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# GREEN SYNTHESIS OF MANGANESE OXIDE NANOPARTICLES using *Phyllanthusacidus*

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## ABSTRACT

Manganese oxide nanoparticles was synthesized by green method using *Phyllanthusacidus*with potassium permanganate as the precursor on overnight incubation at room temperature a black-brown coloured nanoparticle was obtained. The obtained Mno2 particle was characterization by FTIR, SEM, and XRD. Fourier transform infrared spectroscopy spectra of pure MnO2 show the occurrence of O-Mn-O vibrational mode at around 942.02cm$^{-1}$. From scanning Electron Microscopy (SEM) image the surface morphology shows that the nanoparticles are spherical in shape. Adsorption studies like contact time pH 10, adsorbent dosage -0.2g and metal ion concentration 10ppm, Thermodynamics and desorption properties were studied. Antimicrobial property of nanoparticles were observed.

**Key words-** Manganese oxide nanoparticles, *Phyllanthusacidus*, potassium permanganate, green synthesis and Antimicrobial.

## INTRODUCTION

Nanoparticles is a small object that behaves as an entire unit with respect to its transport and properties. Nanoparticles includes liposomes, Nano crystals and Nano suspension, SLN etc. Nano-Mno has great potential applications in environment protection field as a brand new generation of environmental friendly catalyst. There are a variety of research result which show that the functional activity of semiconductor materials depends on the structure(1).

Manganese oxide is one in all the foremost interesting materials, incorporates a large choice structure with large surface extent. The varied structures, chemical properties of manganese oxides are taken advantages of potential application like as cation-exchange, ion and molecules separation, absorbents, sensor, battery, catalysis etc(2). Bacteria, fungi and algae are the micro-organisms which are capable of synthesizing the nanoparticles. Reduction of metal ions to nanoparticles is that the principle. Within the synthesis of silver, gold and other nanoparticles various microbes are involved which have considerably more attention than others and have their applications within the drug delivery systems. In metal reduction electron shuttles play a a significant role by involving proteins and cofactors that have redox potential(3).

In the organic process the foremost abudant micro-organism bacteria is is employed which provides the ambient pressure, temperature and PH. Beside the biological method, involves numerous problems system control, stability of product and aggregation of product. The survival ability that the most significant factor as they are doing not tolerate the high concentration of metals(4).

Green synthesis involves the plant Phyllanthus acidus (L.) Skeels isn't only used for its edible fruits but also wont to treat a large spectrum of diseases like inflammatory, rheumatism, bronchitis, asthma, respiratory disease, hepatic diseases and diabetes(5).

Gas condensation was the primary techniques wont to synthesis Nano crystalline metals and alloys. during this techniques, a metallic or inorganic material is vaporized using thermal evaporation sources like a joule heated refractory crucible, beam evaporation devices. CVD could be a well-known process during which a solid is deposited on a heated surface via a reaction from the vapour or gas phase. Vapour phase nucleation can occur in dense vapour cloud by multimode collision, the atoms are felt a gas to supply necessary collision and cooling for nucleation(6).

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## Materials and methods

### 1 Materials:

*Phyllanthus Acidus* leaves were collected in our campus. Then the leaves were dries in two or three days. Then the leaves were powdered. Potassium permanganate was purchased. Deionized water was used for the preparation of all reagents solutions(7).

**2. Methods:**Synthesis of MnO2 nanoparticles in solution phase was carried out as follows:

5g of Phyllanthus Acidus powder was dissolve in 100ml De-ionized water. The solution was kept in water batch for 10minutes. Then the solution was filtered using filter paper. KMnO4 solution was prepared. The solution was added to filtered solution in perfect ratio. The mixture was stirred using magnetic stirrer. Then the mixture was kept in room temperature for one night. The colour of the solution changed rapidly from purple to yellow-brown (indicating the onset of the formation of MnO2 nanoparticles) and finally dark brown(8).

### 3.PHYTOCHEMICAL ANALYSIS

To identify the phytochemical present in the ethanolic, petroleum ether, chloroform, and aqueous extract of *Ricinuscommunis* plants, Qualitative analysis of phytochemical (9).

### 4. Synthesis of $MnO_2$ nanoparticles

*PhyllanthusAcidus* powder KMnO4 solution was stirred using magnetic stirrer. The colour of the solution changed rapidly from purple to yellow-brown (indicating the onset of the formation of MnO2 nanoparticles) and finally dark brown(10).

### 5. Analysis of MnO nanoparticles by FTIR and SEM

### 5.1 Fourier Transform Infra Red spectrum:

FTIR Fourier Transform Infrared Spectroscopy (FTIR) study was carried out to identify the functional groups present in the adsorbents in the 4000-450cm ranges.

### 5.2 UV-Vis Spectroscopy

UV-Vis Spectroscopy can be used as an excellent tool to characterize the properties of metal nanoparticles,UV-Vis spectroscopy enables the amount of precursor metal ions used during the formation of metal nanoparticles to be measured(11).

### 5.3 Scanning Electron Microscopy

Scanning Electron Microscopy (SEM) with a secondary electron detector can visualize crystal shape, surface morphology, dispersed and agglomerated nanoparticles, and surface functionalization's SEM can examine each particle, including the aggregation of particles particle(12)

### 6. Comparison of antimicrobial activity leaf extract and MnO nanoparticle

25 ml of soft agar (at 45$^{o}$C) was inoculated with 0.1% of an overnight culture of the indicator. Microorganism approximately 5mmx10$^{-7}$ cells were swabbed over nutrient agar plate and 0.5 mmx0.5mm sized wells were made using well cutter and kept for incubation for 30 minutes. Holes were punched in the agar plates were checked for the zone of inhibition, by loading the MnOnano particles in respective wells. They were incubated at 37$^{o}$C for 24 hrs. The inhibition as positive if the width of clear zone around the colonies of producer strains. The larger inhibition zone could be around the wells, thus demonstrating MnOnano particles mediated inhibition of the sensitive microorganisms(13).

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## RESULTS AND DISCUSSION

### 3.The phytochemical analysis

**The phytochemical analysis of** *Phyllanthusacidus* showed the presence of alkaloids phenols and sterols and the quantitative analysis showed that sterols were rich in *Phyllanthusacidus*.

### 4. Synthesis of $MnO_2$ nanoparticles

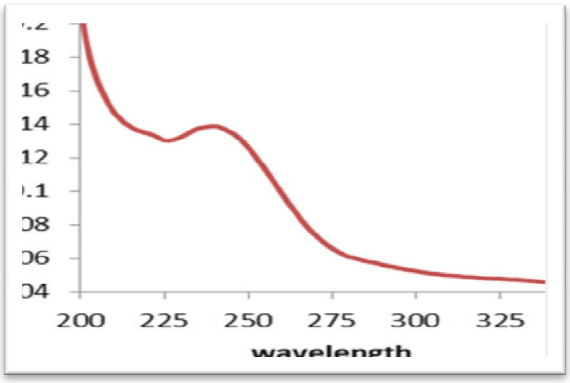
*PhyllanthusAcidus* powder KMnO4 solution was stirred using magnetic stirrer. The colour of the solution changed rapidly from purple to yellow-brown (indicating the onset of the formation of MnO2 nanoparticles) and finally dark brown

### 5.1 Fourier Transform Infra Red spectrum:

The FT-IR spectrum was used to identify the functional groups and other impurities present in the final product. The peaks around 1332.69 cm-1 may it correspond to O-H stretching vibrations. And also typically the peaks at 942.02 cm-1 may correspond to O-Mn-O bond. According to the functional group the peaks around 3697.21 cm-1 may it corresponds to O-H bond.

### 5.2 UV Visible Spectrophotometer:

The UV Visible Spectrophotometer:results revealved that the MnO nanoparticles were showed the maximum absorption at 284 and 325 nm.




### 5.3 Scanning Electron Microscopy

The structure or the surface of the manganese oxide nanoparticle was determined by SEM. The size of the nanoparticle was found to be in the range of 10-20nm. They are spherical shaped nanoparticles.

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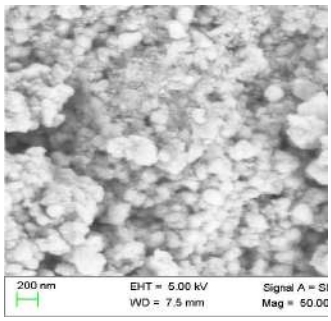
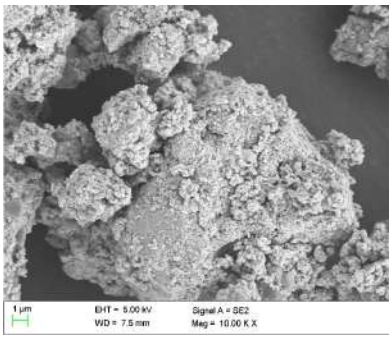
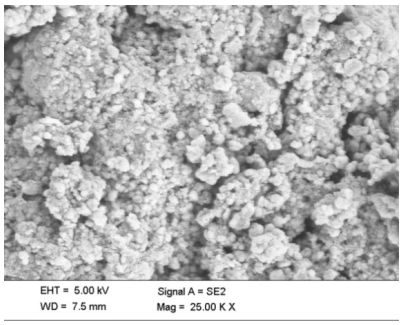
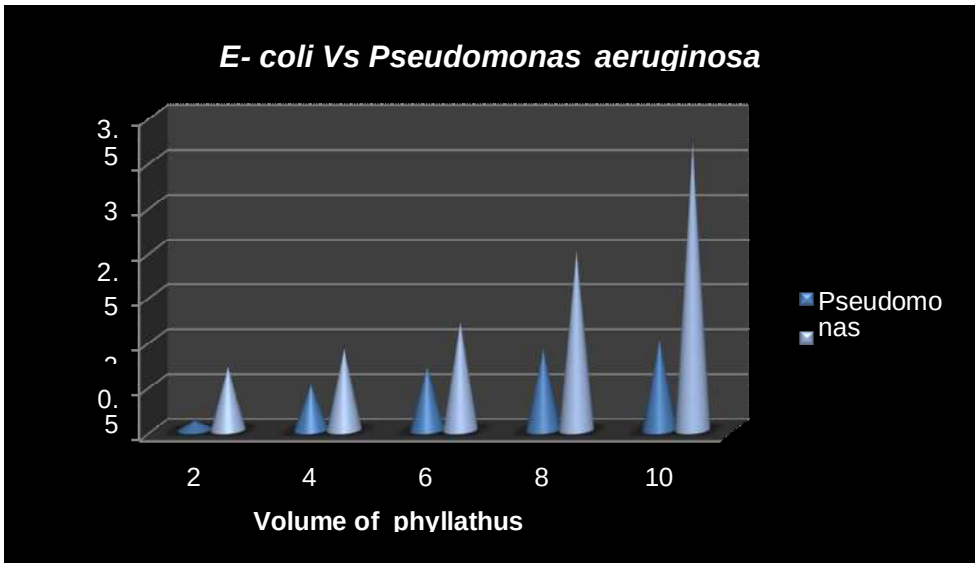


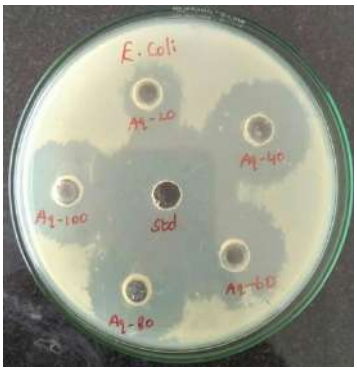




6. **Comparison of antimicrobial activity leaf extract and MnO nanoparticle**




*Escherichia coli* and *Pseudomonas aeruginosa* are two gram negative bacteria which were performed for antibacterial activity and the standard antibiotic used was Chloramphenicol .The results with maximum zone of inhibition by phyllathus acidus mno nanoparticles extract was exhibited more for *E.Coli* than *Pseudomonas aeruginosa*.

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**Discussion**

Manganese oxide nanoparticles were synthesized by green synthesis method using potassium permanganate. The obtained MnO2 solution was characterized by means of Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and Phytochemical Analysis.

Thus MnO nanoparticles is used as a Green synthesis of Nanoparticles aim at minimizing generated waste and implemented sustainable processes. In recent years, green processes using mild reaction conditions and nontoxic precursors have been emphasized in the development of nanotechnology for promoting environmental sustainability.Manganese oxide Nanoparticles are widely used in contaminant sensing, drug delivery, data storage, catalysis and bio medical imaging.Green synthesis of Nanoparticles is important due to increased concern of environmental pollution. Green chemistry based synthesis of Nanoparticles is preferred due to its eco-friendly nature.

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