Pengaruh Rasio Molar dan Penambahan Surfaktan terhadap Karakteristik dan Aktivitas Photocatalytic Nanokomposit Perak/Hausmannite dalam Mendegradasi Pewarna Congo Red = Effect of Molar Ratio and Surfactant Addition on The Characterizations and Photocatalytic Activity of Silver/Hausmannite Nanocomposites in The Removal of Congo Red Dye

Muhammad Yose Rizal, author

Abstrak

ABSTRAK
Pada studi ini, nanokomposit perak/mangan (II, III) oksida (Ag/Mn3O4) digunakan sebagai fotokatalis untuk mendegradasi limbah organik di bawah paparan cahaya. Sebelumnya, nanokomposit Ag/Mn3O4 telah berhasil dibuat dengan dua tahap, yaitu sintesis nanopartikel Mn3O4 melalui metode konvensional sol-gel dan kemudian sintesis perak dengan penambahan Mn3O4 melalui teknik hidrotermal. Fotokatalis Ag/Mn3O4 dibuat dengan tiga variasi molar dan dua variasi surfaktan seperti cetyltrimethylammonium bromide (CTAB) dan sodium dodecyl sulfate (SDS). Nanopartikel dan nanokomposit tersebut dikarakterisasi dengan menggunakan X-ray Diffraction (XRD), X-ray fluorescence (XRF), energy dispersive X-ray spectroscopy (EDX), N2 adsorption-desorption, ultraviolet-visible diffuse reflectance spectrophotometer (UV-Vis DRS), dan Raman spectroscopy. Hasil pengukuran UV-Vis DRS memperlihatkan semua fotokatalis berada pada rentang cahaya tampak, dan pada pengukuran N2 adsorption-desorption memperlihatkan penambahan surfaktan mengakibatkan peningkatan pada surface area dan pore volume dari nanokomposit Ag/Mn3O4. Keberadaan Ag dan surfaktan juga memengaruhi spektrum Raman. Fotokatalis-fotokatalis yang dibuat mempunyai stabilitas yang baik dan mampu mendegradasi model pewarna organik Congo red. Efektivitas proses photocatalytic meningkat pada fotokatalis Ag/Mn3O4 yang disintesis dengan bantuan surfaktan. Peran spesies yang aktif berkontribusi dalam proses degradasi pewarna organik yang diamati melalui scavenger test menunjukkan urutan sebagai berikut: holes, elektron, superoxide radicals, hydroxil radicals.
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<i>ABSTRACT
In this work, silver/manganese (II, III) oxide (Ag/Mn3O4) nanocomposites were used to degrade organic pollutant under light irradiation. Prior, Ag/Mn3O4 nanoparticles have successfully synthesized in two steps, typically synthesis of Mn3O4 nanoparticle by conventional sol-gel process and then synthesis of Ag featuring Mn3O4 by hydrothermal technique. Ag/Mn3O4 photocatalysts were synthesized using three various molar ratios and two various surfactants such as cetyltrimethylammonium bromide (CTAB) and sodium dodecyl sulfate (SDS). The nanoparticles and nanocomposites were characterized by X-ray diffraction (XRD), X-ray fluorescence (XRF), energy dispersive X-ray spectroscopy (EDX), N2 adsorption-desorption, ultraviolet-visible diffuse reflectance spectrophotometer (UV-Vis DRS), and Raman spectroscopy. The UV-Vis DRS results showed all photocatalysts energy gap are in the visible range, and N2 adsorption-desorption analysis showed the addition of surfactants was enlarged the surface area and pore volume of Ag/Mn3O4 nanocomposites. The presence of Ag and surfactants also influenced the Raman

spectra. The as-synthesized photocatalysts have excellent stability and were able to degrade Congo red dye. The effectiveness of photocatalytic process was enhanced in the Ag/Mn3O4 photocatalysts with surfactant-assisted synthesis method. The role of active species contributing to the degradation process that was studied by scavenger test results in the following order: holes, electrons, superoxide radicals, hydroxyl radicals.<i/>