Sintesis dan karakterisasi nanobimetal oksida BiFeO3 menggunakan ekstrak daun okra (abelmoschus esculentus l.,) serta aktivitas fotokatalitiknya terhadap metilen biru = Synthesis and characterization of nanobimetallic oxide BiFeO3 using okra (abelmoschus esculentus l.,) leaf extract and its photocatalytic activity of methylene blue

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Abstrak

Dalam penelitian ini nanopartikel Bi2O3, nanopartikel Fe2O3, dan nanobimetal oksida BiFeO3 telah berhasil disintesis menggunakan metode green synthesis dengan ekstrak daun okra. Kandungan metabolit sekunder yang terdapat dalam ekstrak daun okra seperti alkaloid digunakan sebagai agen penghidrolisa (sumber basa lemah -OH), sedangkan saponin dan flavonoid digunakan sebagai agen penstabil (capping agent). Hasil sintesis nanobimetal oksida BiFeO3 selanjutnya dikarakterisasi menggunakan UV-Vis RS, FTIR, XRD, SEM, dan TEM. Hasil karakterisasi TEM dari nanobimetal oksida BiFeO3 menunjukkan morfologi spherical dan cenderung beraglomerasi. Hasil karakterisasi TEM dari nanobimetal oksida BiFeO3 memiliki struktur kristal rhombhohedral dengan rata-rata ukuran kristal sebesar 14, 55 nm. Selanjutnya hasil karakterisasi UV-Vis DRS dari nanopartikel Bi2O3, nanopartikel Fe2O3, dan nanobimetal oksida BiFeO3 memiliki nilai energi bandgap berturut-turut 2,87 eV, 2,11 eV, dan 2,00 eV. Aktivitas fotokatalitik nanobimetal oksida BiFeO3 dalam mendegradasi methylene blue lebih baik dibandingkan dengan nanopartikel Bi2O3 dan nanopartikel Fe2O3 dengan persen degradasi berturut0turut sebesar 94,04 %, 67,11 %, dan 80,44 %. Kinetika fotodegradasi terhadap methylene blue menggunakan fotokatalis BiFeO3 mengikuti kinetika reaksi orde pseudo 1.

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In this research, Bi2O3 nanoparticles, Fe2O3 nanoparticles, and BiFeO3 nanobimetallic oxide have been successfully synthesized using green synthesis method with okra leaf extract. The content of secondary metabolites contained in okra leaf extracts such as alkaloids is used as a hydrolyzing agent (weak base source -OH), while saponins and flavonoids are used as stabilizing agents (capping agents). The results of the synthesis of BiFeO3 nanobimetallic oxide were then characterized using UV-Vis RS, FTIR, XRD, SEM, and TEM. The results of TEM characterization of BiFeO3 nanobimetallic oxide show spherical morphology and tend to agglomerate. The results of TEM characterization of BiFeO3 nanobimetallic oxide have a rhombhohedral crystal structure with an average crystal size of 14.55 nm. Furthermore, the results of UV-Vis DRS characterization from Bi2O3 nanoparticles, Fe2O3 nanoparticles, and BiFeO3 nanobimetallic oxide have bandgap energy values respectively 2.87 eV, 2.11 eV and 2.00 eV. The photocatalytic activity of BiFeO3 nanobimetallic oxide in degrading methylene blue is better than that of Bi2O3 nanoparticles and Fe2O3 nanoparticles with percent degradation of 94.04%, 67.11%, and 80.44%, respectively. The kinetics of photodegradation against methylene blue using BiFeO3 photocatalysts follow the kinetics of first-order pseudo reaction.