SINTESIS Mn, N-*BIDOPED* TiO_2/ZrO_2 SEBAGAI FOTOKATALIS RESPONSIF SINAR TAMPAK PADA FOTODEGRADASI METILEN BIRU

Fatkhurizkia Annisafitri
18/427617/PA/18577

INTISARI

Sintesis Mn, N-*bidoped* TiO_2/ZrO_2 sebagai fotokatalis responsif sinar tampak pada fotodegradasi metilen biru telah dilakukan. Pengaruh konsentrasi dopan mangan dan suhu kalsinasi terhadap karakter kristal dan aktivitas fotokatalitik material Mn, N-bidoped TiO_2/ZrO_2 dipelajari pada penelitian ini. Proses sintesis dilakukan dengan menggunakan metode sol-gel dan diawali dengan membuat prekursor TiO_2 dari TTIP dan etanol, kemudian direaksikan dengan ZrO_2, urea, dan dopan $MnCl_2.4H_2O$ dengan variasi konsentrasi 2, 4, 6, 8, dan 10 % (b/b). Material hasil sintesis dikalsinasi dengan suhu 500, 700, dan 900 ^oC dan dikarakterisasi menggunakan instrumen *Fourier Transform Infrared Specthrophotometer* (FT-IR), *Specular Reflectance UV-Visible Spectrophotometer* (SR-UV), *X-Ray Diffractometer* (XRD), *dan Scanning Electron Microscope - Energy Dispersive X-Ray* (SEM-EDX). Uji fotokatalitik dilakukan pada larutan metilen biru selama 15, 30, 45, 60, 75, 90, 105, dan 120 menit.

Hasil penelitian menunjukkan bahwa penambahan dopan Mn dan N menggeser tepi serapan fotokatalis ke daerah sinar tampak, dan menurunkan nilai energi celah pita dari material sampai pada kondisi optimum. Semakin tinggi suhu kalsinasi, terjadi peningkatan ukuran kristal, pengurangan kandungan OH, dan perubahan fasa kristal TiO_2 dari anatas menjadi rutil. Nilai energi celah pita pada kondisi optimum diperoleh 2,70 eV ketika dilakukan penambahan dopan Mn 6 % (b/b). Aktivitas fotokatalitik akan meningkat seiring dengan kenaikan penambahan dopan Mn sampai pada kondisi optimum. Pada kondisi optimum, material 6 % Mn, N-*bidoped* TiO_2/ZrO_2 500 ^oC dapat mendegradasi 69,92 % larutan metilen biru 4 ppm selama 120 menit dengan nilai k_{obs} sebesar 0,992 x 10^{-2} ppm/menit.

Kata kunci: fotodegradasi, metilen biru, titanium dioksida, zirkonium dioksida

SYNTHESIS OF Mn, N-BIDOPED TiO_2/ZrO_2 *AS VISIBLE-LIGHT RESPONSIVE PHOTOCATALYST IN METHYLENE BLUE PHOTODEGRADATION*

Fatkhurizkia Annisafitri
18/427617/PA/18577

ABSTRACT

The synthesis of Mn, N-bidoped TiO_2/ZrO_2 as a visible-light-responsive photocatalyst for the photodegradation of methylene blue has been conducted. This study investigates the influence of manganese dopant concentration and calcination temperature on the crystal characteristics and photocatalytic activity of Mn, N- bidoped TiO_2/ZrO_2 materials. The synthesis process was carried out using the sol-gel method, starting with the preparation of the TiO_2 precursor from TTIP and ethanol, which was subsequently reacted with ZrO_2, urea, and the dopant $MnCl_2.4H_2O$ at different concentrations of 2, 4, 6, 8, and 10 % (w/w). The synthesized materials were calcined at temperatures of 500, 700, and 900 °C and characterized using using Fourier Transform Infrared Spectrophotometer (FT-IR), Specular Reflectance UV-Visible Spectrophotometer (SR-UV), X-Ray Diffractometer (XRD), and Scanning Electron Microscope-Energy Dispersive X-Ray (SEM-EDX). The photocatalyst was contacted with a methylene blue solution for 15, 30, 45, 60, 75, 90, 105, and 120 minutes.

The results showed that the addition of Mn and N dopants shifts the absorption edge of the photocatalyst to the visible light region and reduces the bandgap energy of the material to an optimal level. Higher calcination temperatures increase crystal size, reduce OH content, and cause a phase transition in TiO_2 from anatase to rutile. The optimal bandgap energy value obtained was 2.70 eV with the addition of 6 % Mn (w/w). Photocatalytic activity increases with higher Mn dopant concentrations up to the optimal condition. Under optimal conditions, the 6 % Mn, N- bidoped TiO_2/ZrO_2 material calcined at 500 °C was able to degrade 69.92 % of a 4 ppm methylene blue solution within 120 minutes, with a k_{obs} value of 0.992 x 10^{-2} ppm/min.

Keywords: methylene blue, photodegradation, titanium dioxide, zirconium dioxide