

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 berturut-turut 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.