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CHARACTERIZATION OF IRON NANOPARTICLE PREPARATION FROM *PUNICA GRANATUM PEEL*

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ABSTRACT
In the preset study, synthesis iron oxide nanoparticles (Fe_3O_4-NPs) were synthesized using a rapid, single step and completely green biosynthetic method by reduction of ferric chloride solution with *Punica granatum* water extract containing sulphated polysaccharides as amain factor which acts as reducing agent and efficient stabilizer. The structural and properties of the Fe3O4-NPs were investigated by X-ray diffraction, FTIR Fourier transforms infrared spectroscopy and Ultra violates UV. The diameter of iron nanoparticles was predominantly found within the range 15-35 nm.

KEY WORDS: Nanoparticles, Fe3O4-NPs, X-ray, HRBCs, BSA.

INTRODUCTION

Punica granatum[1], is a fruit-bearing deciduous shrub[2] or small tree growing between five and eight meters tall. In the Indian subcontinent's ancient Ayurveda system of medicine, the pomegranate has extensively been used as a source of traditional remedies for thousands of years[3]. In our study we demonstrate the synthesis of ferric nanoparticles using pomegranate Peel of fruit extract (*Punica granatum* L). Pomegranate belongs to the family Punicaceae[4]. A Pomegranate peel has a wide range of potential health benefits. It has been shown to aid in digestion and to help treat certain infections and illnesses. More recently, it has been studied as an appetite suppressant and weight loss aid[5]. Pomegranate leaves contain Tannins, flavones, apgenin, luteolin. They can also be taken in various ways, including teas, pastes and juices [6]. In this paper, the synthesis of irons from copper sulfate ferric chluridsolution was studied using the peel extract of *Punica granatum* as a natural reducing agent. The aim of this work is to preparation the FeNPs by using the Punicagranatum peel extract.

MATERIALS & METHODS

FeNPs were synthesized using the peel extract of pomegranate. The pomegranate peel extract was prepared in water according to the method described previously [7]. For this, peels were air-dried in a vacuum oven at 40°C for 48 h and ground to fine powder; 20 g powdered sample was extracted with 250 ml d.w at room temperature. 0.05M $FeSO_4$ (50 ml) aqueous solution was added to 50 ml peel extract drop wise with continuous stirring. After heating at 80°C for 10 min it was continuously stirred for 4 h at 40°C. The solution was centrifuged at 10,000 rpm, at 4°C for 30 min and pellet was dissolved in distilled water for periodic probe sonication for 5s for 5 min at 30 ±0.5°C. Nano suspension thus obtained was dried in oven at 70°C for 24 h to obtain nanoparticles in powder form for further experiments.

Characterization of FeNPs

Characterization Methods and Instruments

FT-IR spectra of the Fe_3O_4-NPs were recorded in the range 500–4000 nm by (Shimadzu, Tokyo, Japan). The crystalline structure and phase purity of the Fe_3O_4-NPs produced were identified by X-ray diffraction measurement (Shimadzu, Tokyo, Japan).

UV-Vis Spectra Analysis

The reduction of pure Fe^{+3} ions to Fe° was monitored by measuring the UV-Vis spectrum by sampling of aliquots (0. 5 ml) of Fe Nanoparticle solution diluting the sample in 3 ml distilled water. UV-Vis spectral analysis was done by using UV-Vis, at the range of 100 -450 nm and observed the absorption peaks at 240-440 nm regions due to the excitation of surface Plasmon vibrations in the FeNPs solution, which are identical to the characteristics UV-visible spectrum of metallic Iron and it was recorded. Scanning Electron Microscope (SEM) to characterize mean particle size and morphology of Iron oxide nanoparticles, SEM (scanning electron microscope) was performed using Schemadzue SEM machine of 20 KV of accelerating voltage.

RESULTS & DISCUSSION

Ultraviolet-visible spectroscopy (UV-Vis) refers to absorption spectroscopy in the UV-Visible spectral region. This means it uses light in the visible and adjacent (near-UV and near-infrared) ranges. The absorption in the visible range directly affects the change color of the solution. In this region of the electromagnetic spectrum, molecules undergo electronic transitions. The UV Visible spectrum of Fe3O4-NPs in the aqueous pomegranate extract is shown in Figure (1). The two absorption peaks at wavelengths of absorption peaks at 350-450 nm indicate the formation of iron nanoparticles.

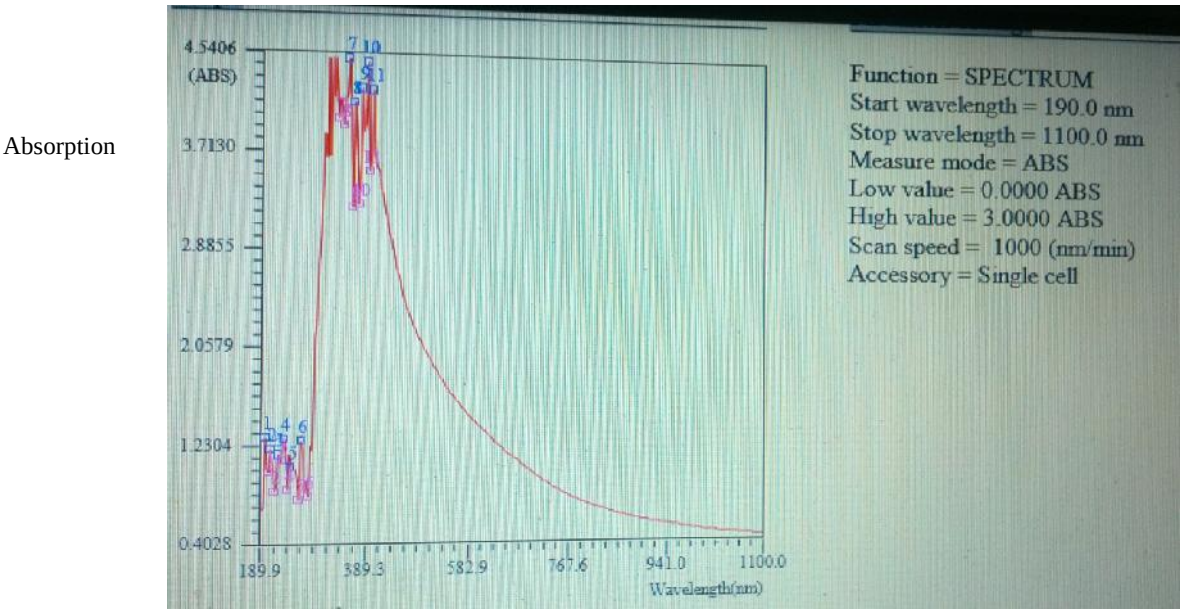


FIGURE 1. The UV-VIS spectrum of Fe_3O_4nanoparticles

To determine the functional groups on *Punica granatum* peel extract and predict their role in the synthesis of Iron nanoparticles, FTIR analysis was performed. The band intensities in different regions of the spectrum for Iron NPs (before and after reaction with Iron Sulfate, respectively) were analyzed and are shown in Figure (2) A, B. There was a shift in the following peaks: 3,346–3,336, 2,920–2,918, 2,355–2,351, 1,643–1,641, 771–769, and 426–422 cm-1. The broad and intense absorption peak at around 3,394cm 21 corresponds to the O–H stretching vibrations of phenols and carboxylic acids. The shift from 3,394 to 3,388 cm-1 may indicate the involvement of O–H functional group in the synthesis of nanoparticles. The peak located at around 2,355 cm21 was attributed to the N–H stretching or the C=O stretching vibrations. The peak shift from 2,355 to 2,351 cm implicated that these groupsmay be involved in the process of nanoparticle synthesis. The peak located at 1,641 cm21 could be assigned to the C=O stretching in carboxyl or C = N bending in theamide group. A shift in this peak (from 1,641 to1,643 cm_{21}) indicated the possible involvement of carboxylor amino groups of the banana extract powder in nanoparticle synthesis The peak at 771 and 760 cm21 corresponds to C–H stretching of aromatic compounds. The formation of Fe3O4 is characterized by two absorption bands at 535 and 307 cm−1 which correspond to the Fe–O bond in magnetite (15) From the FTIR result, the soluble elements present in banana extract could have acted as capping agents preventing the aggregation of nanoparticles in solution,and thus playing a relevant role in their extracellular synthesis and shaping [16].

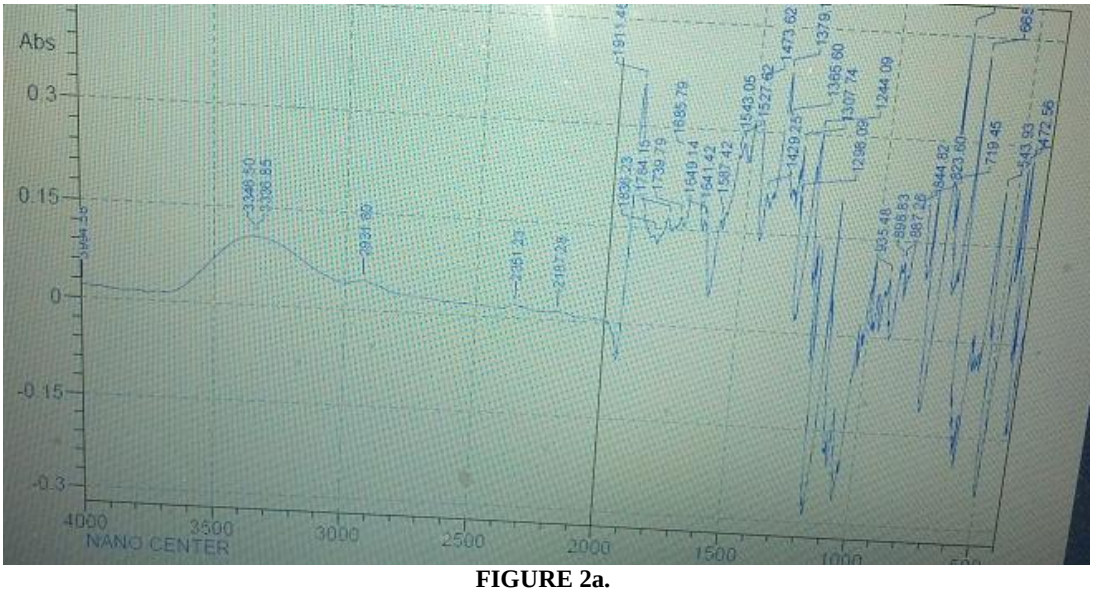
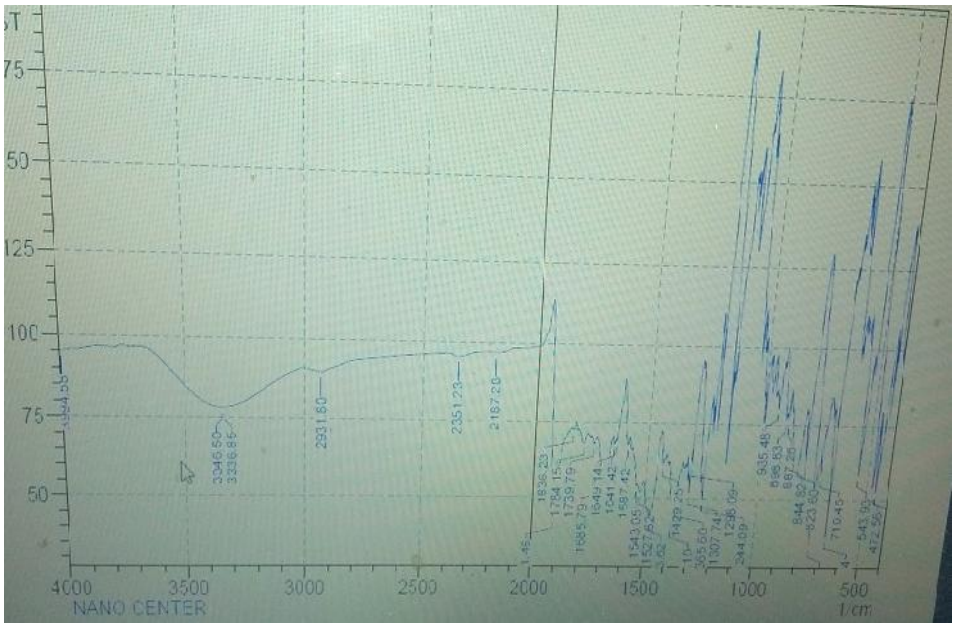


FIGURE 2a.



2b

FIGURE 2: A FT-IR spectrum for the *Punicagranatum* extract powder (A) and Fe3O4-NPs from the biosynthesisreaction (B).

SEM Images of Iron:

SEM analysis results of iron nanoparticles were clearly distinguishable at different enlargements. Iron nanoprticles in the pomegranate peel extract were found to be polydispersed (figure3) and measured in size from 15 to 34 nm.

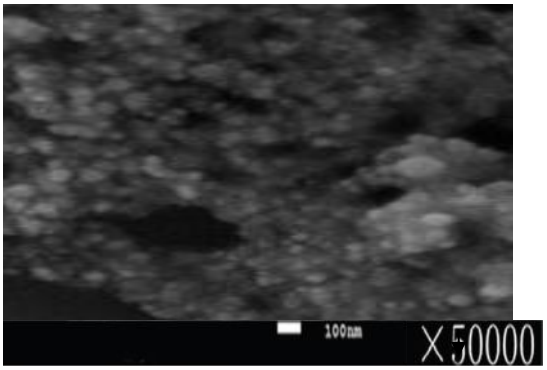


FIGURE 3: SEM image of pomegranate nano particle at 50,000 amplification

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