

ABSTRAK

GREEN-SYNTHESIS $\text{Fe}_3\text{O}_4/\text{CHITOSAN}$ MENGGUNAKAN EKSTRAK MORINGA OLIVERA DAN APLIKASINYA AEBAGAI LABEL MAGNETIK PADA SENSOR GIANT MAGNETORESISTANCE

Oleh

Nina Alif Flour Rinda

20/462120/PA/20092

Penelitian tentang label magnetik dalam teknologi *biosensing giant magnetoresistance* (GMR) dilakukan untuk meninjau cara kerja pada sensor dengan mengkaji karakteristik GMR setelah penambahan nanopartikel *green-synthesized $\text{Fe}_3\text{O}_4/\text{chitosan}$* . Penelitian ini dilakukan dengan melakukan variasi konsentrasi sampel Fe_3O_4 , $\text{Fe}_3\text{O}_4/\text{chitosan}$ 4:2 dan 4:4 dengan variasi konsentrasi 5, 10, 15, 20, dan 25 mg/mL saat uji coba pada *chip* GMR Partikel Fe_3O_4 dan $\text{Fe}_3\text{O}_4/\text{chitosan}$ dikarakterisasi dengan *X-Ray Diffraction* (XRD), *vibrating sample magnetometer* (VSM), dan *fourier transform infra-red* (FTIR), untuk melihat ukuran kristal, gugus fungsi, dan sifat kemagnetan pada sampel. Hasil dari analisa XRD menunjukkan bahwa Fe_3O_4 , $\text{Fe}_3\text{O}_4/\text{chitosan}$ memiliki struktur spinel kubik 22 dan 35 nm . Analisa VSM menunjukkan karakteristik material mendekati superparamagnetik. Analisa FTIR menunjukkan terbentuknya nanopartikel $\text{Fe}_3\text{O}_4/\text{chitosan}$ dengan munculnya gugus fungsi pada Fe-O (bilangan gelombang 586-601 cm^{-1}) dan C-H (bilangan gelombang 2920 cm^{-1}).

Dengan adanya penelitian ini, diharapkan $\text{Fe}_3\text{O}_4/\text{chitosan}$ dapat menjadi label magnetik yang lebih baik untuk sensor GMR dalam aplikasinya sebagai biosensor.

Kata Kunci: $\text{Fe}_3\text{O}_4/\text{chitosan}$, *Giant Magnetoresistance*, GMR komersial, *Green Synthesized*, Label Magnetik

ABSTRACT

GREEN-SYNTHESIZED Fe_3O_4 /CHITOSAN COMPOSITE NANOPARTICLES USING MORINGA OLEIVERA EXTRACT AS MAGNETIC LABELS FOR GIANT MAGNETORESISTANCE SENSORS

by

Nina Alif Flour Rinda

20/462120/PA/20092

This research on magnetic labeling in giant magnetoresistance (GMR) biosensing technology was conducted to investigate the sensor's working mechanism by examining the GMR characteristics after the addition of green-synthesized Fe_3O_4 /chitosan nanoparticles. This study was carried out using variations in sample concentration ratios of Fe_3O_4 , Fe_3O_4 /chitosan 4:2, and 4:4, with concentrations of 5, 10, 15, 20, and 25 mg/mL during testing on the GMR chip. Fe_3O_4 and Fe_3O_4 /chitosan particles were characterized using X-Ray Diffraction (XRD), Vibrating Sample Magnetometer (VSM), and Fourier Transform Infrared Spectroscopy (FTIR) to determine crystal size, functional groups, and magnetic properties. The XRD analysis showed that Fe_3O_4 and Fe_3O_4 /chitosan possessed a cubic spinel structure with crystal sizes of 22 and 35 nm. The VSM analysis indicated that the material exhibited near-superparamagnetic characteristics. The FTIR analysis confirmed the formation of Fe_3O_4 /chitosan nanoparticles, as shown by the appearance of functional groups Fe–O (wavenumber 586–601 cm^{-1}) and C–H (wavenumber 2920 cm^{-1}).

This research suggests that Fe_3O_4 /chitosan has the potential to serve as an improved magnetic label for GMR sensors in biosensor applications.

Keywords: Fe_3O_4 /chitosan, Giant Magnetoresistance, commercial GMR, Green Synthesis, Magnetic Label