

## INTISARI

### Karakterisasi dan Analisa Gugus Fungsi pada *Magnetic Nanoparticles* (MNPs) *Cobalt Nickel Ferrite* ( $\text{Co}_{0,5}\text{Ni}_{0,5}\text{Fe}_2\text{O}_4$ ) yang Dienkapsulasi dengan Silika ( $\text{SiO}_2$ )

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Nanopartikel  $\text{Co}_{0,5}\text{Ni}_{0,5}\text{Fe}_2\text{O}_4$  telah berhasil disintesis dengan menggunakan metode kopresipitasi dan dienkapsulasi dengan prekursor natrium silikat ( $\text{Na}_2\text{SiO}_3$ ) dengan variasi konsentrasi 50%, 30%, 20%, 10% dan 5%. Hasil dari *X-Ray Diffraction* (XRD) menunjukkan adanya fasa spinel ferit pada nanopartikel  $\text{Co}_{0,5}\text{Ni}_{0,5}\text{Fe}_2\text{O}_4$  dengan ukuran kristalit ( $4,2\pm 0,03$ ) nm. Setelah dilakukan enkapsulasi natrium silikat menunjukkan adanya fasa baru  $\text{SiO}_2$  dan ukuran kristalit menjadi ( $3,8\pm 0,01$ ) nm. Hasil *Transmission Electron Microscopy* (TEM) menunjukkan aglomerasi dari nanopartikel berkurang. Analisis gugus fungsi dilakukan menggunakan *Fourier Transform Infra Red* (FTIR). Spektrum FTIR menunjukkan adanya ikatan vibrasi  $M_{\text{oct}}\text{-O}$  di sekitar  $385\text{-}450\text{ cm}^{-1}$  dan  $M_{\text{tet}}\text{-O}$  disekitar  $411\text{-}600\text{ cm}^{-1}$  yang mengindikasikan adanya fasa kubik spinel ferit pada sampel. Setelah dilakukan enkapsulasi natrium silikat muncul ikatan vibrasi baru khas silika berupa  $\text{Si-O-Si}$  ( $447,5\text{ cm}^{-1}$ ),  $\text{Si-OH}$  ( $964,4\text{ cm}^{-1}$ ) dan  $\text{Si-O-Si}_{\text{asymmetric}}$  ( $1087,8\text{ cm}^{-1}$ ) yang menunjukkan adanya interaksi antara silika dengan nanopartikel  $\text{Co}_{0,5}\text{Ni}_{0,5}\text{Fe}_2\text{O}_4$ .

**Kata kunci:** Nanopartikel Magnetik *Cobalt Nickel Ferrite* ( $\text{Co}_{0,5}\text{Ni}_{0,5}\text{Fe}_2\text{O}_4$ ), Kopresipitasi, Enkapsulasi, Natrium Silikat ( $\text{Na}_2\text{SiO}_3$ )

## ABSTRACT

### Characterization and Functional Group Analysis of Silica (SiO<sub>2</sub>) Encapsulated Cobalt Nickel Ferrite (Co<sub>0,5</sub>Ni<sub>0,5</sub>Fe<sub>2</sub>O<sub>4</sub>) Magnetic Nanoparticles (MNPs)

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Cobalt Nickel Ferrite nanoparticles has been successfully synthesized using coprecipitation method and encapsulated by Sodium Silicate Solution (Na<sub>2</sub>SiO<sub>3</sub>) with varying concentrations of 50%, 30%, 20%, 10% and 5%. Diffraction (XRD) patterns showed that nanoparticles contained Co<sub>0,5</sub>Ni<sub>0,5</sub>Fe<sub>2</sub>O<sub>4</sub> spinel ferrite with crystallites size of (4,2±0,03) nm. After sodium silicate encapsulation, the new phase of SiO<sub>2</sub> appeared and the crystallites size became (3,8±0,01) nm. Transmission Electron Microscopy (TEM) showed decreasing agglomeration after sodium silicate encapsulation. Bonding analysis of functional groups was performed using Fourier Transform Infra Red (FTIR). FTIR spectra showed that bond vibration of M<sub>oct</sub>-O is around 385-450 cm<sup>-1</sup> and M<sub>tet</sub>-O is around 411-600 cm<sup>-1</sup> which indicate presence of cubic spinel ferrite in the sample. After sodium silicate encapsulation, there are a new bond vibration typical of silica like Si-O-Si (447,5 cm<sup>-1</sup>), Si-OH (964,4 cm<sup>-1</sup>) and Si-O-Si<sub>asymmetric</sub> (1087,8 cm<sup>-1</sup>) which showed the interaction between sodium silicate and nanoparticles Co<sub>0,5</sub>Ni<sub>0,5</sub>Fe<sub>2</sub>O<sub>4</sub>.

**Keywords:** Magnetic Nanoparticles Cobalt Nickel Ferrite (Co<sub>0,5</sub>Ni<sub>0,5</sub>Fe<sub>2</sub>O<sub>4</sub>), Coprecipitation, Encapsulation, Sodium Silicate Solution (Na<sub>2</sub>SiO<sub>3</sub>)