GREEN FABRICATION OF IRON OXIDE NANORODS FROMAPRICOT HIBISCUS: STRUCTURAL, OPTICAL AND MORPHOLOGICAL ANALYSIS

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ABSTRACT

This study presents the eco-friendly synthesis of Fe_2O_3 nanoparticles using Apricot Hibiscus as a natural reducing and stabilizing agent. X-ray diffraction (XRD) analysis confirms the formation of a highly crystalline cubic iron oxide structure with a crystallite size of 8 nm. Fourier-transform infrared (FTIR) spectroscopy identifies functional groups in Apricot Hibiscus that contribute to the stability of the nanoparticles. These Fe_2O_3 nanoparticles demonstrate promising properties for applications such as photocatalytic degradation of pollutants, antibacterial coatings, and solar energy conversion. The green synthesis method underscores the potential of Fe_2O_3 nanoparticles for sustainable and multifunctional applications in both environmental and biomedical fields.

KEYWORDS

FeO Nanoparticles,Apricot Hibiscus, Nanotechnology, Green Synthesis, XRD, FTIR.

INTRODUCTION

Iron oxide nanoparticles are particles with diameters between about 1 and 100 nm. The two main forms are composed of magnetite and its oxidized form maghemite (γ-Fe_2O_3).Application of iron oxide nanoparticles including high-sensitivity biomolecular, magnetic particle imaging, magnetic fluid hyperthermia, separation of biomolecules, and targeted drug and gene delivery for medical diagnosis and therapeutics. These applications require coating of the nanoparticles by agents such as long-chain, fatty acids, alkyl substituted amines, and diols[1]. They have been used in formulations for supplementation. Iron oxide nanoparticles (IONPs) are widely studied due to their magnetic, catalytic, and biomedical properties. Apricot Hibiscus contains higher levels of flavonoids, polyphenols, and carotenoids, which serve as stronger reducing and stabilizing agents for iron oxide nanoparticle. The enhanced antioxidant activity leads to better control over nanoparticle size and crystallinity[2]. The Apricot coloured petals indicate a higher carotenoid concentration, which can act as an additional capping agent. This enhances nanoparticle stability, prevents agglomeration, and improves dispersibility[3].

MATERIALS AND METHODS

Apricot Hibiscus Flowers were collected from a local garden, washed several times with tap water and rinsed with distilled water to remove dust particles.The apricot hibiscus extract was obtained by cutting the washed flower into 1-inch pieces and mixing it with distilled water by heating 60° C on magnetic stirrer at 200 rpm and leaving it overnight under ambient condition and filtering the extract using Whatman filter paper. 0.1M of Ferric Chloride salt stirred in 100 ml of distilled water on magnetic stirrer at 400 rpm for 30 minutes to form Ferric Chloride solution. 10 ml of apricot hibiscus extract was mixed with 90 ml of Ferric Chloride solution and stirred continuously for two hours at 400 rpm.The pH of the solution was maintained at 12 by dropwise addition of NaCl. The formation of iron oxide nanoparticles was marked by the appearance of intense black precipitate. The precipitate was washed with ethanol and distilled water. After washing, the collected iron oxide nano powder was dried in oven at 60° C for one hours.

RESULT AND DISCUSSION

The X Ray diffraction (XRD) pattern of the prepared iron oxide nanorods was studied by using X Ray Diffractometer.Figure 1 represents Xray Diffraction of Iron Oxide Nanorods. The structural characterization of Iron oxide nanorods were carried out by XRD method,2θ=31.6975°along (2 3 3) plane, 2θ=45.4148° along (4 0 0) plane,2θ=75.2351° along (5 3 3) plane which belongs to Iron Oxide Nanorods [4]. The average crystalline was found to be 8 nm using Debye Scherer formula [5]. Table 1 represents Average crystalline size of Iron oxide nanorods.Table 1 represents average crystalline size of Iron Oxide Nanorods.

Sample	2θ (degree)	FWHM (radian)	Crystalline Size D (nm)	Average crystalline size D (nm)
FeO	31.6975	0.1181	12.25772	8.17334
	45.4148	0.1574	9.19717	
	75.2351	0.4723	3.06520	

Table 1: Average crystalline size of Iron Oxide Nanorods

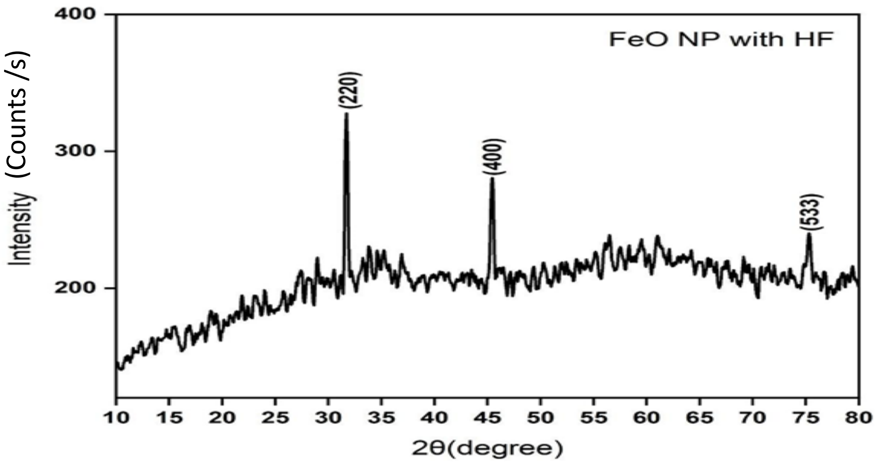

Figure 1 : Xray Diffraction spectrum of Iron Oxide Nanorods

FOURIER TRANSFORM INFRARED SPECTROSCOPY

Sample was scanned in the wavelength ranging between 3000 and 500 cm $^{-1.}$ FTIR spectrum for hibiscus extracts displayed several strong bands around 408.91, 470.63, 516.92, 540.07, 671.23cm^{-1}Figure2 represents analysis of IronOxide Nanorods.Strong band position at 408.91 cm^{-1} may be attributed to the stretching mode of Fe and O stretches[6].

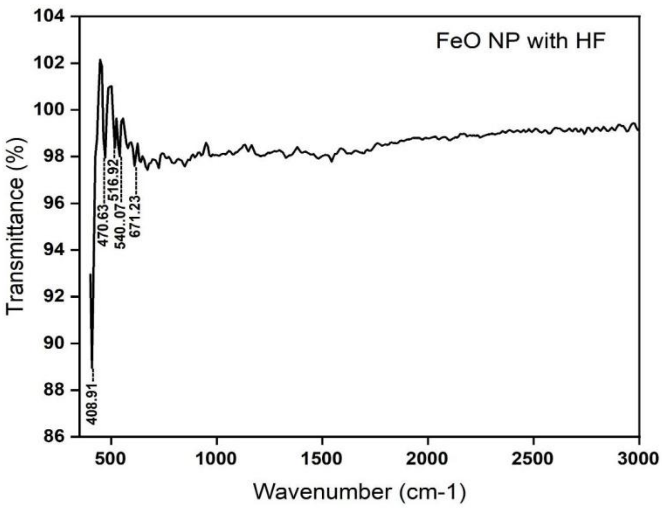

Figure 2: FTIR Analysis of Iron Oxide Nanorods

CONCLUSION

Iron oxide Nanorods was synthesized using Apricot Hibiscus as a sustainable precursor. The XRD Diffraction showed that green synthesis Iron Oxide Nanorods exhibits rod shape and the average particle size was found to be 46 nm using Scherer formula and the crystalline size was found to be 8 nm. FTIR confirms the absorbed band at 540.07 for the hibiscus extract corresponds to Fe – O stretches. FTIR spectroscopy identifies the functional groups present, indicating interactions between iron oxide and bioactive compounds from Apricot Hibiscus, which may enhance stability and surface properties. The biofunctional properties from Apricot Hibiscus for antibacterial coatings, drug delivery, and biosensing.

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