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Green synthesis of Novel Nickel oxide Nanoparticles using mangroves and its electrochemical characterization

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***Abstract*- Green technology and bio perspective research approaches are long lasting and most preferable one. Magic of this output is harmless and mostly in nano scale. Mangroves are small tree that's grows in saline environment. Many types of Mangroves are available in worldwide, Avicennia marina which is available in Tuticorin District that species flower part has utilised for NiO nano particle synthesis. NiO nanoparticles are using as Catalyst, Sensors, plastics, batteries, smart energy efficient materials, etc., Effective and novel nano materials are got. The characterisation techniques are UV, FTIR, AFM, Electrochemical workstation. In UV, Optical absorption peak intensity is found 319nm. The Functional group analysis is done through Fourier transform spectroscopy. The FTIR band at 418.57 cm-1, 466 cm-1 and 618.67 cm-1 reveals the presence of NiO. Spongy cubic like morphological behaviour is studied by Atomic force microscopy.**

Keywords: - Green synthesis, Mangroves, UV, FTIR, AFM.

I. INTRODUCTION

The research and researcher is not only involved to discovering or producing new materials to the world. The research accent and look after the existing our earth. As fastest, more yield materials and their route having some impact to the society. In nano science and technology are having more features, applications, steps and its concentrating misconception [1]. Nano particles are variety of shapes and size in nano region. Green synthesis is long lasting and future perfect technology; it attracts researchers by evolving new materials with novelty [2]. Transition metal and metal oxide nanoparticles used as catalyst, Sensors, plastics, batteries, smart energy efficient materials, ceramics and electronic applications [3] – [6]. In transition metal oxide like nickel oxides become one of the most important because it having their outstanding electrical application, extreme catalytic property, fuel cell electrode preparations.

Various technique are possible to synthesis NiO nanoparticles like chemical precipitation, sol – gel method, hydro thermal, Solvo thermal, microwave method etc, [7] – [9]. The industrial revolution and improvement towards strategically green is based on electrochemical and analytical applications, which utilize chemically modified electrodes [10, 11]. Recently there has been a considerable effort in the investigation of environmentally and biologically important compounds

In the present study, was approached green synthesis of nickel oxide nanoparticles from avicennia marina [12]. Avicennia marina is a species of mangroves in the plant family of acanthaceae (formerly in the Verbenaceae or Avicenniaceae) [13]. The thin, light – grey; avicennia marinas grow as a shrub or tree to a height of three to ten metres, or up to 14 metres in tropical regions. The habit is a gnarled arrangement of multiple branches. The flowers range from white to a golden yellow colour, are less than a centimetre across, and occur in clusters of three to five. This approach very simple, low cost effective, non - toxic, eco friendly method for the synthesis of novel nickel oxide nanoparticles from nickel chloride using the leaf extracts of aveceinnia marina (Mangroves). The flower extracts may act as stabilizing and capping agents [14].

II. MATERIALS AND METHODS

A. Collection of plant materials and preparation of plant extract

The fresh flowers of aveniccia marina are collected from mangrove ecosystem in Tuticorin coast, India. The aveniccia marina flowers are cleaned in running tap water and air dried in shade up to 10 days. After dried, the flowers were cut into small pieces and homogenized into a fine powder using mechanical grinder. All analytical reagents are purchased from e-merck. About 5 g of powdered of flowers

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are taken separately in two 250 ml conical flask containing 100 ml of millipure distilled water and boiled for 10 min. Then the aqueous flower extract of avecinnia marina collected separately into beaker by filtered through Whatman's no. 1 filter paper. The extract was used for the synthesis of nanoparticle.

B. Biosynthesis of nanoparticles

About 50ml of avecinnia marina extracts were taken in to beakers and 50ml of 0.1M nickel nitrate are added drop wise separately with constant stirring at ambient temperature. The reaction mixture colour change was observed. The extracts are then centrifuged at 10,000 rpm for 20 min. The NiO nanoparticles are washed with millipure distilled water for 2-3 times to remove unbound phyto constituents or impurities. Then nano particles dried at 200°C in a hot air oven and stored at 4°C.

C. Characterization of Nanoparticles

Synthesised nickel oxide nanoparticles were analysed using following instruments. UV–Vis spectral analysis was performed on a JASCO, V-600 spectrophotometer .The Nicolet iS5 Fourier transform infrared spectrometer (FT-IR) integrates high performance optics. The Atomic force microscopy model is Nano surf easy 2 scan BT02218 is profilometer – a sharp cantilever tip interacts with the sample surface sensing the local forces between the molecules of the tip and sample surface. CH Instruments electrochemical workstation.

III. RESULTS AND DISCUSSION

A. UV Visible spectroscopy

The NiO nanoparticles were characteristics by UV Vis spectroscopy. Absorption spectrum of NiO nanoparticles shows characteristics peak at 319 nm. When compared bulk NiO, blue shift takes place in the below figure 1 and confirm the Nickel oxide nanoparticles.

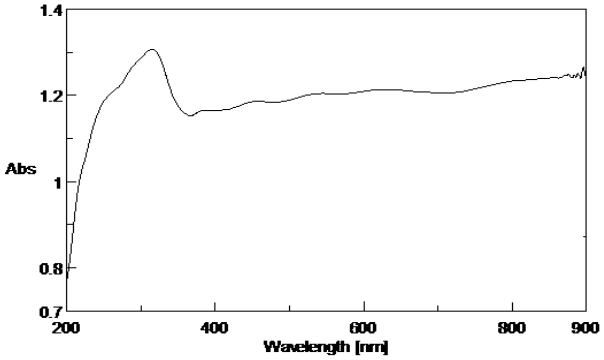

Fig.1 represents the absorbance spectra of the NiO nanoparticles.

B. Fourier transforms infrared spectroscopy

Fig. 2 shows the FTIR spectra of prepared NiO nanoparticles. In general, the FTIR bands due to metal - oxygen occurs in the region of 400-850 cm-1. Figure 2 shows peak at 466 cm−1, which corresponds to Ni–O stretching vibration [15]. The band at 618 cm−1 is associated with Ni-O-H stretching bond. This result is well consistent with other previously published reports. The bands at 3451 cm−1 and 1638 cm−1 are assigned O–H stretching vibration of surface adsorbed water molecule.

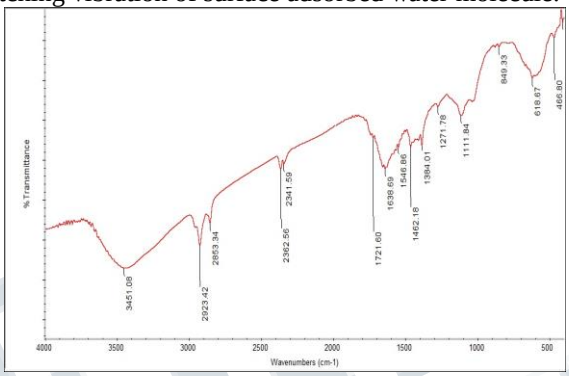

Fig.2. represents the FTIR spectra of the NiO nanoparticles.

C. Atomic Force Microscopy

AFM analysis of novel NiO nanoparticles are equally aligned slightly agglomerated near spongy cubic structure in nano scale. In 2 D view, describes the roughness of the product. The following parameters were used 1.56 µm, 3.4 µm and 6.25 µm and respective area is 2.461 pm^2, 9.842 pm^2and 39.37 pm^2. The mean value of roughness is -18.629nV for entire sample area. So it is suitable for electrochemical application.

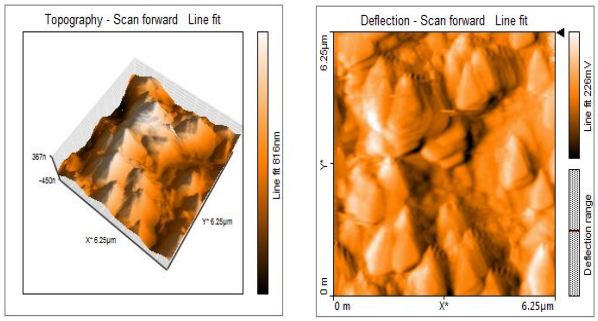

Fig.3. the AFM image of the NiO nanoparticles.

D. Electrochemical behaviour

Cyclic voltammetric behaviour of NiO nanoparticles were carried out at potential range from -0.6 to 1.6 vs Ag/AgCl. The figure 4 exhibits two oxidation peaks at -150 mV and 950 mV. The both peaks are confirmed the formation of

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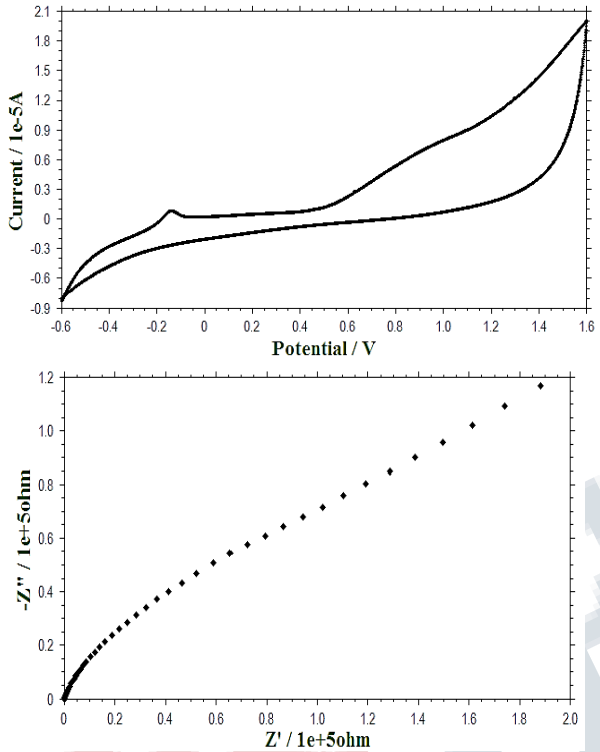
NiO. Electrochemical impedance spectrum NiO nanoparticles shows good double layer capacitance (Cdl), using the equation Cdl=1/2□fmaxRt. Impedance of nickel oxide nanoparticles represented in nyquist plots plot as shown in Fig. 5



IV. CONCLUSION

The NiO nanoparticles have been successfully synthesized by a green method ambient temperature. The optical behaviour is confirmed from UV Vis spectroscopy. The functional group determination is extremely delivered in FTIR characteristic bands. The AFM images confirm that NiO nanoparticles have spongy cubic shape in nanoscale. Electric property of samples had done through CH Instruments that shows the NiO have super paramagnetic behaviour.

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