

MICROWAVE ASSISTED GREEN SYNTHESIS AND ANTIBACTERIAL STUDY OF IRON OXIDE NANO PARTICLES USING COFFEA BENGHALENSIS

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Abstract

Iron Oxide Nano particles were synthesized from *coffea benghalensis* as both reducing agent and capping agent. The synthesized nano particles were characterized using Scanning Electron Microscopy, Infra Red spectroscopy and UV-Visible spectroscopy. The synthesized iron oxide nano particles were found to have average particle size in the nano range where tested for their antibacterial activity against gram negative *Escherichia Coli* bacteria.

Keywords: *Green Synthesis, coffea benghalensis, Iron Oxide, E.Coli.*

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Introduction

Iron oxide nano particles has been one of the extensively investigated transition metal oxides because of its significant variable oxidation states, crystal structures, low cost, magnetic properties, and environmental friendly nature (Cai et al., 2014 and Nguyen et al., 2015) Iron oxide NPs are used as high-performance anode in lithium ion batteries, biomedical field as safe labeling of endothelial progenitor cells, in the field of environmental remediation and food analyzes, magnetic targeted site-specific drug delivery, electromagnetic interference shielding, microwave absorbers, molecular electronics, magnetic recording media, etc (Henam et al., 2017) Iron Oxide Nano particles can be synthesized by microwave assisted green synthesis of coffea benghalensis leaf extract. The leaf extract acts both as reducing agent and capping agent in this process. The synthesized Iron Oxide Nano particles where characterized using Scanning electron microscopy, Infra Red spectroscopy and Ultra Violet-Visible spectroscopy. The anti bacterial activity of Fe_2O_3 nano particles against *E. Coli* bacteria was evaluated. Usually, noble metal NPs were extensively designed to study antimicrobial activities. As compared with noble metals, iron oxide materials are easily available and economically beneficial (Henam et al., 2017)

Materials and Methods

1. Sample Collection

Coffea benghalensis leaf was collected from Uzhavoor village in kerala. The leaves were thoroughly washed and dried in shade at room temperature and finely grinded to powder. Ferric Chloride solution was obtained from Merck Pvt. Ltd, India and used directly without further purification as it was of analytical grade. Type 3 Distilled water was used throughout this project.

2. Preparation of leaf extract

20g of crushed coffee leaves were taken in a 250 ml beaker and 100ml of distilled water was added. The solution was heated at 80°C in the water bath to get the extract. The extract (Naik et al., 2002) was collected and filtered into another beaker using a funnel and a filter paper. A clear coffee extract is collected and is stored in a clean dry beaker for further use.

3. Synthesis of nano particle

50ml of the freshly prepared 1mM Ferric Chloride solution is buretted out into a clean sterilized flask. 50ml of the coffee leaves extract is added into the Ferric Chloride solution (1:1 proportion) (Ojha et al., 2013) There was an immediate color change on

the addition of the coffee leaves extract to the Ferric Chloride solution .The solution resulting from the addition of coffee leaves extract and Ferric Chloride solution is black in color. The solution was heated in a microwave oven at 300 watts for 5 minutes (Ahamad and Sastry, 2004). The solution was transferred into the centrifuge tube and is centrifuged properly. After centrifugation the supernatant was discarded and the residue, washed properly using distilled water and centrifuged again to remove any impurities present in it.

Results and discussion

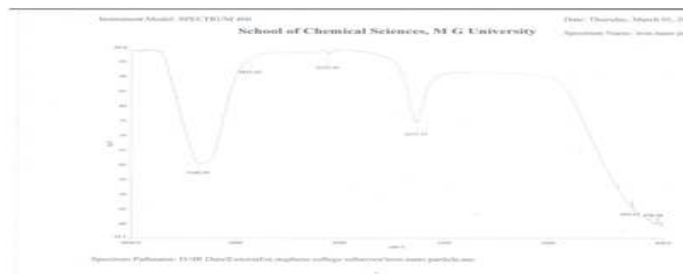
1. Synthesis of Iron Nano Particles

Iron nano particles were synthesised from *Coffea benghalensis* using microwave assisted green synthesis using Coffee leaves extract. The nano particles obtained is used for the analysis of UV, IR spectroscopy, the particles size is measured using SEM and its antibacterial properties also tested.

2. Characterization

The morphology and size were verified by characterizing the sample by FT-IRUV spectroscopy and SEM analysis for studying the functional groups and diameter of the nano particles.

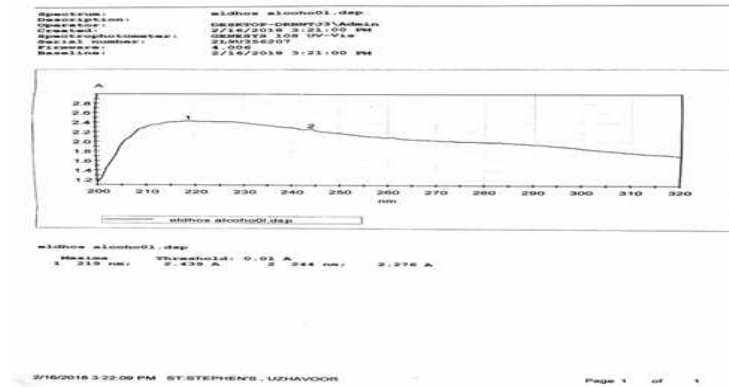
i FTIR Analysis



FTIR analysis of coffee leaves extract and synthesized Iron nano particles was done to analyze and evaluate the attached bio molecules to the Iron nano particles. The FTIR of extract showed vibrations stretching at 1631.33 cm^{-1} for C=C and 3348.99 cm^{-1} for O-H. The C-H and C-N adsorption bands were also observed 2855.42 and 1383 cm^{-1} respectively.

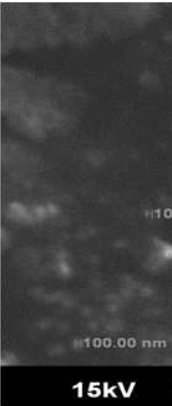
Comparing to that of the FTIR of the product(Iron Nanoparticles) it showed wide stretch of O-H group at 3419 cm^{-1} , C=C at 1635 cm^{-1} , C-H at 2923 cm^{-1} , and C-O-C and C-N at 1020 and 1379 cm^{-1} which matches almost to that of the extract. The oxidized poly phenols on the synthesized Iron Nanoparticles were examined. It may

ii. UV-Visible Spectroscopy



iii. Scanning Electron Microscopy

The SEM image confirms that the particle lies well in the nano range with average particle size 102 nm.



3. Antibacterial Activity

The anti bacterial activity of the synthesized iron oxide nano particles were done at Tropical institute of ecological sciences, pambadi, kottayam. Well Diffusion method was used and agar medium was used as the bacterial broth. Anti bacterial activity against *E.Coli* was determined and the component was found to show considerable anti bacterial activity.



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T I E S - t i e s M i n d a n d N a t u r e

TEST REPORT

Name: Mr. Eldose Raju, St. Stephen's College, Uzhavoor.

We have tested the extracts for antibacterial activity through agar well diffusion method, handed over us on 01.03.2018 and following are the test results. Zone size measured in cm.

| Pathogens | Test (I) | Control (C) |
|----------------|----------|-------------|
| <i>E. coli</i> | 2.3 | 0 |
| | 2.5 | 0 |
| | 2.3 | 0 |
| | 2.6 | 0 |
| | 2.5 | 0 |
| | 2.3 | 0 |

Thank you for availing our services. Kindly contact us for any further assistance in this regard.

10.03.2018
Kottayam

Scientist In- charge

Note: Electronically generated report. Not authenticated.

Distilled water was used as the control and the anno particle was found to show a zone of inhibition of 2.4 cm.

Conclusion

As a result of this study, it is proved that Iron Nano particles can be synthesized successfully in an easy and less time consuming way via microwave assisted green synthesis using coffee leaves extract. The poly phenols in coffee leaves extract may possess the properties of reducing the ferric cation and also act as capping agents. The synthesized nano particles were characterized using spectroscopic techniques and checked for their anti bacterial activity against *E. Coli* bacteria. The nano particles where shown to possess remarkable anti bacterial activities against *E.Coli*

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