

## SINTESIS Co-DOPED ZrO<sub>2</sub> SEBAGAI MODEL FOTOKATALIS RESPONSIF SINAR TAMPAK DENGAN VARIASI KONSENTRASI Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O DAN SUHU KALSINASI

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### INTISARI

Sintesis Co-doped ZrO<sub>2</sub> sebagai model fotokatalis responsif sinar tampak dengan variasi konsentrasi Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O dan suhu kalsinasi telah dilakukan. Penelitian ini bertujuan untuk melakukan sintesis Co-doped ZrO<sub>2</sub> sebagai model fotokatalis responsif sinar tampak dan memperoleh pengaruh variasi konsentrasi dopan Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O dan suhu kalsinasi terhadap karakter Co-doped ZrO<sub>2</sub>. Penelitian diawali dengan sintesis ZrO<sub>2</sub> dan Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O konsentrasi 1, 3, 5, 7 dan 9% (b/b) dengan metode refluks, kemudian material yang diperoleh dikalsinasi pada suhu 500, 600, 700, 800, 900, dan 1000 °C selama 4 jam sehingga diperoleh serbuk Co-doped ZrO<sub>2</sub>. Hasil sintesis dikarakterisasi dengan X-Ray Diffractometer (XRD), Scanning Electron Microscope-Energy Dispersive X-Ray (SEM-EDX), Fourier Transform Infrared (FTIR), dan spektrofotometer Specular Reflectance UV-Vis (SR-UV).

Hasil karakterisasi menggunakan XRD menunjukkan bahwa sampel hasil sintesis didominasi Co-doped ZrO<sub>2</sub> fase monoklinik dengan ukuran kristal sekitar 45,70-74,82 nm. Karakterisasi menggunakan EDX membuktikan bahwa dopan Co telah berhasil terdoping ke permukaan ZrO<sub>2</sub> dengan komposisi sebesar 0,26% yang ditandai dengan penurunan intensitas serapan spektra FTIR pada bilangan gelombang 400-700 cm<sup>-1</sup> karena terganggunya kestabilan ikatan Zr-O-Zr. Berdasarkan karakterisasi menggunakan SR-UV, Co-doped ZrO<sub>2</sub> hasil sintesis memiliki rentang nilai E<sub>g</sub> sebesar 2,85-3,28 eV dengan panjang gelombang sekitar 377,87-434,80 nm. Sampel Co-doped ZrO<sub>2</sub> diketahui memiliki responsivitas yang optimum terhadap sinar tampak dengan penambahan konsentrasi Co 3% pada suhu kalsinasi 900 °C.

Kata Kunci : Co-doped ZrO<sub>2</sub>, konsentrasi dopan, fotokatalis, metode refluks, suhu kalsinasi

## **SYNTHESIS OF Co-DOPED ZrO<sub>2</sub> AS A MODEL OF VISIBLE LIGHT RESPONSIVE PHOTOCATALYST WITH VARIOUS CONCENTRATIONS OF Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O AND CALCINATION TEMPERATURES**

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### **ABSTRACT**

Synthesis of Co-doped ZrO<sub>2</sub> as a model of visible light responsive photocatalyst with various concentrations of Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O and calcination temperatures have been performed. This research aims to synthesize Co-doped ZrO<sub>2</sub> as a model of visible light responsive photocatalyst and to obtain the effect of various concentrations of dopant Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O and calcination temperatures on Co-doped ZrO<sub>2</sub> character. The research was initiated with the synthesis of ZrO<sub>2</sub> and various concentrations of 1, 3, 5, 7 and 9% (w/w) Co(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O by reflux method, then the obtained materials were calcined at 500, 600, 700, 800, 900, and 1000 °C for 4 hours to obtain Co-doped ZrO<sub>2</sub> powder. The synthesis results were characterized with X-Ray Diffractometer (XRD), Scanning Electron Microscope-Energy Dispersive X-Ray (SEM-EDX), Fourier Transform Infrared (FTIR), and Specular Reflectance UV-Vis (SR-UV) spectrophotometer.

The characterization results using XRD showed that the synthesized sample was dominated by the monoclinic phase of Co-doped ZrO<sub>2</sub> with the crystal size about 45.70-74.82 nm. Characterization using EDX proves that Co dopant has been successfully doped to ZrO<sub>2</sub> surface with a composition of 0.26% which is characterized by a decrease in the absorption intensity of FTIR spectra at wave numbers 400-700 cm<sup>-1</sup> due to disruption the stability of Zr-O-Zr bonds. Based on the characterization using SR-UV, the synthesized Co-doped ZrO<sub>2</sub> has an E<sub>g</sub> value range of 2.85-3.28 eV with a wavelength of around 377.87-434.80 nm. Co-doped ZrO<sub>2</sub> samples were known to have optimum responsiveness to visible light with the addition of Co concentration of 3% at a calcination temperature of 900 °C.

**Keywords :** Calcination temperature, Co-doped ZrO<sub>2</sub>, dopant concentrations, photocatalyst, reflux method