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Green synthesis of nano particles from Mulbery leaves and studies of Anti oxidant & pollutent removal activated by spectrophotometry

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ABSTRACT:

A nanoparticle or ultrafine particle is usually defined as a particle of matter that is between 1 and 100 nanometres (nm) in diameter The term Nanoparticles are usually distinguished from microparticles (1-1000 µm), "fine particles" (sized between 100 and 2500 nm), and "coarse particles" (ranging from 2500 to 10,000 nm), because their smaller size drives very different physical or chemical properties, like colloidal properties and optical or electric properties. Biological synthesis of nanoparticles using microorganisms, enzymes, and plant part extracts has been the subject matter of researchers in the recent past as an eco-friendly alternative to a variety of chemicals involves synthetic/ chemical methods. Using plants as bio reductants can have advantages over other biological processes like using microbial population because it eliminate elaborate process of maintaining cell culture and can be suitable scaled up for large-scale synthesis.

The development of reliable, eco-friendly processes for the synthesis of nanomaterials is an important aspect of nanotechnology today. Biological synthesis process provides a wide range of Iron mentally acceptable methodology low cost production and minimum time required. We have studied a simple biotechnological process for synthesis of Iron nanoparticles using whole plant extract of Morus alba.The antioxidant activity of synthesized nanoparticles was studied. Total antioxidant activity was studied using ammonium molybdate method. Results found that the synthesized Iron nanoparticles were found to having potent antioxidant activity.

Key words: Mulberry leaves, Anti oxidant activity, Nano particles, Spectrophotometry.

Introduction :

Nanoparticle are integral components in a wide variety of applications, including medicine, semiconductors, catalysis, and energy. They are defined as particles with a size between 1-1000 nm. At smaller size scales, particles can behave differently than their bulk counterparts. For example, as particles become smaller, their surface area increases greatly. Nanoparticle is typically synthesized from a top-down or bottom-up approach. A bottom-up approach relies on nucleating atomic-sized materials into the eventual Nanoparticle. While the exact synthesis method depends on the material being generated, some common methods include the Turkevich method (citrate reduction), gas phase synthesis, block copolymer synthesis, and more recently, microbial synthesis. Top-down methods, where a bulk material is physically broken down to make smaller molecules, include milling, laser ablation, and spark ablation.

Colloidal nanoparticle synthesis Nanoparticles are traditionally synthesized using wet chemistry methods, which involve first generating the particles in a solution, drop casting the wet particles onto a substrate, and removing the solvent, surfactants, and other materials from the particles. This wet synthesis method requires a significant amount of time and chemicals, and the resultant material may be contaminated with residues from the solution.

Mulberry Leaf: { Morus alba} Morus, a genus of flowering plants in the family Moraceae, consists of diverse species of deciduous trees commonly known as mulberries12, growing wild and under cultivation in many temperate world regions. Generally, the plant has three main species ostensibly named for the fruit color of the best-known cultivar: white, red, and black mulberry (Morus alba, rubra, and nigra, respectively), with numerous cultivars but more than 200 species are identified in taxonomy. Raw mulberries are 88% water, 10% carbohydrates, 1% protein, and less than 1% fat (table). In a 100 g (3.5 oz) reference amount, raw mulberries provide 180 kJ (43 kcal), 44% of the Daily Value (DV) for vitamin C, and 14% of the DV for iron; other micronutrients14 are in insignificant quantity.

Instrumentation

REMI electronic hot plate with adjustable temperature was used for the extraction of the Morus alba by plant material. TECHOMP double beam UV –

Visible spectrophotometer with quartz cuvetts of 10mm path length was used for the spectral analysis. The microscopic observation was carried out using Nikon eclipse E 100 electronic microscope.

Materials and Methods:

Chemicals:- Chemical name Grade Make 1 Zinc sulphate Analytical reagent grade Rankem chemicals, Gujarat 2 Ammonium molybdate Analytical reagent grade Merk chemicals, Mumbai 3 Sulphuric acid Analytical reagent grade Merk chemicals, Mumbai 4 Sodium phosphate Analytical reagent grade Merk chemicals, Mumbai 5 Ascorbic acid Analytical reagent grade Merk chemicals, Mumbai

Collection of plant material: Fresh leaves of Morus alba were collected in Khjipalem village, Guntur district, AP. The plant name was confirmed by Department of Chemistry, KVR KVR and MKR College. The fruits were shade dried and powered, the powdered sample is then stored in the suitable conditions (air tight, light resistant containers).

Preparation of Plant Extract: Morus alba plant was collected and kept in hot air oven for drying at 60°C for six hours. The dried leaves were chopped into fine pieces with the help of mixer grinder. It was collected, weighed for 1.0 g, and then mixed in 100 mL of double distilled water. This mixture was boiled at 60°C in the water bath for one hour. The solution was cooled at room temperature and filtered by Whatman filter paper No. 1. The filtrate was collected and stored at 4°C for further experiment.

Green Synthesis of Iron chloride nano particles: 15 ml of leaf extract of Morus alba was added to 2.195 g of zinc acetate dihydrate dissolved in 35 ml of distilled water. The reaction mixture was kept on magnetic stirrer for 6 h. After 6 h, 2 M NaOH (4 g of NaOH pellet in 50 ml of Milli-Q water) was added to the solution and it was placed in incubator at 60 °C with magnetic stirring for overnight then it was centrifuged at 14,000 rpm for 15 min. Precipitate was subjected to washing with alcohol and distilled water three times each. Precipitate was dried in an incubator at 40–50 °C and fine powder was prepared with the help of ceramic pestle and mortar.

Antioxidant Activity:

Phosphomolybdate assay: The total antioxidant capacity of the fractions was determined by phosphomolybdate method using ascorbic acid as a standard. An aliquot of 0.1 ml of sample solution was mixed with 1 ml of reagent solution (0.6 M sulphuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). The tubes were capped and incubated in a water bath at 95°C for 90 min. After the Samples had cooled to room temperature; the absorbance of the mixture was measured at 700 nm against a blank. A typical blank contained 1 ml of the reagent solution and the appropriate volume of the solvent and incubated under the same conditions. Ascorbic acid was used as standard. The antioxidant capacity was estimated using following formula

$$\text{Anti Oxident effect} = \frac{\text{Control absorbance} - \text{sample absorbance}}{\text{Control absorbance}} \%$$

Results & Discussions:

The green synthesis of Iron nano particles using Morus alba and fruit extract was successfully carried out, as the change in the color of the solution from blue color to dark brown color exhibits the reduction of the Iron in aqueous solution. The exact mechanism for the formation of nano particles in living plants is not yet known, nor investigated in depth. The process, conceptually, appears to be close to the mechanisms of bio mineralization due to excitation of surface plasma on vibrations in Iron nano particles. During this reaction process the pH of the solution was in acidic range, which implies that the reaction occurs under acidic condition. It is well known that Iron nanoparticles exhibit yellowish brown color in aqueous solution. Morus Alba having medicinal importance. The aqueous extract of Morus Alba was used for the synthesis of Iron nanoparticles.

As the leaf, fruit extract of Morus alba was mixed in the aqueous solution of the Iron ion complex, it started to change the color from light yellow colour to dark brown due to reduction of Iron ion; which indicated formation of Iron nano particles. The change in color due to the bio- reduction of Iron in presence of plant extract was checked periodically. The color was changed from light yellow colour to dark brown was observed on increasing the time. The maximum brown was observed at an incubation time of 16Hrs. Morus alba completes the process with in 16H. Hence this time was sufficient for the synthesis of Iron nano particles using the selected plants. The time to time color change in the synthesis process was given in table and the color change photos were given in figure. The time to time color change was given in table.1.

After the completion of bioreduction of Iron, the formed particles were collected. For this the solution was centrifuges the solution at 3000rpm for five min. the pellet was washed with water and then used for further studies. The green synthesis of Iron nano particles using Mimusops balata fruit extract was successfully carried out, as the change in the color of the solution from yellowish brown to dark brown color exhibits the reduction of the zinc aqueous solution due to excitation of surface Plasmon vibrations in Iron nanoparticles. During this reaction process the pH of the solution changes from 6.1 to 6.3 which implies that the reaction occurs under acidic condition. This complete reaction occurs in seven hours. The brown to dark brown color change of the reaction mixture indicated the formation of Iron nanoparticles.

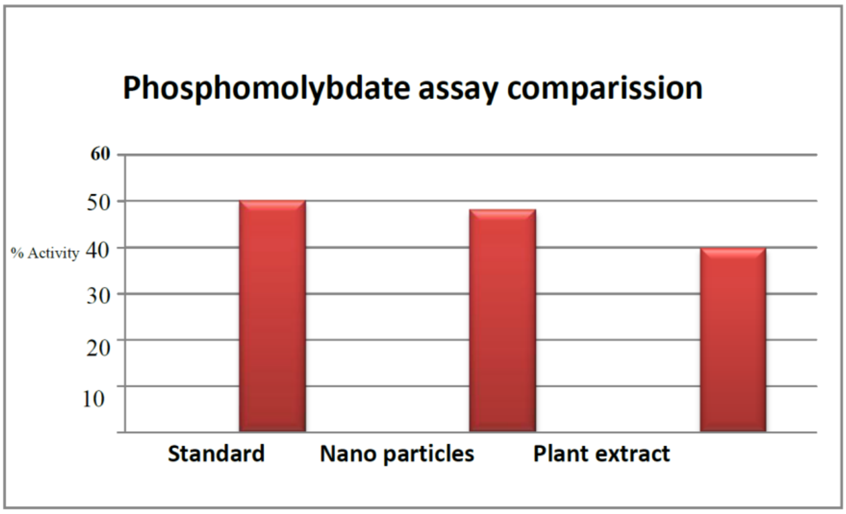
Time to time color change of Iron metal solution during the formation of Iron nano particles:

S. No	Time intervals in Hours	Color observed for Iron Oxide Nano particles Concentration
1	0	Light color
2	1	Light color
3	2	Light color
4	3	Dark color
5	4	Dark color
6	5	Dark color
7	6	Very Dark color
8	7	Very Dark color
9	8	Very Dark color

Color charge during the synthesis of zinc nano particles

S No	Part	No Average absorbance	Phosphomolybdate assay
1	Standard	0.523	50.12
2	Nano particles	0.392	48.01
3	Plant extract	0.214	39.73

Total antioxidant activity of Iron nanoparticles in Phosphomolybdate method



Phosphomolybdate assay comparison graph

Conclusion

Biological synthesis of nanoparticles using microorganisms, enzymes, and plant part extracts has been the subject matter of researchers in the recent past as an eco-friendly alternative to a variety of chemicals involve synthetic/ chemical methods. Using plants as bio reductants can have advantages over other biological processes like using microbial population because it eliminate elaborate process of maintaining cell culture and can be suitable scaled up for large-scale synthesis.The development of reliable, eco-friendly processes for the synthesis of nanomaterials is an important aspect of nanotechnology today. Biological synthesis process provides a wide range of Iron mentally acceptable methodology low cost production and minimum time required. We have studied a simple biotechnological process for synthesis of Iron nanoparticles using whole plant extract of Morus alba.The nanoparticles were in different shapes and the particle surface was found to be rough.

The antioxidant activity of synthesized nanoparticles was studied. Total antioxidant activity was studied using ammonium molybdate method. Results found that the synthesized Iron nanoparticles were found to having potent antioxidant activity.

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