

**PENGARUH JUMLAH PREKURSOR TITANIUM
TETRAISOPROPOKSIDA TERHADAP AKTIVITAS FOTOKATALIS
NANOKOMPOSIT $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI PADA FOTOREDUKSI ION
 $[\text{AuCl}_4]^-$**

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INTISARI

Sintesis fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ tersensitisasi polianilin dengan variasi jumlah prekursor titanium tetraisopropoksida telah dilakukan untuk mempelajari pengaruh terhadap aktivitas fotokatalitiknya pada fotoreduksi ion $[\text{AuCl}_4]^-$. Penelitian ini diawali dengan sintesis magnetit (Fe_3O_4) melalui kopresipitasi dan sonikasi, diikuti dengan pelapisan silika (SiO_2) pada magnetit melalui proses sol-gel dan sonikasi, kemudian pelapisan titania (TiO_2) dengan variasi jumlah titanium tetraisopropoksida (TTIP) sebanyak 0, 1, 2, 4 dan 6 mmol melalui proses sol-gel dan sonikasi, dilanjutkan sensitisasi polianilin (PANI) melalui polimerisasi oksidatif anilin dengan oksidator amonium peroksidisulfat (APS). Produk sintesis dikarakterisasi dengan *X-ray diffractometer* (XRD), *fourier transform infrared* (FTIR) *spectrophotometer*, *scanning electron microscope-energy dispersive X-ray* (SEM-EDX), *transmission electron microscope* (TEM), *vibrating sample magnetometer* (VSM) dan *specular reflectance* (SR) *UV-Vis spectrophotometer*. Uji aktivitas fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI berbagai variasi jumlah TTIP dilakukan dengan mencampur fotokatalis dan larutan $[\text{AuCl}_4]^-$ dalam sistem *batch* pada pH optimum dengan paparan sinar UV dan sinar tampak.

Hasil penelitian menunjukkan bahwa berdasarkan analisis FTIR, XRD, SEM-EDX, TEM dan VSM, fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI berbagai variasi jumlah TTIP berhasil disintesis. Aktivitas dan energi celah pita $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI meningkat seiring dengan bertambahnya jumlah prekursor TTIP yang digunakan. Kemampuan fotoreduksi $[\text{AuCl}_4]^-$ oleh fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI paling efisien berlangsung pada kondisi pH 4. Fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI(6 mmol) menunjukkan aktivitas fotoreduksi tertinggi sebesar 98,2 dan 92,5 % pada radiasi sinar UV dan tampak. Nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI dapat dipisahkan secara efektif oleh medan magnet eksternal. Penurunan aktivitas fotokatalis nanokomposit $\text{Fe}_3\text{O}_4/\text{SiO}_2/\text{TiO}_2$ -PANI setelah 4 kali pemakaian sebesar 18,7 % pada pH 4.

Kata kunci: TiO_2 , Fe_3O_4 , fotoreduksi $[\text{AuCl}_4]^-$, PANI, variasi TTIP.

**EFFECT OF TITANIUM TETRAISOPROPOXIDE PRECURSOR
AMOUNT TO THE ACTIVITY OF Fe₃O₄/SiO₂/TiO₂-PANI
NANOCOMPOSITE PHOTOCATALYST ON THE PHOTOREDUCTION
OF [AuCl₄]⁻ ION**

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ABSTRACT

Synthesis of polyaniline sensitized Fe₃O₄/SiO₂/TiO₂ nanocomposite photocatalyst had been performed by altering the amount of titanium tetraisopropoxide to study the effect of their photocatalytic activity on [AuCl₄]⁻ ion photoreduction. Firstly, magnetite (Fe₃O₄) was synthesized through coprecipitation and sonication. Silica (SiO₂) coating on magnetite was done through sol-gel and sonication processes. Then, titania (TiO₂) coating was done by altering the amount of titanium tetraisopropoxide (TTIP) of 0, 1, 2, 4 and 6 mmol through sol-gel and sonication process. Lastly, polyaniline (PANI) sensitization was done through oxidative polymerization of aniline with ammonium peroxydisulfate oxidator (APS). The synthesis products were characterized by X-ray diffractometer (XRD), fourier transform infrared (FTIR) spectrophotometer, scanning electron microscope-energy dispersive X-ray (SEM-EDX), transmission electron microscope (TEM), vibrating sample magnetometer (VSM) and specular reflectance (SR) UV-Vis spectrophotometer. Photocatalytic activity of Fe₃O₄/SiO₂/TiO₂-PANI nanocomposite photocatalysts with various TTIP amount were done by interacting the photocatalyst and the [AuCl₄]⁻ solution in a batch system at optimum pH with exposure to UV and visible light.

The results showed that according to FTIR, XRD, SEM-EDX, TEM and VSM analysis, photocatalysts of Fe₃O₄/SiO₂/TiO₂-PANI nanocomposite of various TTIP amount were successfully synthesized. Activity and band gap energy of Fe₃O₄/SiO₂/TiO₂-PANI were increased as increasing the number of TTIP precursors used. The capability of [AuCl₄]⁻ photoreduction by Fe₃O₄/SiO₂/TiO₂-PANI nanocomposite photocatalysts were carried out efficiently at pH 4. Fe₃O₄/SiO₂/TiO₂-PANI(6 mmol) nanocomposite photocatalyst showed highest photoreduction activity of 98.2 and 92.5 % under UV and visible radiation respectively. The Fe₃O₄/SiO₂/TiO₂-PANI nanocomposites could be effectively separated by the external magnetic field. After used for 4 times, the photocatalytic activity of Fe₃O₄/SiO₂/TiO₂-PANI nanocomposite decreased by 18.7 % at pH 4.

Keywords: TiO₂, Fe₃O₄, [AuCl₄]⁻ photoreduction, PANI, TTIP variation.