses foto-Fenton untuk menonaktifkan bakteri *E. coli* dalam air.

Kata kunci: *count*, *Escherichia coli*, foto-Fenton, hematit, kopresipitasi, pasir besi

IRON SAND-BASED HEMATITE Fe₂O₃ CATALYST IN HETEROGENEOUS PHOTO-FENTON PROCESS FOR DISINFECTION OF ESCHERICHIA COLI BACTERIA IN WATER

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ABSTRACT

This study developed a heterogeneous photo-Fenton method using an iron oxide catalyst based on iron sand from Glagah Beach for disinfection of *Escherichia coli* bacteria in water. The iron oxide catalyst was prepared by dissolving iron sand through a coprecipitation method. The resulting catalyst was characterized using X-ray Fluorescence (XRF), X-ray Diffraction (XRD), Fourier Transform Infrared spectroscopy (FTIR), Scanning Electron Microscope (SEM), and Energy Dispersion X-ray Spectroscopy (EDX). The performance of the iron oxide catalyst in the heterogeneous photo-Fenton process was evaluated for the disinfection of *E. coli* bacteria in livestock wastewater under UV light exposure. The number of *E. coli* was determined using a counting method. The effect of the H₂O₂:Fe²⁺ mole ratio, catalyst mass, pH, and irradiation time was investigated in the photo-Fenton process to determine the optimal disinfection conditions.

The results showed that the total Fe content in iron sand was 56.7%, which could form 20.3% Fe₂O₃ (hematite). The particle size of the synthesized hematite catalyst ranged from 10.67 to 21.33 nm, with a dominant Fe atomic composition of 57.77%. Disinfection tests showed that the initial number of *E. coli* colonies in the water sample, which was 1.14×10^4 CFU/mL, was significantly reduced after the heterogeneous photo-Fenton process achieved 99% efficiency. The conditions that produced the highest disinfection were a mole ratio of H₂O₂:Fe²⁺ of 10:1, a catalyst mass of 0.1 gram in 25 mL of water sample at pH 7, and an irradiation time of 60 minutes, which achieved 99.99% efficiency. Thus, the hematite Fe₂O₃ catalyst derived from iron sand has the potential to be an economical alternative in the photo-Fenton process for disinfecting *E. coli* bacteria in water.

Keyword: count, *Escherichia coli*, photo-Fenton, hematite, coprecipitation, iron sand