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Eco-Friendly Nanocomposite and Properties of Manganese Nanoparticles using UV-Vis and IR Fourier Spectrum

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Abstract:- Ecological nanocomposite is an interesting and growing field of material science because of its applicability to the development of new technological ecology. Nanoparticles are usually obtained by various chemical and physical methods that cause most environmentally friendly waste. This study describes a simple, easy, and inexpensive process for the synthesis of manganese nanoparticles by reducing manganese acetate using available natural extracts, namely lemon extract as a reducing agent and curcumin as a stabilizer. Curcumin was isolated from turmeric using a solvent extraction process and used to stabilize manganese nanoparticles. The properties of curcumin and manganese nanoparticles were carried out using UV-visible and Fourier-IR spectroscopy.

Keywords:- *Curcumin, Manganese, ECO Friendly Synthesis, Nanoparticles, UV- Vis and FT-IR Spectroscopic Techniques.*

I. INTRODUCTION

Coordination bonds are found in plants and animals. Chlorophyll is an important part of plant life and the coordination compounds of Mg (II). Blood color is due to the coordination compound Fe (II), hemoglobin. Most other trace elements in the human body act in the form of coordination bonds. [1] Due to the various redox states, the unique properties of metal ions, such as electron reduction / transport and multivalent coordination structures, can make metal ions and their complexes potentially applicable to drugs. Organic compounds (the latter are widely used for drug discovery) [2].The use of metal complexes as therapeutic agents dates back to 3500 BC. Tracking bc [3]. Most modern strategies are usually based on the physical or chemical principles of the synthesis of metal nanoparticles. However, both production processes are not environmentally friendly due to many disadvantages [4].

➢ *Synthesis of Manganese Nanoxide Materials*

Composite of nanomaterials MnO_2. It is known that MnO_2 can exist in different structural forms: α, β, γ, δ, ε, etc. When the basic structural unit (the [MnO6] octahedron) is differently associated with different bonds [MnO_6], MnO_2 can be divided into three categories: type, tunnel β and type of tunnel chain structure, type of sheet structure or layer. There is 3D structure of λ-MnO_2 types [5]. The properties of MnO_2 are greatly influenced by the stage and morphology. In addition, the performance of lithium-ion batteries depends on the stage of MnO_2. In this case, many attempts were made to obtain MnO_2 having a different phase and shape [6].In general, MnO_2 nanostructures can be synthesized by oxidation of Mn^2, reduction of MnO_4, a redox reaction between Mn_2 and MnO_4, or other direct phase conversion of manganese oxide. Other special forms, such as nanowall [7] and nanoplate [8], produced nanoblocks such as hedgehog [9], multipod [10] and nanoplate [11].

II. MATERIALS AND METHODS

All chemicals and solvents used are analytical reagents. All samples were prepared using fresh double distilled water. Curcumin was isolated from turmeric (BSR-01), purchased locally.

Name	***Mean yield (fresh) t/ha***	***Crop duration (days)***	***Dry recovery (%)***	***Curcumin (%)***	***Oleoresin (%)***	***Essential Oil (%)***
BSR-1	*30.7*	*285*	*20.5*	*4.2*	*4.0*	*3.7*

Table 1

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➢ *Collection of Extracts*

A collection of lemon extract has been collected from local markets. They are washed twice with distilled water, cut into pieces and squeezed well until a pure extract is obtained. The lemon extract is filtered using Whatman ~ 1 filter paper, and the filtrate is collected in a clean, dry container and stored for future use. Curcumin (CR) was extracted from turmeric by using soxhlet solvent extraction method in 95% ethanol medium. BSR01 turmeric variety was used in this method for better curcumin yield which was investigated in our previous research work [12] the final curcumin extract absorbance was measured at 425 nm against alcohol blank and the curcumin content was estimated as per [13]. The above ethanol residual extract was evaporated and dried then stored for further uses.

Synthesis of Manganese Nanoparticles (MnNP). For the synthesis of MnNP, a dilute solution of manganese acetate (1 mM) is prepared. During the reaction, twice distilled water is used. PH and temperature are maintained to some extent for best results. A freshly prepared solution of manganese (10 ml) with pure lemon extract (10 ml) stored in a beaker is added to reduce manganese ions, and the mixture is constantly mixed to properly restore metal ions. The reaction mixture is stored at a temperature of 50 to 600 ° C. for 60 minutes in a thermomagnetic stirrer for 60 minutes to change color from greenish to light yellow , which means a decrease in metal ions.Then, freshly prepared curcumin extract (1 mM) with the above mixture from a solution of a nanoparticle stabilizer is added and stirred continuously for about 1 hour. The color of the solution gradually changes from yellow to tan, and finally, a constant reddish-brown color is obtained. This indicates complete stabilization of MnNP. The main factor is that during the experiment, the pH is maintained at 3-4, and the temperature is 50-600 ° C. The solution was centrifuged by washing several times to obtain pure MnNP. Decant the supernatant and dry it in the oven. [14]

III. CHARACTERIZATION

Visible UV light absorption spectrum of a sample was measured using a Shimadzu UV-Vis V-530A spectrophotometer in the range of 425 nm. FT-IR spectrum analysis and a Jasco FT-IR / 4100 spectrophotometer investigated nanoparticles with a resolution of 4 cm from 4000 to 400 cm was recorded. Microscopic scanning electronic images (SEM) were obtained using a scanning electron microscope model JEOL JSM-6390LV. Morphological changes are detected by high resolution electron microscopy (HRTEM) using a 300 kV JEOL-3011 ultra-high resolution polar instrument.

The synthesized MnNP is known for color solutions that change color from light green to light yellow due to a decrease in ionic metals and from yellow to reddish brown due to the blocking of stabilizers. Color changes can be easily seen with the naked eye. This clearly shows the formation of well reduced and stabilized MnNP.

➢ *UV-Vis Spectra Studies*

Simplest methods for characterizing nanoparticles is UV-Vis spectroscopy. Synthesized curcumin curcumin (CR) was confirmed by a strong broad absorption peak at about 425 nm. This may be due to a combination of n $\rightarrow \pi$ * transitions or $\pi \rightarrow \pi$ * and n $\rightarrow \pi$ * transitions (see Figure 1). UV-visible MnNP spectroscopy (Fig. 2) shows the maximum absorption at critical wavelengths. The maximum absorption of Mn nanoparticles, which is 360 nm. The appearance of absorption edges at 360 nm is a clear indicator of the formation of Mn nanoparticles.

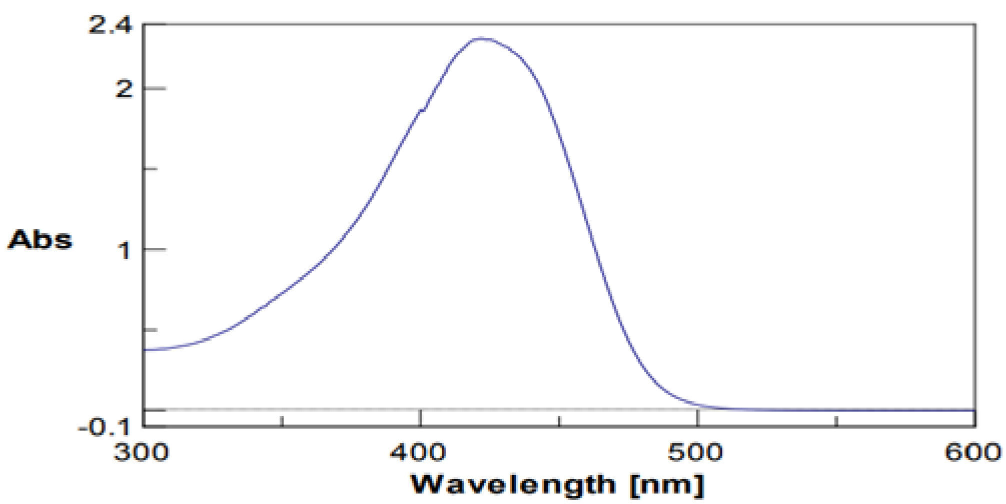

Fig. 1: UV-Vis spectra of curcumin.

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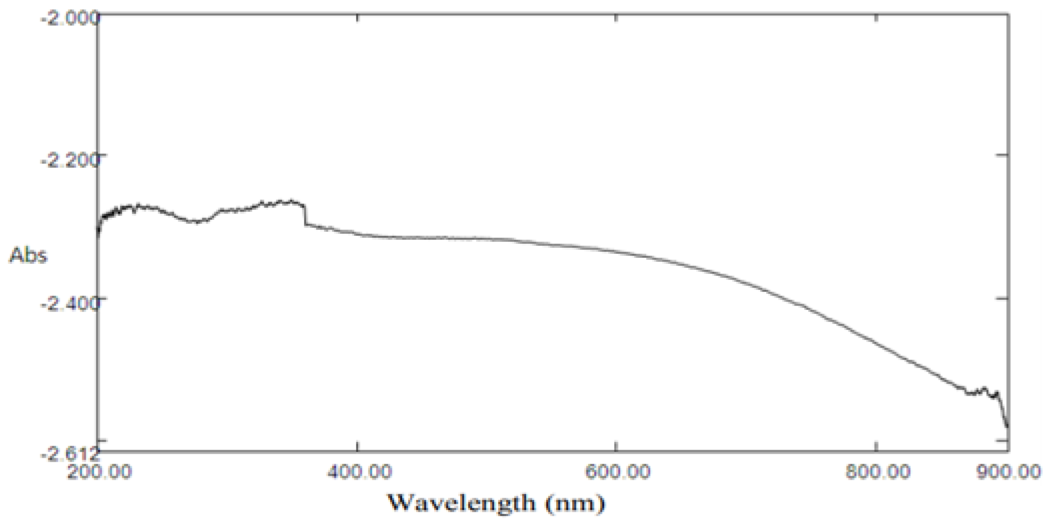

Fig. 2: UV-Vis spectra of Mn nanoparticles.

➢ *FT-IR Spectra Studies*

IR Fourier spectrum (FT-IR) spectroscopy is becoming increasingly sensitive, especially from the point of view of detecting inorganic and low organic species. The IR Fourier spectrum of curcumin and manganese stabilized nanoparticles is shown in Figure 3. Spectra were recorded in the range from 4000 to 500 cm^{-1}. The FT-IR spectrum shows a characteristic peak. Data obtained at 3650 cm^{-1} peaks due to lengthening of —OH of water or ethanol present in the system. Broadband is weak in the 2935cm^{-1} range. It was assigned to the Ph-OH group in the curcumin section. C = 1625 cm^{-1}. curcumin deformation; reaches a higher wave number at 1704 cm^{-1} due to interaction with manganese nanoparticles; characteristic peaks and a supervisor were detained in the range from 1574 to 1515 cm^{-1} Check the aromatic unsaturation (C = C) of the stabilized curcumin system.

Maximum absorption and supmin at 1393cm^{-1}; Otes denotes a curved water ribbon adsorbed on Mn nanoparticles. The presence of a band of curcumin (C-O) was 1026 cm^{-1} and 1160 cm^{-1} and supmin peak was found. Two significant absorption peaks at 901 cm^{-1} and 730cm^{-1} were observed in accordance with the properties of the O-Mn-O tensile bond, indicating the presence of MnO_2 nanoparticles in the sample.

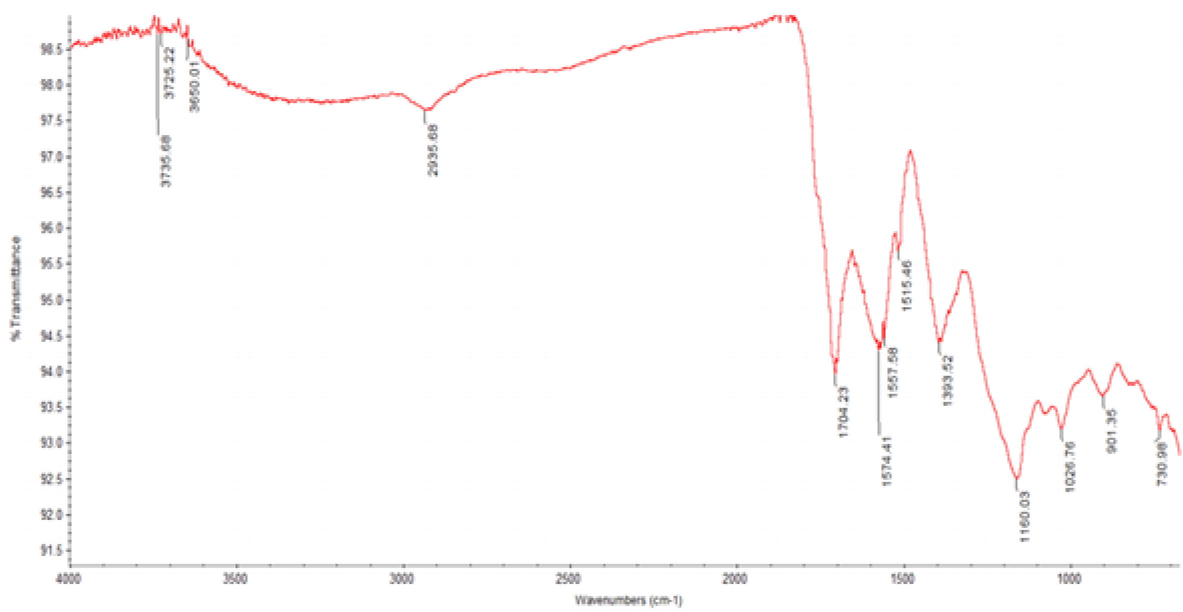

Fig. 3: FT-IR spectrum of Mn nanoparticles.

IV. RESULTS AND DISCUSSION

The synthesized results and discussions of MnNP are known for color solutions that change color from light green to light yellow due to a decrease in metal ions and from yellow to reddish brown due to the limitation of the stabilizer. Color changes can be easily seen with the naked eye. This clearly shows the formation of well reduced and stabilized MnNP. Manganese oxide nanoparticles have been successfully obtained from manganese salts from two different anions. The resulting manganese oxide nanoparticles have high crystalline properties with a tetragonal structure. The mean size of manganese oxide nanoparticles varies from 25 to 60 nm. The inventors have found that the size of the nanoparticles size can be tuned by changing the metal precursor. The IR Fourier spectrum confirms the presence of manganese oxide.

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