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"SYNTHESIS AND CHARACTERIZATION OF NICKEL OXIDE BY USING UV/VIS SPECTROMETRY, SCANNING ELECTRON MICRSCOPY AND ITS ANTIMICROBIAL ACTIVITY AGAINST BACILLUS SPP., PSEUDOMONAS SPP. ESCHERICHIA COLI"

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ABSTRACT

Nanobiotechnology combines biological principles with physical and chemical procedures to generate nano-sized particles with specific functions. A green synthesis of nickel oxide and nickel synthesized by boiling method using an extract of *Molinga Olefera*. UV/Vis-Spectra showed the maximum absorbance of 280 nm in the Nickel oxide Nanoparticles formation. Boiling method is a new and an up scaling approach for synthesizing Nanoparticles of low cost and green synthesis method. In the present study, Nickel oxide Nanoparticles were prepared via boiling method using *Aloe Vera* and Nickel Chloride as it is commercially available. The SEM images and FTIR were studied to determine the structure of Nickel Oxide and Nickel Nanoparticles. We have also studied their microbiological activity. In future we are working on their applications in magnetic behavior and anticancer mechanism of the synthesised NiO Nanoparticles that can be use for cancer therapy.

KEYWORDS: Nanobiotechnology by boiling method using an extract of *Molinga Olefera*.

INTRODUCTION

Nano particles (NPs) are defined as a small object that behaves as a whole unit in terms of its transport and properties. In scientific terms "nano" means 10^{-9} meter where one nanometer is equivalent to one thousandth of micrometer, one millionth of millimeter and one billionth of a meter. In Greek, 'nano' derives from the Nanos, which means dwarf.[1] It is further

classified according to size: in terms of diameter, fine particles cover a range between 100 and 250 nanometers (nm), while ultrafine particles, on the other hand, are sized between 1 and 100 nm. Nanoparticles may or may not exhibit size-related properties that differ significantly from those observed in fine particles or bulk materials. Although the size of most molecules would fit into the above outline, individual molecules are usually not referred to as Nanoparticles. Particles with a size between 1 and 100 nm are normally regarded as Nanoparticles.

Metal oxides nanostructures play crucial role in many areas of chemistry, physics and materials science. In this work, the boiling method was employed to prepare Nickel Oxide Nanoparticles. The materials obtained were thermally treated at various temperatures. Some chemicals can interfere directly with the proliferation of microorganisms at concentrations that can be tolerated by the host. The antimicrobial activity of Nickel oxide Nanoparticles is well known. Hence we make use of this property to inhibit growth of *E.coli*, *Bacillus spp.*, *Pseudomonas spp.* using disc diffusion method. These two bacterial strains were selected as they are highly contagious; thence we can evaluate the potential antimicrobial activity of nickel oxide Nanoparticles.

The main aim of this work is to develop a method for the synthesis and characterization of Nickel Oxide Nanoparticles and characterization using UV/Vis-Spectrophotometer, FT-IR, SEM and microbiological activity.

EXPERIMENTAL SET-UP

Preparation of Plant Extract from *Molinga Olefera* Leaves

Molinga Olefera Leaves were collected and thoroughly washed with conductivity water. The green extract was synthesized by taking 10gm finely cut leaves in 20 ml of conductivity water. Then the leaves were nicely crushed in mortar pestle and were centrifuged for 10 min at low temperature. After centrifugation, the supernatant was filtered using *Whatmann paper* and filtrate was used for the synthesis of NiO Nanoparticles.

Synthesis of Nickel Oxide Nanoparticles using plant extracts

14 ml of Nickel chloride solution in conductivity water (0.08 M solution of Nickel chloride $NiCl_2.6H_2O$, MERCK) was mixed with the obtained biological extract and added into 50 ml of boiling conductivity water. After few minutes, the solution developed with a characteristic color (brown-red). Resulted solution was kept in an oven at 60°C for 2 hours. The

precipitation which contains Nano NiO was obtained. Finally, Nano NiO was grinded with mortar to be shaped into powder. The particles were purified by centrifuged and stored in stopped bottles for further studies.

The Growth Mechanism of the Nickel Oxide Nanopowder

The growth process of NiO and Ni Nanopowder can be controlled through the following listed chemical reactions:

$2NiCl_2 + NaBH^{-4}(s) + 2H_2O \rightarrow 2NiOn(s) + 2H_2(g) + 4H^{+} + O^{-1}$ …… (1)

The formation mechanism of the NiO Nanoparticles is a complex process and the $NiCl_2$ complexes serve as basic growth units for the preparation of NiO nanostructures. During the process, part of the $NiCl_2$ colloids dissolves into Ni^{2+} and Cl^{-} according to the reaction. When the concentration of Ni^{2+} and Cl^{-} reaches the super saturation stage NiO nuclei will form.

RESULTS AND DISCUSSION

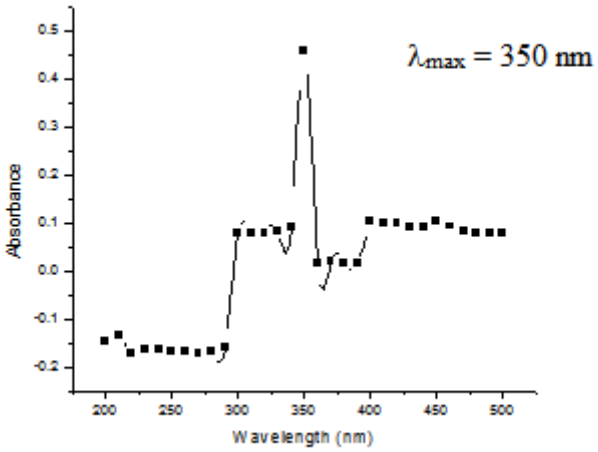
UV/Visible Analysis of the reaction

The reduction of NiO was characterized by measuring the UV–visible spectrum of the reaction medium at 2 hours after diluting a small amount of the sample into distilled water. UV–visible spectral analysis was done by using UV/Vis spectrophotometer (UV-1800 SHIMADZU SPECTROPHOTOMETER).

Table 1: Determination of $_{max}$ for Nickel Oxide Nanoparticles.

Wavelength /nm	Absorbance
200	-0.1456
210	-0.1345
220	-0.1734
230	-0.1635
240	-0.1623
250	-0.1696
260	-0.1665
270	-0.1724
280	-0.1693
290	-0.1612
300	0.0768
310	0.0789
320	0.0791
330	0.0838
340	0.0923
350	**0.4567**
360	0.0155

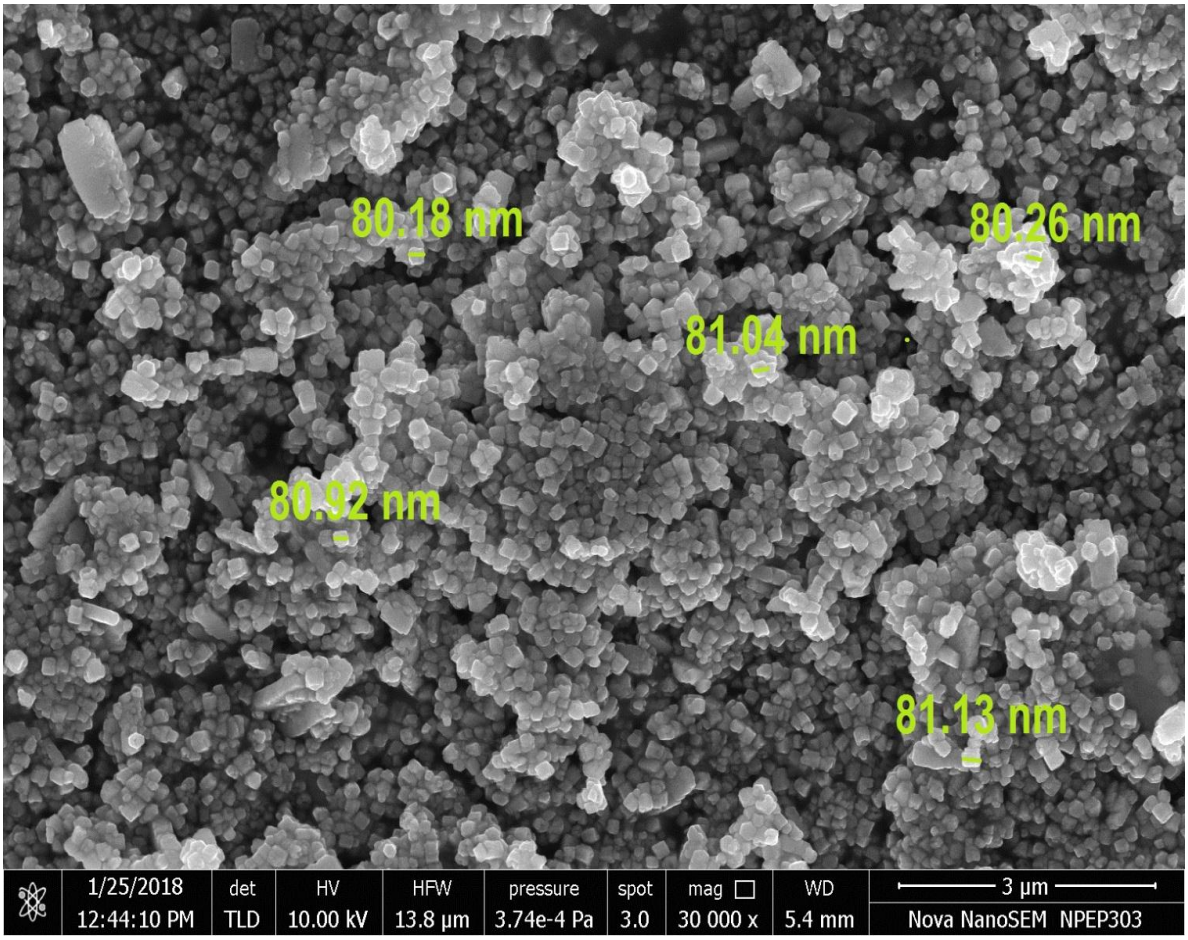
370	0.0198
380	0.0166
390	0.0162
400	0.1023
410	0.0982
420	0.0988
430	0.0923
440	0.0921
450	0.1034
460	0.0926
470	0.0817
480	0.0802
490	0.0792
500	0.0790



Graph 1: Calibration curve of absorbance vs. wavelength for NiO Nanoparticles solution by UV/VIS Spectrophotometry technique.

SEM of Silver Nanoparticles

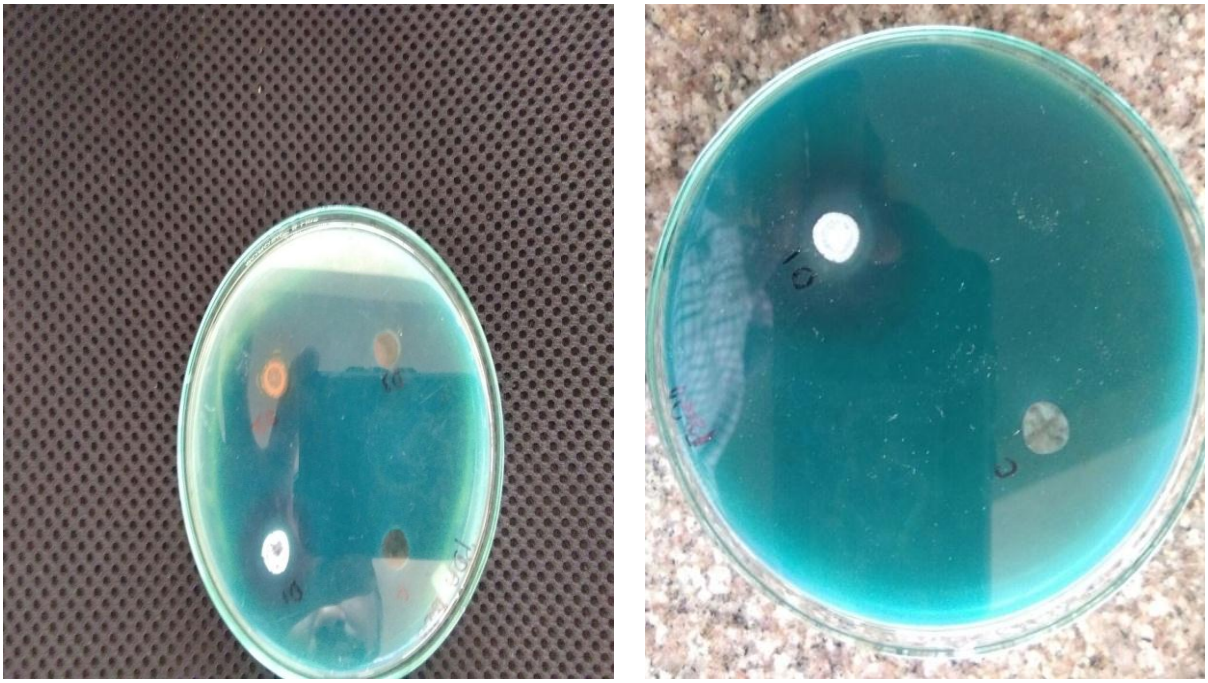
Scanning electron microscopy (SEM) provides size of the Nanoparticles which confirms the size of Nickel Oxide Nanoparticles. The average size of an individual particle is estimated to be 80.71 nm.



ANTIMICROBIOLOGICAL ACTICITY

Bacillus spp.

E.coli



Pseudomonas spp.

Antibacterial Effect of different Compound on different organism i.e. *E.coli, Bacillus spp., Pseudomonas spp.* effective on nutrient agar plates.

The most effective extracted compound that inhibited growth of E. coli, Bacillus, Pseudomonas spp. D-1, D-2, inhibited Alcoholic infusion extract D-1, D-2 more effective against Bacillus.

CONCLUSIONS AND FUTURE SCOPE

We have successfully synthesized NiO Nanoparticles. Boiling water method is a new approach for synthesizing Nanoparticles and is of low cost and material availability. Nickel Nanoparticles have applications as catalysts and magnetic substances. There are several reports on the preparation of Ni Nanoparticles, but our method use of boiling water method. During the process, the control of particle size and shape is essential.

Nickel Nanoparticles shown good Antimicrobiological activity against *E.coli, Bacillus spp., Pseudomonas spp.* Further study is required to identify the anticancer mechanism of the synthesised Ni and NiO Nanoparticles that may use for cancer therapy.

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