



Assisted/Facile Green Synthesis of Iron Nanoparticles using Ipomea root Extract and it's Characterization

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Abstract: The undertaken study describes to Green-synthesis of iron Nano particles by Ferrous Sulfate Hepta-hydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) and utilizing the bio components of root extract of Ipomea. Root extract performed as equally reducing and stabilizing agent. The advancement of green processes for the synthesis of NP is unfolding into decisive derivative of nanotechnology. It has various returns such as, ease with which the method can be maximize, effortless and cost effective etc. To identify the compounds dependable for reduction of Iron ions, the functional groups there in Root extract were scrutinized by Fourier Transform Infrared (FTIR) spectroscopy. The Fe Nano-crystallites of middling size particle have been synthesized by rapid, simple and eco-friendly approach. Iron Nano particles were characterized using Scanning Electron Microscopy (SEM) and EDX. The particles obtained in an agglomerated form. The Antibacterial activity showed no significant effect of the FeNP's.

Keywords: Iron Nano particles, *Ipomea*, Green-synthesis, F.T.I.R, Scanning Electron Microscopy (S.E.M), E.D.X.

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1. Introduction

Nanotechnology is thoughtful and regulates the material at sizes between 1 and 100 nm [1]. Nano materials and nano-science contains the capability to tell and regulates the specific atoms and molecules production [2]. All the objects on this universe were prepared with atoms. Important physical properties of nanoparticles are due to Specific surface region, dimension, shape and comparative ratios [3].

Present-day, zero-valent iron (ZVI) has captivated positive thought due to the reduction of nitro composite to respective amide [4] [5]. In addition, nano-scale iron particles (NPs) has turn out to prevail the finest hence the coarse structure just because of its large surface area to volume ratio that could be applicable in fluoride adsorption in addition to high reactivity correlated to have a bulk feature. It acts as an adequate catalyst for reducing dangerous organic mixtures in wastewater [6] [7]. Iron NPs by the use of distinct routes primarily chemical synthesis and biogenesis (green synthesis) has been synthesized [8]. Core issues coupled with chemical synthesis is the formation of hazardous chemicals and new by-products. Synthesis by means of bioprocess produces never hazardous results. The agglomeration constraint for NPs would handle in behalf of being an active bio particle. The critical constraint surface protection that belongs with the formation of iron NPs. Being extremely reactive, the disposition of iron NPs to

structured hydroxide and oxide film weaken their catalytic reactivity for falling bio impurities in wastewater. The valuable association among reactive spot of NPs and contaminants are cut down just because of the dense structure of the support. Herein the study, iron NPs was prepared adopting the green synthesis through *Ipomea* root extract as reducing agent [9] [10].

Plant root extract comprises unique secondary metabolites generally flavonoids, terpenoids phenolic acid and alkaloids. Mentioned mixtures were primarily bound to the reduction of ionic into gross metallic nanoparticles generation. These primary and secondary metabolites were persistently caught up in the redox reaction to synthesize eco-friendly nano-sized particles [11] [12]. *Ipomea* be an herb, in the affiliation with Convolvulaceae and vastly nutritive. The genus is relevant food harvest usually grow in tropical, subtropical and breezy temperate territory. Sweet potato is noticeably lavish in nutrients that include: vitamins, carbohydrate and minerals as well it carry exceptional quality of pro-vitamins A and vitamin C. The poly-phenolic extracts from *Ipomea* roots were identified to display large radical-scavenging response, antimutagenic effect, potential chemo-preventive effect and anti-diabetic effect. A fresh phenolic acid derivative and 4, 5-di-O-cafeoyldaucic acid has been newly screened and separated through HPLC and NMR within the root extracts of *Ipomea* gathered in Peru. On behalf of sweet potato roots, numerous researches have been reported on the task of phenolic substances in

darkening of the treated foodstuffs. Despite, inadequate knowledge is accessible on combination and bio-functioning of phenolic substances in the roots of U.S. *Ipomea* [13] [14] [15]. Five most important phenolic chemicals were acknowledged as CA, ChA, 4, 5-di-CQA, 3, 5-di-CQA, and 3, 4-di-CQA. Chlorogenic acid was maximum in root extract.

2. Material and Method

Ferrous Sulfate Hepta-hydrate was obtained from Merck, Pakistan. De-ionized water used throughout experiment. *Ipomea* root was used in this synthesis. It was provided by PCSIR, Karachi. All glassware were washed with de-ionized water and then dried in hot oven. The crystallization of FeNP's was measured on SEM Model No. JSM 6380LA with EDX Unit Model No. EX-54175JMU. F.T.I.R was carried on IR-Prestige-21 Shimaduz FTIR spectrophotometer.

2.1 Preparation of Plant Extract

20 grams roots of *Ipomea* plant root were taken for preparation of Root extract. At the start dust was disinterested from the roots with tape water, washed numerous times with de-ionized water to clear away the prevailing dust particles and other remaining impurities. After that roots were put on the blank papers for air dried for a week [16]. The roots were crushed into a fine powder and placed in open air for a day air drying. Then, dried 10g roots were warmed in 100ml distilled water at 80°C for 20 minutes at water bath [17]. Subsequently that solution was filtered using filter paper (watt man-40). The p^H of the root extract was 5.5.

2.2 Green Synthesis of Iron Nanoparticles

0.01M solution of Ferrous Sulfate Hepta-hydrate was prepared and used for the Transition Metal Nanoparticles Synthesis. 25.00ml of 0.01M $FeSO_4 \cdot 7H_2O$ solution was put into conical flask. Add drop wised 25ml of root extract through burette. The reaction between $FeSO_4 \cdot 7H_2O$ and *Ipomea* root extract was carried out on Hot plate with magnetic stirrer for 15 minutes at 300 rpm and the temperature was set to 75°C [18].

2.3 Separation of Iron Nanoparticles

After the completing of reaction, centrifuge the solution at 10,000 rpm for 10 min at 5°C temperature. Residue was washing with de-ionized water and diluted Ethanol solution. Finally got the crystal and forward it for Characterization.

3. Result and Discussion

Color of the chemical change from pale yellow to blackish green such a thing was the indication of the formation of FeNP's.

3.1 SEM and EDX Result

The shape of synthesized Iron Nanoparticles was analyzed on SEM. Figure 1 and Figure 2 illustrate the details of surface morphological and nano-structural examination by taking on SEM and EDX images. The outcome Figure 1 showed circled iron nanoparticles of distinct sizes and shapes. Comprehensively, the synthesized FeNP's are spherical in shape with high agglomeration. EDX analysis convey a qualitative along with quantitative position of the elements that could be participate in the creation of nanoparticles. The elemental information of the synthesized nanoparticles for the FeNP's, showing a higher count

at 0.65 keV due to the iron, validate the development of iron nano-particles Figure 2. Typically, metallic iron nano-crystals illustrate a characteristic optical absorption peak in the region of 0.65 keV due to their surface plasmon resonance Scanning. The elemental scrutiny of iron nanoparticles confirm in Figure 2 revealed the top percentage of iron (Fe) followed by C, O, Si, S, K and Ca. A small number of other elements like Al and Ti were too there in bit quantity [19].

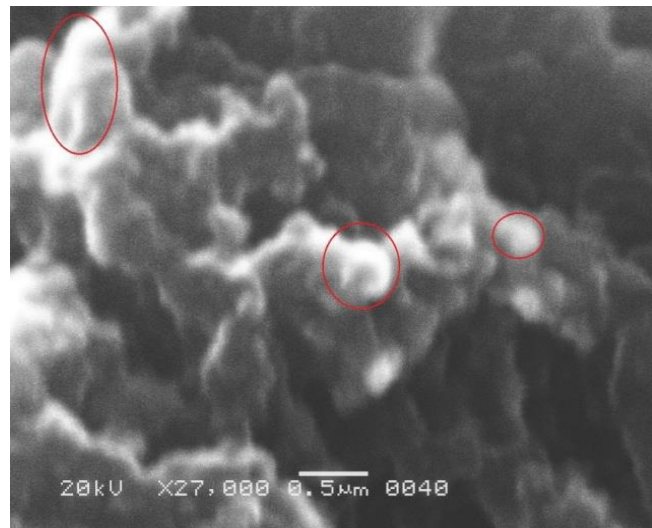


Figure 1 SEM analysis of the root extract and the synthesized FeNP's

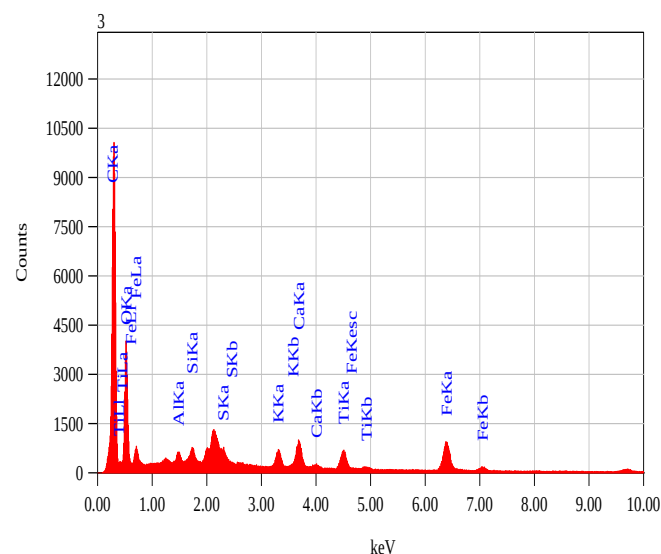


Figure 2 SEM EDX analysis for root extract and the synthesized FeNP's

3.2 FTIR Result

The root extract and the synthesized FeNP's were observed using FTIR as shown in Figure 3 and Figure 4. FTIR was carry through to categorize feasible biological macromolecules liable for the reduction of FeNP's. Comparison of FTIR Spectra of *Ipomea* root extract and newly synthesized iron nanoparticles revealed that the complex has been formed between the metal and the carbon-carbon double bond [20]. Absence of bending & stretching peaks of C=C at 619, 997, 1107, 1186, 1137 and 1417 cm^{-1} confirm our assumption. The peaks at 1000-1200 cm^{-1} directs C-O single bond.

3.3 Anti-bacterial Activity

To demonstrate the behavior of FeNP's in Antimicrobial activity, the synthesized FeNP's were investigated on various bacteria. In the study, spread plate method was performed against pathogenic bacteria. *Pseudomonas sp* and *Staphylococcus aureus* (Gram-positive) were used to study the performance of the FeNPs' against the bacteria. The zone of inhibition which clearly shows that the green synthesized FeNP's has the minimum zone of Inhibition [21]. It was found to be 0.2 mm for *S. aureus* and 0.3 mm for *Pseudomonas sp*. In this study, the result showed that there was no substantial effect on performing Antibacterial Activities of the iron nanoparticles using *Ipomea* root extract.

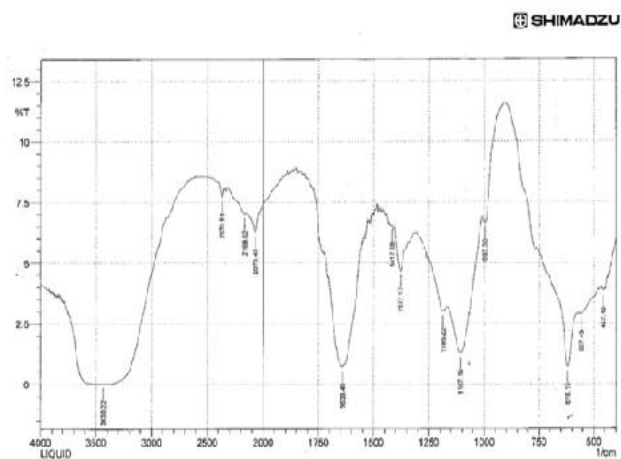


Figure 3 FTIR Spectrum of Ipomea Root

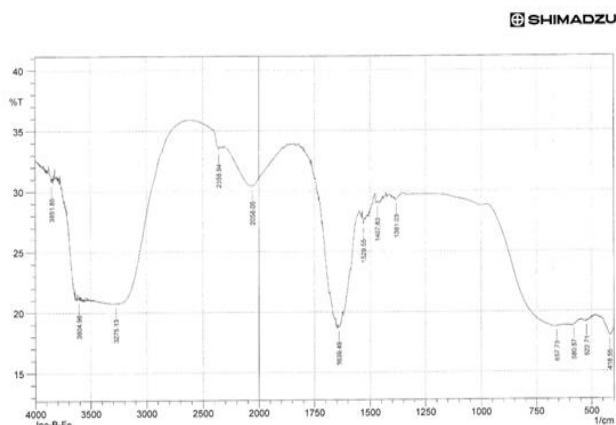


Figure 4 FTIR Spectrum of FeNP's

4. Conclusion

Ipomea roots extract were capable to synthesize iron nanoparticles very successfully by approaching the Environmental friendly methodology. The roots extract would be proceed as reducing agent plus stabilizing agent. The scheme of the synthesis was simple, economical and arrange for an effectual direction for preparation for Fe NP's without using of destructive chemicals. The synthesized Fe nanoparticles were characterized by many techniques which endorse the formation of Fe NP's. The SEM results revealed that nanoparticles were in the agglomerated form and their sized was less than 100 nm. The EDX results convinced that the percentage of iron nanoparticles in the sample. This results

revealed that FeNP's which is synthesized by *Ipomea* root extract were not favorable for reduction. The Antibacterial activities indicated no essential significance of these Nanoparticles.

Conflict of Interest

Authors declare no conflict of interest.

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