

# Sintesis nanokomposit ZnO/GdFeO<sub>3</sub> menggunakan ekstrak daun tempuyung (*sonchus arvensis* l.) dan aktivitas fotokatalitiknya terhadap malasit hijau = Synthesis nanocomposite ZnO/GdFeO<sub>3</sub> using *sonchus arvensis* l. leaf extract and activity photocatalytic of malachite green

Rika Andriyani Putri, author

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## Abstrak

### <b>ABSTRAK</b><br>

Pada penelitian ini, sintesis nanopartikel ZnO, nanopartikel GdFeO<sub>3</sub>, dan nanokomposit ZnO/GdFeO<sub>3</sub> secara green synthesis berhasil dilakukan menggunakan ekstrak daun tempuyung (*Sonchus arvensis* L.) yang berperan sebagai sumber basa lemah dan capping agent. Hasil sintesis selanjutnya dikarakterisasi menggunakan instrumentasi spektrofotometer UV-Vis, UV-Vis DRS, spektroskopi FTIR, XRD, PSA, SEM-EDX, dan TEM. Hasil karakterisasi spektrofotometer UV-Vis menunjukkan adanya puncak serapan UV-Vis nanopartikel ZnO pada panjang gelombang maksimum 371 nm. Hasil karakterisasi UV-Vis DRS menunjukkan bahwa nilai band gap nanopartikel ZnO, nanopartikel GdFeO<sub>3</sub>, dan nanokomposit ZnO/GdFeO<sub>3</sub> berturut-turut sebesar 3.2 eV, 2.65 eV, dan 2.8 eV. Berdasarkan hasil karakterisasi XRD, nanopartikel ZnO memiliki struktur hexagonal wurtzite dan nanopartikel GdFeO<sub>3</sub> memiliki struktur orthorombic. Hasil karakterisasi PSA menunjukkan bahwa distribusi ukuran rata-rata partikel ZnO/GdFeO<sub>3</sub> berada pada rentang 50.75-141.8 nm. Berdasarkan hasil karakterisasi SEM, nanopartikel GdFeO<sub>3</sub> berbentuk spherical dan nanokomposit ZnO/GdFeO<sub>3</sub> berbentuk semi-spherical. Berdasarkan hasil karakteri TEM, ukuran rata-rata partikel nanopartikel GdFeO<sub>3</sub> dan nanokomposit ZnO/GdFeO<sub>3</sub> berturut-turut sebesar 41.4 nm dan 33.3 nm. Nanopartikel ZnO, nanopartikel GdFeO<sub>3</sub>, dan nanokomposit ZnO/GdFeO<sub>3</sub>- diuji aktivitas fotokatalitiknya untuk mendegradasi senyawa zat warna malasit hijau di bawah sinar tampak. Persentase degradasi malasit hijau menggunakan nanopartikel ZnO, nanopartikel GdFeO<sub>3</sub>, dan nanokomposit ZnO/GdFeO<sub>3</sub> berturut-turut yaitu sebesar 72.06%, 67.47%, dan 91.49% selama 2 jam waktu penyinaran. Reaksi fotodegradasi malasit hijau nanokomposit ZnO/GdFeO<sub>3</sub> mengikuti kinetika orde pseudo satu

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### <b>ABSTRACT</b><br>

In this research, ZnO nanoparticles, GdFeO<sub>3</sub> nanoparticles, and ZnO/GdFeO<sub>3</sub>- nanocomposites have been synthesized by *Sonchus anvensis* L. leaf extract as a source of weak bases and capping agent. The results have been characterized using UV-Vis spectrophotometer, UV-Vis DRS, FTIR spectroscopy, XRD, PSA, SEM-EDX, and TEM instrumentations. UV-Vis spectrophotometer characterization results showed the UV-VIS peak absorption of ZnO nanoparticles at  $\lambda_{max}$  371 nm. UV-Vis DRS characterization results showed the band gap value for ZnO nanoparticles, GdFeO<sub>3</sub> nanoparticles, and ZnO/GdFeO<sub>3</sub>- nanocomposites were 3.2 eV, 2.65 eV, dan 2.8 eV. Based on XRD characterization results, ZnO nanoparticles have a hexagonal wurtzite structure and GdFeO<sub>3</sub> nanoparticles have an orthorhombic structure. PSA characterization results showed that the average sized distribution of ZnO/GdFeO<sub>3</sub> particles in range 50.75-141.8 nm. Based on SEM characterization results, GdFeO<sub>3</sub> nanoparticles have a spherical shaped and ZnO/GdFeO<sub>3</sub> nanocomposites have a semi-spherical shaped. Based on TEM characterization results, the average size of GdFeO<sub>3</sub> nanoparticles and ZnO/GdFeO<sub>3</sub> nanocomposites were 41.4 nm and 33.3 nm. ZnO nanoparticles,

GdFeO<sub>3</sub> nanoparticles, and ZnO/GdFeO<sub>3</sub>- nanocomposites have been tested for photocatalytic to degraded pigment compounds of malachite green under visible light. The percentage of malachite green degradation with ZnO nanoparticles, GdFeO<sub>3</sub> nanoparticles, and ZnO/GdFeO<sub>3</sub>- nanocomposites were 72.06%, 67.47%, dan 91.49% for 2 hours irradiations. The calculations of reaction kinetics of malachite green photodegradation was found that nanocomposite ZnO/GdFeO<sub>3</sub> reaction followed pseudo first-order kinetics.