Sintesis nanokomposit ZnO/GdFeO3 menggunakan ekstrak daun tempuyung (sonchus arvensis l.) dan aktivitas fotokatalitiknya terhadap malasit hijau = Synthesis nanocomposite ZnO/GdFeO3 using sonchus arvensis l. leaf extract and activity photocatalytict of malachite green

Rika Andriyani Putri, author

Abstrak

Pada penelitian ini, sintesis nanopartikel ZnO, nanopartikel GdFeO3, dan nanokomposit ZnO/GdFeO3 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 GdFeO3, dan nanokomposit ZnO/GdFeO3 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 GdFeO3 memiliki struktur orthorombic. Hasil karakterisasi PSA menunjukkan bahwa distribusi ukuran rata-rata partikel ZnO/GdFeO3 berada pada rentang 50.75-141.8 nm. Berdasarkan hasil karakterisasi SEM, nanopartikel GdFeO3 berbentuk spherical dan nanokomposit ZnO/GdFeO3 berbentuk semi-spherical. Berdasarkan hasil karakteri TEM, ukuran rata-rata partikel nanopartikel GdFeO3 dan nanokomposit ZnO/GdFeO3 beruturt-turut sebesar 41.4 nm dan 33.3 nm. Nanopartikel ZnO, nanopartikel GdFeO3, dan nanokomposit ZnO/GdFeO3- diuji aktivitas fotokatalitiknya untuk mendegradasi senyawa zat warna malasit hijau di bawah sinar tampak. Persentase degradasi malasit hijau menggunakan nanopartikel ZnO, nanopartikel GdFeO3, dan nanokomposit ZnO/GdFeO3 berturut-turut yaitu sebesar 72.06%, 67.47%, dan 91.49% selama 2 jam waktu penyinaran. Reaksi fotodegradasi malasit hijau nanokomposit ZnO/GdFeO3 mengikuti kinetika orde pseudo satu.
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In this research, ZnO nanoparticles, GdFeO3 nanoparticles, and ZnO/GdFeO3- nanocomposites have been synthesized by Sonchus anversis 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 Î»max 371 nm. UV-Vis DRS characterization results showed the band gap value for ZnO nanoparticles, GdFeO3 nanoparticles, and ZnO/GdFeO3- 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 GdFeO3 nanoparticles have an orthorhombic structure. PSA characterization results showed that the average sized distribution of ZnO/GdFeO3 particles in range 50.75-141.8 nm. Based on SEM characterization results, GdFeO3 nanoparticles have a spherical shaped and ZnO/GdFeO3 nanocomposites have a semi-spherical shaped. Based on TEM characterization results, the average size of GdFeO3 nanoparticles and ZnO/GdFeO3 nanocomposites were 41.4 nm and 33.3 nm. ZnO nanoparticles, GdFeO3 nanoparticles, and ZnO/GdFeO3- 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, GdFeO3 nanoparticles, and ZnO/GdFeO3- nanocomposites were 72.06%, 67.47%, dan 91.49% for 2 hours irradiations. The calculations of reaction kinetics of malasite green photodegradation was found that nanocomposite ZnO/GdFeO3 reaction followed pseudo first-order kinetics.