

ABSTRAK

EFEK PENAMBAHAN SERBUK KAYU DAN BESI (III) OKSIDA (Fe_2O_3) PADA GEOPOLIMER UNTUK FOTODEGRADASI ZAT WARNA METILEN BIRU

Oleh

OLGA SAPUTRA

Telah dilakukan penelitian efek penambahan serbuk kayu dan besi (III) oksida (Fe_2O_3) pada geopolimer untuk adsorpsi zat warna metilen biru yang bertujuan untuk mengetahui pembuatan komposit geopolimer, pengaruh penambahan serbuk kayu dan Fe_2O_3 terhadap kemampuan adsorpsi, serta struktur fasa, gugus fungsi, morfologi, dan kemampuan absorbansi yang terbentuk. Komposit geopolimer dibuat dengan mencampurkan serbuk kayu dan Fe_2O_3 ke dalam matriks geopolimer. Sampel dikarakterisasi menggunakan SEM-EDS, XRD, FTIR, dan UV-Vis. Hasil XRD menunjukkan bahwa sampel geopolimer/serbuk kayu (GE/SK) didominasi oleh fasa *quartz* (SiO_2) dan *enstatite* ($\text{Mg}_2\text{Si}_2\text{O}_6$), sedangkan geopolimer/serbuk kayu/ Fe_2O_3 (GE/SK/FE) didominasi oleh fasa *quartz* (SiO_2) dan *anorthite* ($\text{CaAl}_2\text{Si}_2\text{O}_8$). Hasil SEM-EDS memperlihatkan bahwa penambahan Fe_2O_3 meningkatkan densifikasi matriks, dengan unsur dominan Si, O, dan Al. FTIR mengidentifikasi gugus fungsi utama seperti Si-O-Si, Si-O-Al, O-H, dan C-H, dengan pergeseran pita serapan akibat interaksi Fe^{3+} . Hasil UV-Vis menunjukkan bahwa GE/SK/FE memiliki kapasitas adsorpsi dan fotokatalisis tertinggi, dibuktikan dengan penurunan signifikan absorbansi metilen biru pada panjang gelombang 600–700 nm (puncak monomer 666 nm) di bawah paparan UV. Kombinasi serbuk kayu dan Fe_2O_3 menghasilkan mekanisme ganda adsorpsi–fotokatalisis yang efektif untuk pengolahan limbah cair yang mengandung zat warna kationik.

Kata Kunci: geopolimer, serbuk kayu, Fe_2O_3 , metilen biru, adsorpsi, fotokatalisis.

ABSTRACT

THE EFFECT OF ADDING WOOD POWDER AND IRON (III) OXIDE (Fe_2O_3) TO GEOPOLIMER FOR THE PHOTODEGRADATION OF METHYLENE BLUE DYE

By

OLGA SAPUTRA

A research was conducted on the effect of adding wood powder and iron (III) oxide (Fe_2O_3) to geopolymer for the adsorption of methylene blue dye, aiming to investigate the preparation of geopolymer composites, the effect of wood powder and Fe_2O_3 addition on adsorption capacity, as well as the resulting phase structure, functional groups, morphology, and absorbance properties. Geopolymer composites were prepared by incorporating wood powder and Fe_2O_3 into the geopolymer matrix. Samples were characterized using SEM-EDS, XRD, FTIR, and UV–Vis spectroscopy. XRD results showed that geopolymer/wood powder (GE/SK) samples were dominated by quartz (SiO_2) and enstatite ($\text{Mg}_2\text{Si}_2\text{O}_6$) phases, while geopolymer/wood powder/ Fe_2O_3 (GE/SK/FE) samples were dominated by *quartz* (SiO_2) and anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_8$) phases. SEM-EDS revealed that the addition of Fe_2O_3 increased matrix densification, with Si, O, and Al as the dominant elements. FTIR identified main functional groups such as Si–O–Si, Si–O–Al, O–H, and C–H, with peak shifts due to Fe^{3+} interaction. UV–Vis results indicated that GE/SK/FE exhibited the highest adsorption and photocatalytic performance, as evidenced by a significant decrease in methylene blue absorbance at wavelengths of 600–700 nm (monomer peak at 666 nm) under UV irradiation. The combination of wood powder and Fe_2O_3 produced an effective dual adsorption–photocatalysis mechanism for treating wastewater containing cationic dyes.

Keywords: Geopolymer, wood powder, Fe_2O_3 , methylene blue, adsorption, photocatalysis.