World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:18, No:11, 2024

Potential Antibacterial Applications and Synthesis, Structural, Magnetic, Optical, and Dielectric Characterization of Nickel-Substituted Cobalt Ferrite Nanoparticles

Authors : Tesfay Gebremichael Reda

Abstract : Nanoparticle technology is fast progressing and is being employed in innumerable medical applications. At this time, the public's health is seriously threatened by the rise of bacterial strains resistant to several medications. Metal nanoparticles are a potential alternate approach for tackling this global concern, and this is the main focus of this study. The citrate precursor sol-gel synthesis method was used to synthesize the, $Ni_x Co_{(1-x)} Fe_2 O_4$, (where x = 0.0:0.2:1.0) nanoparticle. XRD identified the development of the cubic crystal structure to have a preferential orientation along (311), and the average particle size was found to be 29-38 nm. The average crystallizes assessed with ImageJ software and origin 22 of the SEM are nearly identical to the XRD results. In the created NCF NPs, the FT-IR spectroscopy reveals structural examinations and the redistribution of cations between octahedral (505-428 cm-1) and tetrahedral (653-603 cm-1) locales. Finally, the decrease of coercive fields HC, 2384 Oe to 241.93 Oe replacement of Co^{2}+ cation with Ni^{2}+. Band gap energy rises as Ni concentration increases, which may be attributed to the fact that the ionic radii of Ni^{2}+ ions are smaller than that of Co^{2}+ ions, which results in a strong electrostatic interaction. On the contrary, except at x = 0.4, the dielectric constant decreases as the nickel concentration increases. According to the findings of this research work, nanoparticles composed of $Ni_{0.4} Co_{0.4} Fe_2 O_4$ have demonstrated a promising value against S. aureus and E. coli, and it suggests a proposed model for their potential use as a new source of antibacterial agents.

Keywords : antimicrobial, band gap, citrate precursor, dielectric, nanoparticle
Conference Title : ICMSNAC 2024 : International Conference on Materials Science, Nanoscience and Applied Chemistry
Conference Location : Reykjavik, Iceland
Conference Dates : November 18-19, 2024