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Fabrication of Iron Oxide Nano Particle Using *Cassia Auriculata*leaf Extract and its Characterization

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Abstract
Cassia auriculata is used extensively in the indigenous system of medicine as an anti-diabetic agent. An eco-friendly green synthesis of iron oxide nanoparticles using leaf extract of *Cassia auriculata* leaf was investigated. UV visible spectra showed the maximum absorbance of 285 and 324 nm due to the excitation of surface plasmon vibrations in the iron oxide nanoparticles formation. FTIR spectrum exhibited the characteristic band at 618 cm-1 which indicated the Fe-O stretching of Fe2O3 nanoparticles. The sharp peaks indicated the crystallinity and purity of iron oxide nanoparticles. The average particle size of the synthesized iron oxide nanoparticles was estimated to be 47 nm using the Scherrer equation. Transmission electron microscope (TEM) image of iron oxide nanoparticles showed that the nanoparticles size was below 20 nm. **Keywords :***Cassia auriculata*leaf, Iron Oxide, Nanoparticles

Introduction
Biosynthesis of iron oxide Nanoparticles from plant system is a new and recent development technique. Nanomedicine is physical and chemical methods are more popular for nanoparticles synthesis whereas, the biogenic production is a better option due to eco-friendliness, less harmful nature against the environmental and other non targeted organism. Nanoparticles are great interest due to their extremely small things can be used in the other entire scientific field such as chemistry, biology, physics, materials science and engineering. Nanoparticles conducted at the nanoscale, which is about 1 to 100nm. In the last few years, several pharmaceutical companies have obtained approval from the US Food and Drug Administration (FDA) forth development of nanotechnology-based drugs. Recently, an extensive research has been focused on nano-structure because it is unique magnetic and electric properties and its application in medical treatment.

Iron oxide nanoparticles have attracted intensive research interest because of their important applications in cancer therapy, drug delivery, magnetic resonance imaging (MRI) and wastewater treatment (Vicky et al., 2010). The biosynthesis of iron oxide nanoparticles of different sizes and shapes has been reported using bacteria (Yeary et al., 2005), fungi (Roh et al., 2006) and plant extract (Senthil et al., 2012). Green synthesis of nanoparticles is very cost effective, environment

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friendly and non-toxic. In this green synthesis route, the bio-molecules in plant system can act as capping and reducing agents and increase the rate of reduction and stabilization of nanoparticles.

The iron oxide nanoparticles have been synthesized from various plants have different application in various sectors. Particularly a few report have been studied the *cassia aurticulate* leaf extract. Extract were used to synthesis different metal nanoparticles expect iron oxide. In the present study deals with biosynthesis and characterization of stable iron oxide nanoparticles from *cassia aurticulate* leaf extract.

Materials and methods

Collection, identification and phytochemical screening of Cassia auriculata

Fresh leaves of Cassia auriculatawill be collected from Adhiparasakthi Agricultural college , kalavai, Tamil Nadu, India and the plant material will be identified and authenticated by Botanical survey of India, Tamil Nadu Agricultural University Campus, Coimbatore, Tamil Nadu, India. The collected leaves will be washed and shade dried under ambient conditions in a sterile location devoid of moisture. The shade-dried leaves will be made into a fine powder using a mechanical mixer and stored at -20^{0}C in an airtight container until further, 25 g powdered sample will be dissolved in 250 ml distilled water and the extract will be prepared by the hot percolation method using a Soxhlet apparatus. The crude filtrate will be completely dried at room temperature and yield of the extract will be determined and stored at -20^{0}C in an airtight container until further use. (Harborne, 1998). The crude ethanol extract will be used for phytochemical screening using standard phytochemical analytical methods.

Reagents and Chemicals:

For the synthesis of iron oxide nanoparticles, *Cassia auriculata*(commonly called as Avaram) leaf extract was used as the reducing agent. Ferrous sulphate (FeSO4) was used as precursor. Ethanollic extract was used throughout the experiment.

Results

Plant sample collection and extract preparation

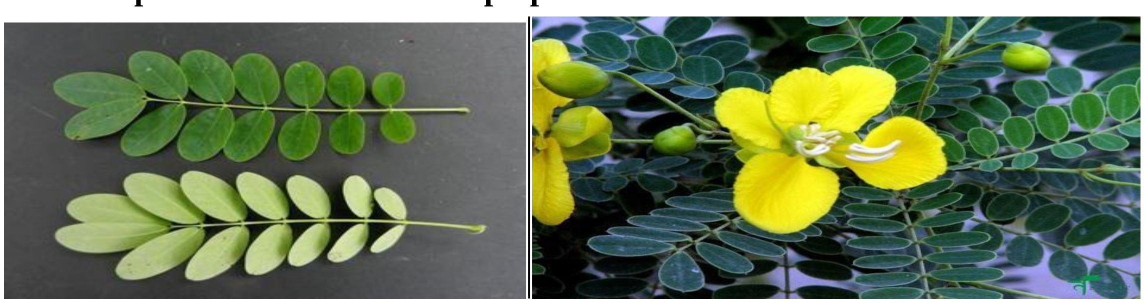

Fig 1:: Image of *Cassia auriulata*leaf and flower

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Fig:2Soxhlet extraction of *cassia auriulata*leaf

Synthesis of Iron oxide nano particle from *Cassia auriculata*Different volume of ethanol extract was added to 100 mL of ferrous sulphate solution in a 100 mL conical flask at dark room temperature. The difference in colour of the solution was observed within 5-10 min from colour less to dark brown; shown in image 3 this colour change is due to the formation of iron oxide nano particle. The reduction of iron oxide ions into iron particles during exposure to the flower extract was followed by colour change from yellow to dark brown. The colour change was monitored by measuring the UV–Vis spectrum of the reaction media (image 3). The synthesized iron oxide nano particles were in the range of 436nm. It is well known that iron oxide nano particle exhibit yellowish brown colour in aqueous solution due to excitation of surface Plasmon vibrations in iron oxide nanoparticles. As the flower extract was mixed in the solution of the iron oxide complex, it started to change the colour from yellowish to brown due to reduction of iron oxide ion, which may be the indication of formation iron oxide nanoparticles. Previous studies have reported the presence of iron oxide nanoparticle exhibiting yellowish brown colour in solution due to the excitation of surface Plasmon vibrations [3].

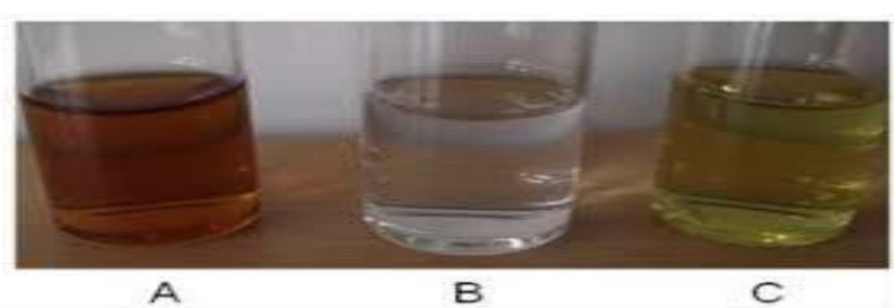

Fig 3: Biosynthesis of iron oxide nanoparticles from flower extract. A) Leaf extract B) ferrous sulphate C) Formation of iron oxide nanoparticle

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Determination of synthesized iron oxide nano particles

UV spectroscopy analysis

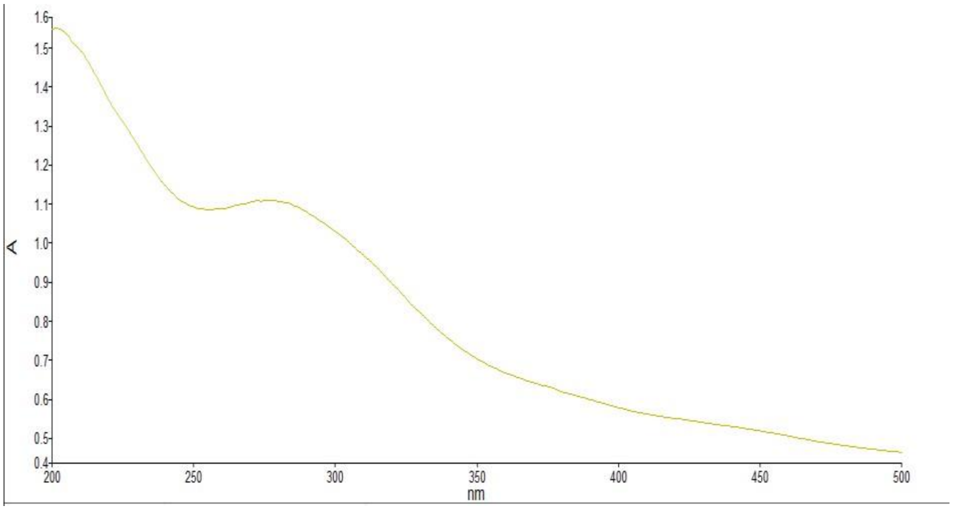

Figure:4 Represents the absorbance obtained by UV-spectroscopy on various concentration gradient of sample of *cassia auriculata*leaf.

After the addition the *Cassia auricuata* leaf extract into the ethanol solution of Ferrous sulphate, the solution was filled in glass cuvette of path length 1.1mm and UV-Vis spectral analysis has been done in the range of 200 to 500 nm. DI water was used as blank. The absorption spectrum of the colorless to black color by ferric Sulphate showed absorption maximum at ~500 nm, indicating the presence of Iron oxide nanoparticles.

Fourier transforms infrared spectrophotometer analysis

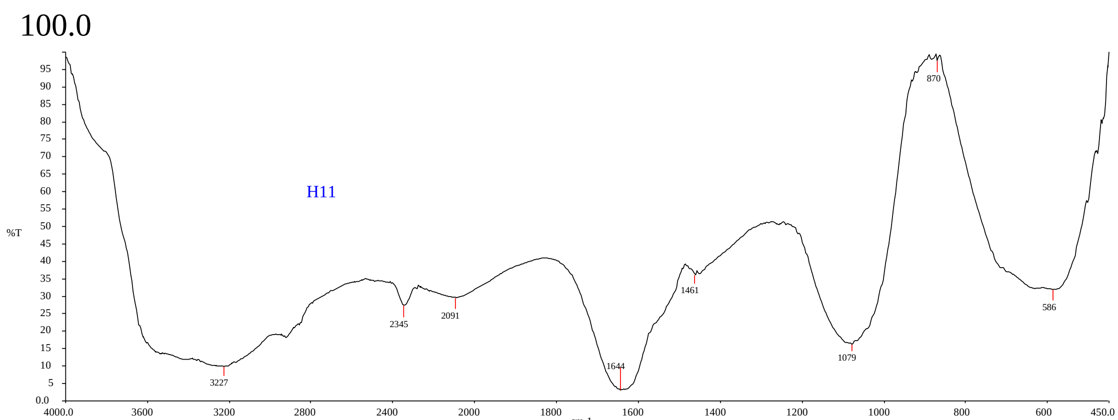

Figure:5 shows the FT-IR spectrum of *Cassia auriculata* leaf and flower extract

The Leaf extract of plant specimen was loaded in FTIR spectroscope with a scan range from 400 to 4000cm-1 with resolution of 4 cm-1.

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FT-IR spectrum of *Cassia auriculata* leaf extract.The strong absorption peak at 3227 cm-1 is assigned to O-H stretching of alcohol and phenolic compounds or stretching of the –NH band of amino group. The presence of peak at 2345 cm-1 are assigned to aliphatic C-H stretching in methyl and methylene groups. The peak at 1644 cm-1 is due to stretching vibration of CO groups in the ketones, aldehydes and carboxylic acids. The peak belonging to 1461 cm-1 is due to COO stretching vibration. The peak at 1644 cm-1 is attributed to the presence of carboxylate ions (COO), which is responsible for the formation of iron oxide nanoparticles. The peaks at 1083 and 1043 cm-1 indicate the presence of CO groups. This peak was absent in plant extract which indicate the formation of iron oxide nanoparticles. The absorbance band at 876 cm-1 might be assigned to the existence of some amount of oxidized iron oxide on the surface. FT-IR analysis confirmed that the bio reduction of ferric sulphate into iron oxide nanoparticles is due to the reduction by capping material of *Cassia auriculata* leaf extract.

TEM analysis

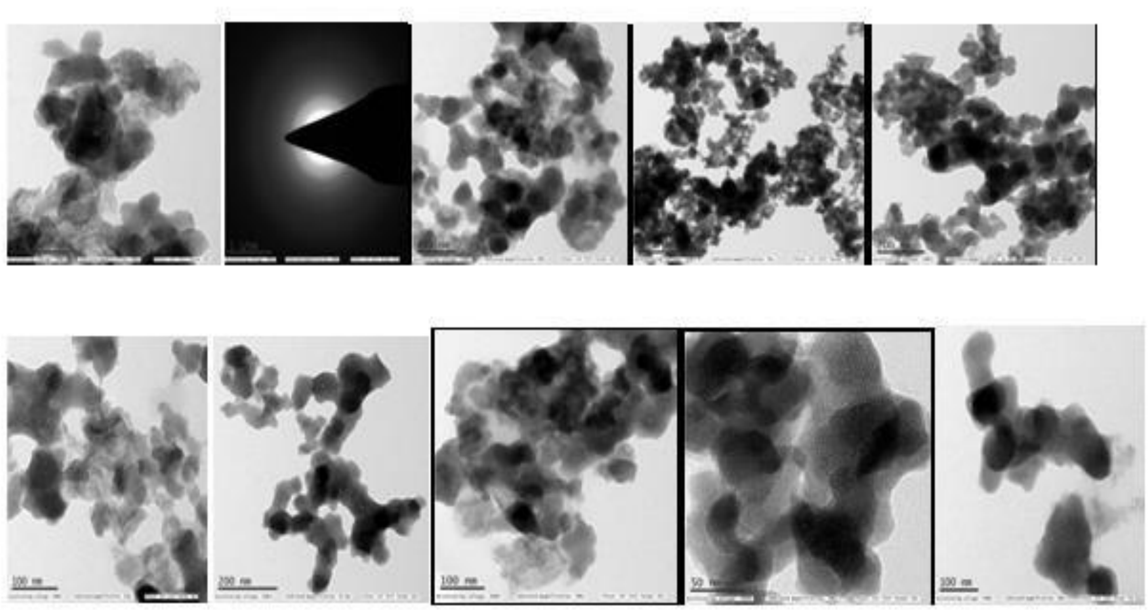

Fig 8: TEM images of synthesized iron oxide nanoparticles *Cassia auriculata* leaf extract

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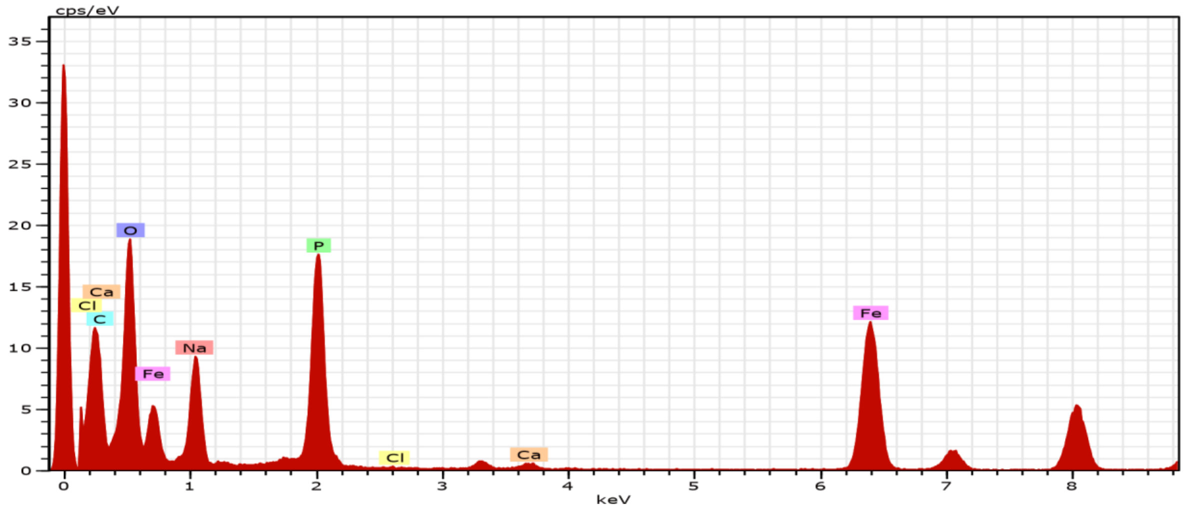

Fig 9:TEM analysis of TEM images analysed different wavelength 200nm,100nm,0.5nm.

The morphology of the nanoparticles mostly appeared to be a porous and spongy. However, to obtain a clear size, shape and structural image of the nanoparticles the samples were analyzed using Transmission Electron Microscopy (Fig.5). Transmission electron microscope image reveals the size of the synthesized iron oxide nanoparticles to be less than 200nm. TEM Analysis of leaf extract of *Cassia auriculata*showed the carbon, oxygen, sodium, phosphorous, calcium, chloride and iron nanoparticles. .It is concluded that our prime target of synthesis of iron oxide nanoparticles is achieved. This was also confirmed by the images taken in various wave lengths 200nm, 100nm, 0.5nm.

Conclusion

The rapid biological synthesis of iron oxide nanoparticles using leaf broth of *Cassia auriculata*provides an environment friendly, simple and efficient route. Fourier transform infrared spectroscopy indicated that the phenolic compounds and proteins may be responsible for the reduction of ferrous ions. TEM analysis confirms that the size of the iron oxide nanoparticles was found to be less than 200 nm. Thus, the green synthesis using *Cassia auriculata*leaf extracts can be economic and effective method for the synthesis of iron oxide nanoparticles. CANP is a very good eco-friendly and non-toxic bio reductant for the synthesis of Fe3o4NPs and opens up further opportunities for fabrication of drugs and medical devices.

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