

SINTESIS NANOKOMPOSIT $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ DAN UJI AKTIVITASNYA SEBAGAI FOTOKATALIS UNTUK REDUKSI ION Cr(VI)

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INTISARI

Telah dilakukan sintesis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ dan pengujiannya sebagai katalis fotoreduksi ion Cr(VI). Penelitian diawali dengan sintesis magnetit (Fe_3O_4) dengan metode kopresipitasi dan sonikasi, dilanjutkan dengan pelapisan silika, kemudian pelapisan TiO_2 melalui proses sol-gel, dilanjutkan dengan penempelan nanopartikel perak (Ag). Produk hasil sintesis dikarakterisasi menggunakan difraktometer sinar-X, *scanning electron microscope-energy dispersive X-ray*, *transmission electron microscope*, *vibrating sample magnetometer* dan *specular reflectance spectrophotometer*. Uji aktivitas fotokatalis dilakukan dengan menginteraksikan nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ dengan larutan ion Cr(VI) pada pH 3 dalam sistem batch dalam reaktor tertutup yang dilengkapi dengan lampu UV dan visibel.

Hasil penelitian menunjukkan bahwa nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ memiliki sifat magnetik yang baik serta responsif terhadap paparan sinar UV dan sinar tampak yang ditandai dengan adanya serapan pada daerah sinar UV dan tampak pada spektra reflektansi spekular UV-Visibel. Nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ 5% memiliki kemampuan fotoreduksi yang lebih baik dibandingkan dengan fotokatalis $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ dan TiO_2 dalam paparan sinar UV maupun tampak. Studi kinetika fotoreduksi menunjukkan bahwa reaksi mengikuti model kinetika reaksi Langmuir-Heninselwood dengan nilai konstanta laju fotoreduksi $0,0203 \text{ menit}^{-1}$ dalam paparan sinar UV dan $0,0199 \text{ menit}^{-1}$ dalam paparan sinar tampak.

Kata kunci: fotokatalis, Cr(VI), $\text{TiO}_2\text{-Ag}$, nanokomposit, $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$

SYNTHESIS OF $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ NANOCOMPOSITE AND ITS ACTIVITY TEST AS PHOTOCATALYST FOR REDUCTION OF Cr(VI) ION

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ABSTRACT

Synthesis of $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ nanocomposite and its activity test for photoreduction of Cr(IV) ion have been conducted. The synthesis was initiated by the preparation of magnetite (Fe_3O_4) using co-precipitation and sonication method, followed by coating of silica and TiO_2 using sol gel method, and modification of Ag nanoparticle on the surface. The products were characterized using X-ray diffractometer, scanning electron microscope-energy dispersive X-ray, transmission electron microscope, vibrating sample magnetometer, and specular reflectance spectrophotometer. Photocatalytic activity test was conducted by mixing $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ nanocomposite and solution of Cr(VI) ion under batch system at pH 3 in a closed reactor equipped with UV and visible lights.

The result showed that $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ nanocomposite had a good magnetic characteristic. The $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ nanocomposite was responsive toward UV and visible lights indicated with the edge absorption of UV and visible in UV-Vis spectra. The $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ 5% nanocomposite had a better photoreduction activity than $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ nanocomposite under UV and visible lights. Kinetic study of photoreduction activity of Cr(VI) using $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$ 5% showed that the reaction followed the Langmuir-Heinselwood with rate constants of 0.0203 and 0.0199 min^{-1} under UV and Visible, irradiation respectively.

Key words : Photocatalyst, Cr(VI), $\text{TiO}_2\text{-Ag}$, nanocomposite, $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2\text{-Ag}$