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Synthesis and Characterization of Iron Oxide Nanoparticles by Murraya Koenigii leaves

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Abstract. Nanotechnology becomes the most interesting area for researchers from last two decades. There are several methods to synthesis nanoparticles but the use of green method for synthesis reduces or eliminates the generation of hazardous byproducts. Green synthesis method is environment friendly alternative to conventional synthesis techniques. Green chemistry is about reducing risk, energy, environmental impact, hazard, cost, materials and waste. The green method or biological method involves the use of microorganisms, plants etc. for synthesis of nanoparticles. In our present research work we use Murraya koenigii leaves powder extract as reducing and capping agent. Plant sources containing the phytoconstituents viz., Tannins, Alkaloids, Polyphenols, Flavonoids, Citric acid etc. Metallic and metal oxides nanoparticles of various shapes, sizes, contents and physicochemical properties can be synthesized using green synthesis method. The synthesized Iron oxide Nanoparticles were characterized be different analytical techniques. The surface morphology revealed by SEM, elemental composition by EDX, Different functional groups revealed by FTIR spectroscopy and particle size measured by particle size analyzer.
Keywords: Green synthesis, Plant extract, nanoparticles, Phytochemical.

1. Introduction

In chemical manufacture and application, green chemistry relies on concepts that assist to reduce the use/generation of hazardous compounds. Green synthesis aims to find new ecofriendly processes for clean environment. As a result, it is a dynamic and vital subject in science. In contrast, environmental chemistry is concerned with researching chemical contaminants and their effects on the environment. Because of the practical uses of green chemistry, academic researchers are currently investigating alternatives to traditional synthetic processes. "Green Chemistry" seeks to create a chemical route that will consider and how it will affect the society [1-2]. Most Nanoparticles synthesis processes are excessively costly due to the employment of hazardous and toxic compounds. Green nanoparticles are most commonly produced by synthesizing nanoparticles with a particular advantage [3-4]. Plants are also widely spread, freely accessible, and safe to touch. They also supply a variety of metabolic compounds. Today, metal oxides are used in many applications in material science, including fuel cells, microelectronic circuits, piezoelectric devices, sensors and coatings to defend surfaces from erosion or serve as catalysts. Metal oxides were also utilized to remove pollutant from the environment. Oxide nanoparticles are characterized by their tiny size and edge surface sites related to other nanoparticles [5-9]. For example, metal oxides like TiO_2, ZnO, MgO or CaO have a high degree of stability under severe process conditions, making them ideal for use by humans and animals alike [10-16]. Due to their antibacterial characteristics, silver and zinc oxide nanoparticles have been viewed as a possible option for stopping infectious illnesses. Its inherent characteristics are controlled primarily by its size and form, composition, crystallinity and morphology as a metal Nanoparticles.

2. Materials And Methods

Fresh leaves of Sweet neem (Murraya koenigii) collected from local region after washing drying and grind fine powder can be obtained. 20 gm of leaf powder mixed in 200 ml DI and stirred at 70 ^{o}C for 60 min. after filtering with whatman filter paper we got the plant extract which preserved at 4 ^{o}C for future purpose. $FeSO_4$ used as metal precursor salt. 1.51 gm of $FeSO_4$ dissolved in 100 ml DI and heated and stirred for 15 min at 40^{o}C.NaOH pallets were used for maintaining pH. 1.19 g of NaOH dissolve in 100ml distilled water and heated & stirred for 10min at 50^{o}C. Then 100ml of prepared solution of $FeSO_4$ was mixed with 50 ml of prepared solution of NaOH. After that 100ml of $FeSO_4$.NaOH was added to 50ml of Murraya koenigii leaves extract (1:2 vol. ratio) & heated and stirred for 60 min at temperature of 30^{o}C. Then final solution was heated in a microwave at 150 ^{o}C for 3 min & then dried in oven overnight. The final solution turned from turbid light yellow to black color during the growth process. Experimental Techniques The prepared samples were characterized by different analytical techniques. The surface morphology and elemental analysis of prepared nanoparticles were characterized by SEM EDX. Particle size revealed by DLS technique and details of different functional groups identified by FTIR.

3. Result And Discussion

Ftir Analysis: FTIR spectra (Figure 01) shows a peak at 3249.79 cm^{-1} which refers to the presence of hydroxyl groups. The peak at 1034.47 cm^{-1} revealed the presence of C-N extended vibration of amines and strong peak at 666.75 cm^{-1} shows the presence of metal oxide bonds or the presence of Iron and oxide bonding so FTIR analysis clearly verifies the formation of Iron oxide nanoparticles [17-18].

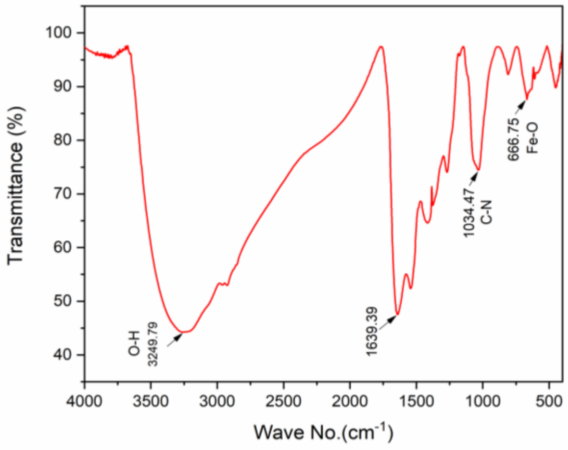

FIGURE 1. FTIR spectra of Iron Oxide nanoparticles

Fesem And Edx Analysis: SEM was used to examine the surface morphology of produced Fe_2O_3 NPs. (Figure 02). The SEM micrographs well illustrate the iron-oxide nanoparticles formation which is spread uniformly, with aggregation. The nanostructures that are irregular-shaped be viewed when you look at the micrographs as well. Figure 03 shows the EDX spectra of biosynthesized NPs. The EDX results show presence of oxygen and iron in our sample.

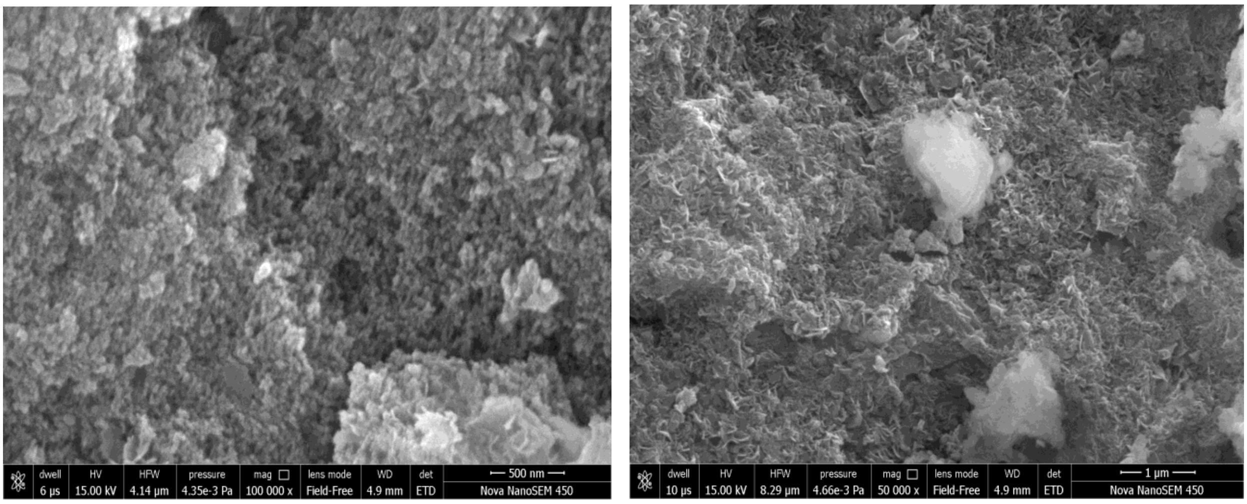

FIGURE 2. SEM Micrographs of Iron Oxide Nanoparticles

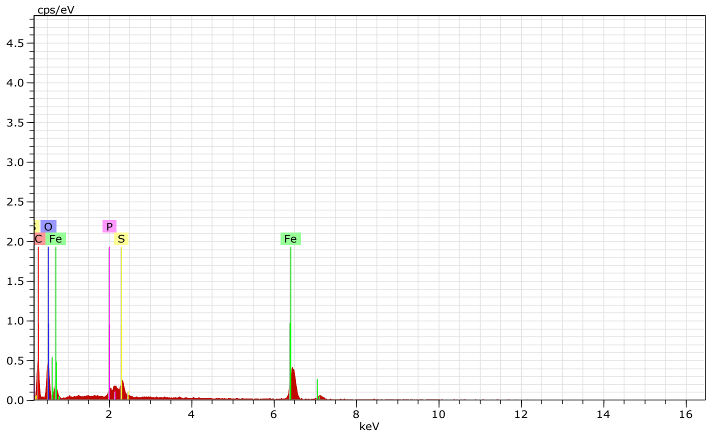

FIGURE 3. EDX spectrum of Iron Oxide Nanoparticles

TABLE 1. Atomic and Weight percentage of elements of Iron Oxide nanoparticles

Element	Series	Weight %	Atomic %
Fe	K-Series	39.38	14.13
C	K-Series	34.94	58.29
O	K-Series	18.26	22.87
S	K-Series	4.23	2.67
P	K-Series	3.18	2.06
Total		100 %	100 %

Dls Analysis: Particle size distribution for Iron Oxide nanoparticles developed by Plant extract shown in figure 04. The particle size is the dimension of core combined with the capping materials around it. The DLS technique revealed the particle size about 50-300 nm which is in good agreement with other results.

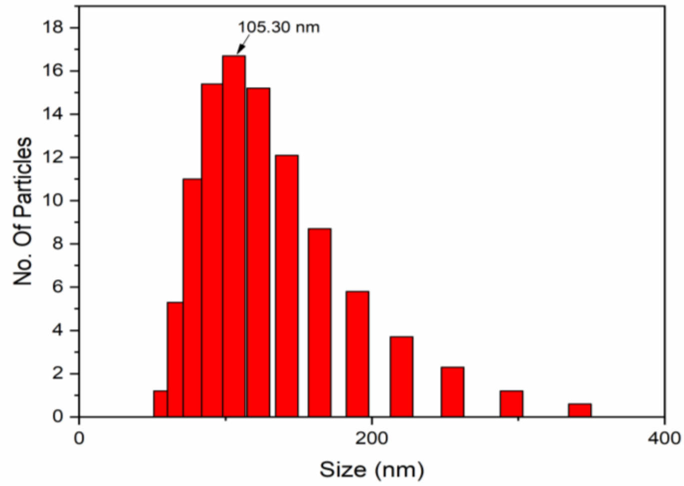

FIGURE 4. Particle size histogram of Iron oxide nanoparticles

4. Conclusion

Due to the reduction in hazardous chemicals green approach becomes popular among the groups of researchers. The synthesized nanoparticles are developed by environment benign route which is also economic and also at very low cost. Murraya koenigii leaves extract successfully synthesize the Iron oxide nanoparticles of size 50 to 300 nm which is revealed by dynamic light scattering. The surface morphology of nanoparticles revealed by FESEM and elemental analysis by EDX which confirms the purity of Iron oxide nanoparticles. FTIR shows the details of functional groups attached with sample. Green synthesis of Fe_2O_3 nanoparticles shows a far more compatible, environmentally friendly, low-cost, and non-time-consuming strategy. acknowledgement the writers are thankful to the center of nonconventional energy sources and department of physics, university of Rajasthan for providing the considerable analysis facilities. conflict of interest there are no conflict of interest involve with any continuous events in this study.

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