**Abstract**

 Iron oxide nanoparticles have been widely investigated due to their magnetic properties and its potential applications in the area of bioscience and medicine. **The Iron oxide has several advantages such as it has better oxidation stability, compatibility in the non aqueous solution, chemical inertness and non toxicity [1]. The adsorption nature of iron oxide has the significant attention in the removal of inorganic chemical pollutants in waste water and underground water [2]. The synthesis of magnetic nanoparticles are done using several physical and chemical methods having drawbacks such as defective surface, low production rate, usage of toxic chemicals and hazardous products during synthesis. Green synthesis technique is the** cost effective, **eco friendly method and active organic compounds of plant materials used as the reducing agent instead of toxic compounds. The distinct advantages of the green synthesis technique are to overcome the drawbacks of other conventional and timescale biological synthesis techniques. Plant extract acts as the low capping and stabilizing agent. Iron oxide nanoparticles synthesis was done using different plant extracts [3]. In this study, g**reen synthesis route is the one of the most advantageous routes to synthesize Fe2O3 nanoparticles using beet green extract (BETA VULGARIUS) with precursor as ferric chloride solution in a fixed ratio [4]. The iron oxide nanoparticles were synthesized by taking 0.1M of ferric chloride in 25ml of de-ionized water and 25ml of the aqueous solution of leaf extract of BETA VULGARIUS was added in it and colour change was observed. The synthesized iron oxide nanoparticles are characterized using UV-Vis spectroscopy, X-Ray diffraction (XRD), Fourier Transform infrared spectroscopy (FT-IR), Scanning electron microscopy (SEM), High Resolution Transmission Spectroscopy (HR-TEM) and Vibrating Sample Magnetometer (VSM).

The UV-Vis spectral analysis of iron oxide nanoparticles from beta vulgarius leaf extract after removing the settled sample from the plant matrix solution. The UV-Vis spectral analysis confirms the formation and stability of iron oxide nanoparticles. The spectrum was recorded between the ranges of 200-800nm. The characteristics peak at 234 nm indicates the presences of Fe2O3 nanoparticles [5]. The optical band gap was found to be 5.299 eV. The FT-IR characterization study is performed to identify the ferric ions and organic stabilizing plant compounds which acts as the reducing agent in ferric chloride ions to form the iron oxide nanoparticles. The FT-IR spectrum of iron oxide nanoparticles from beta vulgaris leaf extract recorded in the range 4000-400cm-1. The absorption bands around 3367cm-1 and 1638cm-1 represents O-H stretching vibrations. The characteristic absorption bands observed around 654 cm-1, 606cm-1 and 562 cm-1 indicates the Fe-O stretching, confirms the presence of iron oxide nanoparticles. These bands correspond to the tetrahedral sites of metal-oxygen bonds and the band around 420 cm-1 corresponds to the octahedral sites of metal-oxygen bonds [6]. FT-IR analysis confirms the bio reduction of ferric chloride into iron oxide nanoparticles.XRD analysis confirms the crystalline nature of iron oxide nanoparticles. The characteristic peaks correspond to (121), (122), (201), (210), (123), (132), (221), (042), (124) and (142) planes. All the diffraction patterns are in good agreement with the JCPDS Card no. 89-7047 corresponding to Fe2O3 in orthorhombic geometry. And the average crystallite size is found to be around 21 nm [7].

The morphological studies of synthesized nanoparticles were studied using the SEM and HR-TEM analysis. The SEM and HR-TEM analysis of different magnifications reveals the shape of iron oxide nanoparticles from beta vulgaris leaf extract. SEM analysis shows the distorted orthorhombic shape of iron oxide nanoparticles. The nanoparticles were agglomerated and coagulated in some places may be due to the beet green extract [8]. The particle size was found in the HR-TEM analysis to be around 21 nm which is good agreement with XRD analysis. The elemental composition of synthesized iron oxide nanoparticles were studied using EDAX spectra. It confirms the presence of Fe-O bond composition. The Selected Area Electron Diffraction pattern of synthesized iron oxide nanoparticles derived from beta vulgaris leaf extract. Each ring corresponds to the characteristic planes of XRD pattern. The magnetic behaviour of Iron oxide nanoparticles is studied using the vibrating sample magnetometer [9]. The saturation magnetization, remanent magnetization and coercivity are found to 788.9E-6 emu, 2.24 E-6 emu and 39.524G respectively.