



## **SINTESIS Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S SEBAGAI FOTOKATALIS UNTUK DEGRADASI ZAT WARNA METILEN BIRU**

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### **INTISARI**

Sintesis Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S sebagai fotokatalis untuk degradasi zat warna metilen biru telah dilakukan. Tujuan utama dari penelitian ini yakni melakukan modifikasi fotokatalis TiO<sub>2</sub> agar lebih responsif terhadap sinar tampak serta dapat dipisahkan dengan mudah dari media reaksi. Penelitian diawali dengan melakukan sintesis Fe<sub>3</sub>O<sub>4</sub> dengan metode sono-kopresipitasi. Partikel Fe<sub>3</sub>O<sub>4</sub> hasil sintesis dilapisi TiO<sub>2</sub> membentuk struktur *core-shell* dengan rasio molar Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub> yang bervariasi, lalu diuji ketertarikannya dengan magnet eksternal. Rasio molar Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub> optimum digunakan untuk sintesis material Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S. Fotokatalis Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S disintesis dengan rasio molar S/Ti yang bervariasi. Hasil sintesis dikarakterisasi dengan menggunakan spektrofotometer FT-IR, difraktometer sinar-X (XRD), spektrofotometer SR UV-Visibel, *Scanning Electron Microscope* dengan *Energy Dispersive X-ray* (SEM-EDX) dan *Transmission Electron Microscope* (TEM). Aktivitas fotokatalitik TiO<sub>2</sub>, Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>, dan Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S diuji dalam proses degradasi zat warna metilen biru pada kondisi pH dan waktu optimum serta dalam paparan sinar ultraviolet maupun tampak.

Hasil penelitian menunjukkan bahwa fotokatalis Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S berhasil disintesis. Rasio molar optimum Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub> yakni 1:5. Energi celah pita fotokatalis Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S mengalami penurunan seiring bertambahnya rasio molar S/Ti hingga pada rasio 5% yakni 3,04 eV. Fotokatalis Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S dengan rasio molar S/Ti 5% mampu mendegradasi metilen biru sebesar 85,74% dalam paparan sinar ultraviolet dan sebesar 78,14% dalam paparan sinar tampak dengan waktu optimum penyinaran 210 menit dan pada pH 10.

Kata kunci : Fotokatalis, Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S, Metilen Biru



## **SYNTHESIS OF Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S AS A PHOTOCATALYST FOR DEGRADATION OF METHYLENE BLUE DYE**

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### **ABSTRACT**

The synthesis of Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S as a photocatalyst for degradation of methylene blue dye has been conducted. The main purpose of this research was to modify the TiO<sub>2</sub> photocatalyst to be more responsive to visible light and can be separated easily from the media of reaction. The synthesis was initiated by preparation of Fe<sub>3</sub>O<sub>4</sub> particles using sono-coprecipitation method. The Fe<sub>3</sub>O<sub>4</sub> particles were then coated with TiO<sub>2</sub> to become core-shell structure at a various molar ratio of Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub>. Magnetic pull strenght of Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> to magnetic field was then tested. The optimum molar ratio of Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub> was used for synthesis of Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S at a various molar ratio of S/Ti. The Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S was characterized FTIR, XRD, TEM, SEM-EDX, and SR UV-visible methods. Photocatalytic activity of TiO<sub>2</sub>, Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>, and Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S was tested in the process of degradation of methylene blue solution under optimum pH and time conditions in ultraviolet and visible light exposure.

The results showed that the Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S photocatalyst was successfully synthesized. The optimum Fe<sub>3</sub>O<sub>4</sub>:TiO<sub>2</sub> molar ratio was 1:5. Band gap energy of Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S photocatalysts decreased with an increase of S/Ti molar ratio up to a ratio of 5%, which was 3.04 eV. The Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S photocatalyst with a 5% S/Ti molar ratio was able to degrade methylene blue by 85,74% in ultraviolet light exposure and by 78,14% in visible light exposure with an optimum irradiation time of 210 minutes and under pH 10 conditions.

Keywords : Photocatalyst, Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub>-S, Methylene blue