Research Article

Herbal formulation mediated synthesis of silver nanoparticles and its antifungal activity

P. Vignesh, S. Rajeshkumar*

ABSTRACT

Aim: The aim of the study was to evaluate herbal formulation (Andrographis paniculata and moringa olifera) mediated synthesis of silver nanoparticles (AgNPs) and its antifungal activity. **Materials and Methods:** Andrographis paniculata and Moringa olifera formulated and used for green synthesis of AgNPs has been gaining importance due to its simplicity and eco-friendliness. In this study, the herbal formulation mediated AgNPs are evaluated for antifungal activity using agar well diffusion method. **Objective:** The objective of the study was to evaluate herbal-mediated synthesis of AgNPs and its antifungal activity.

KEY WORDS: Antifungal, Green synthesis, Nanoparticles

INTRODUCTION

These days, green science techniques are discernible for amalgamation metal nanoparticles due to reasonable, simple, and high response rate. In the present investigation gold nanoparticles (AuNPs) were eco-accommodating blended utilizing thyme separate at the room temperature for 30 min to give non-dangerous, which can be utilized for various applications. Recognizing properties of integrated AuNPs were finished by different systematic method including ultraviolet-visible assimilation spectroscopy endorsed nearness of AuNPs in the arrangement, the useful gatherings of thyme remove in the decrease and topping procedure of AuNPs are controlled by Fourier transform infrared (FT-IR), crystalline with the FCC plane affirmed by X-beam diffraction (XRD) design, vitalhity energy dispersive X-ray spectroscopy decided presence of components in the example, surface morphology, various shapes and size of present AuNPs were appeared by checking scanning electron microscopy (SEM), nuclear power microscopy (atomic force microscopy), and transmission electron microscopy (TEM). Starting and end wreck temperature of the AuNPs was dictated by warm gravimetric spectroscopy (thermal gravimetric analysis). Furthermore, antibacterial, cancer prevention agent, and cytotoxicity properties of AuNPs were examined. Antibacterial movement of AuNPs was researched on Gram-positive (*Bacillus*) and Gram-negative (*Escherichia coli*) by plate dissemination; in addition, minimum inhibitory concentration and minimum bactericidal concentration were resolved. DPPH free radical searching measure was utilized for cancer prevention agent property and contrasted with butylated hydroxytoluene as a standard cell reinforcement that demonstrated high cancer prevention agent movement. Combined AuNPs have incredible cell feasibility in a portion depended way and exhibit that this strategy gave nontoxic to the combination of AuNPs. The normal distance across of integrated AuNPs was about 35 nm (Hamelian *et al*., 2018).[1]

In the present examination, we report the green amalgamation of NiO nanoparticles utilizing *Aegle marmelos* as a fuel and this technique is eco-friendly and practical. The plant *A. marmelos* is utilized in the field of pharmaceuticals to fix infections such as constant loose bowels, peptic ulcers, and looseness of the bowels in India, for about 5 centuries. The as arranged nanoparticles were affirmed as unadulterated face focused cubic stage and single crystalline in nature by XRD. The development of agglomerated circular nanoparticles was appeared by high-resolution (HR)-SEM and HR-TEM pictures. The molecule measure determined from HR-SEM was in the range 8–10 nm and it matches with the normal crystallite estimate determined from the

Access this article online

Website: jprsolutions.info | ISSN: 0975-7619

Department of Pharmacology, Nanobiomedicine Lab, Saveetha Dental College, Saveetha University, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

***Corresponding author:** Dr. S. Rajeshkumar, Department of Pharmacology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600 077, Tamil Nadu, India. Phone: +91-9629739263. E-mail: ssrajeshkumar@hotmail.com

Received on: 15-04-2019; Revised on: 29-06-2019; Accepted on: 23-07-2019

XRD design. NiO indicates exceptional outflow crests at 363 and 412 nm in its photoluminescence (PL) spectra. The band hole of 3.5 eV is seen from DRS considers and the development of unadulterated NiO is affirmed by FT-IR spectra. The as arranged NiO nanoparticles demonstrate overly paramagnetic conduct, when charge considers are completed. It is then assessed for cytotoxic action toward A549 cell culture, antibacterial action, and photocatalytic degradation (PCD) of 4-Chlorophenol (4-CP), which is known as the endocrine disrupting chemical (EDC). From the outcomes, it is discovered that the cell suitability of A549 cells was adequately diminished and it demonstrated better antibacterial action toward Gram-positive bacterial strains. It is likewise ended up being an effective and stable photocatalyst toward the debasement of 4-CP (Angel Ezhilarasi *et al*., March 2018).[2]

In the present study, we report the green synthesis of NiO nanoparticles using *A. marmelos* as a fuel and this method is eco-friendly and cost-effective. The plant *A. marmelos* is used in the field of pharmaceuticals to cure diseases such as chronic diarrhea, peptic ulcers, and dysentery in India, for nearly 5 centuries. The as-prepared nanoparticles were confirmed as pure face-centered cubic phase and single crystalline in nature by XRD. The formation of agglomerated spherical nanoparticles was shown by HR-SEM and HR-TEM images. The particle size calculated from HR-SEM was in the range 8–10 nm and it matches with the average crystallite size calculated from the XRD pattern. NiO shows intense emission peaks at 363 and 412 nm in its PL spectra. The band gap of 3.5 eV is observed from DRS studies and the formation of pure NiO is confirmed by FT-IR spectra. The as-prepared NiO nanoparticles show superparamagnetic behavior when magnetization studies are carried out. It is then evaluated for cytotoxic activity toward A549 cell culture, antibacterial activity, and photocatalytic degradation (PCD) of 4-chlorophenol (4-CP), which is known as the endocrine disrupting chemical (EDC). From the results, it is found that the cell viability of A549 cells was effectively reduced and it showed better antibacterial activity toward Gram-positive bacterial strains. It is also proved to be an efficient and stable photocatalyst toward the degradation of 4-CP (Angel Ezhilarasi *et al*., March 2018).[2]

MATERIALS AND METHODS

Preparation of Herbal Extract

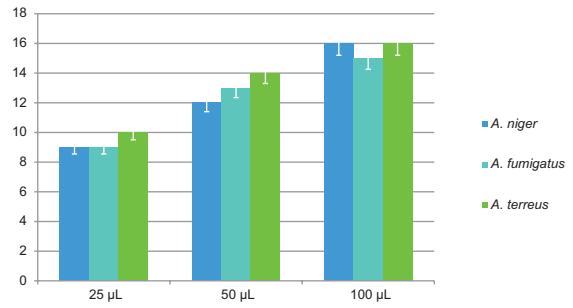
Herbal leaves were collected from Chennai. The collected leaves were washed 3–4 times using distilled water then dried it in shade for 7–14 days. The well-dried leaves were made into the powder.

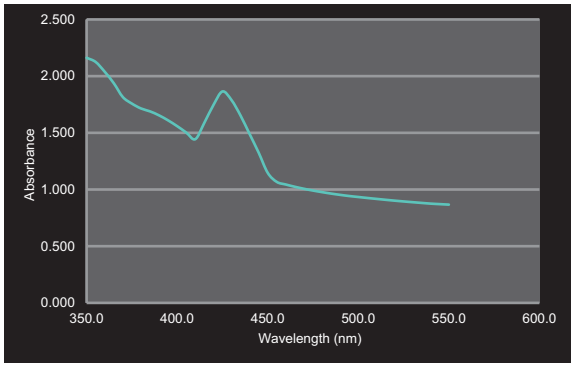
RESULTS AND DISCUSSION

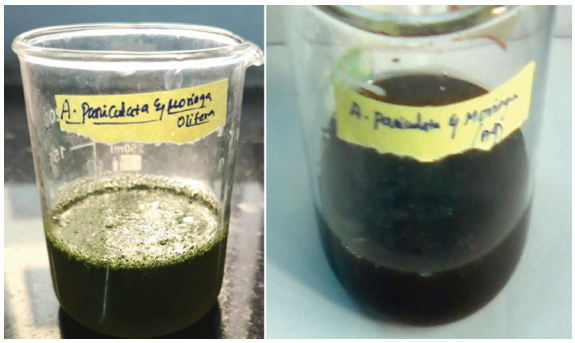
The strong intense and sharp peaks of Ag clearly indicated that the resulting products are highly crystalline. The obtained XRD pattern clearly indicated the formation of Ag and showed no other diffraction peaks, and thus confirming the purity of Ag phase. The crystallite size of the Ag nanocrystals was where D is the average crystal size, λ is the wavelength of the X-ray radiation, and β is fullwidth at half maximum. The calculated crystallite size from the intense plane of (200) was found to be 9.69 nm. The reduced crystallite size may be due to the method employed, as plant extract has the ability to act as a fuel and capping agent, thereby reducing the size of the particle. Thus, it is predicted that the small crystallite size with high crystallinity of the synthesized AgNP will have a remarkable impact on the biological activity.

Green Synthesis and Antifungal Activity of Nanoparticles

The plant formulation (*A. paniculata* and *M. olifera*) 10 mL was added with 1 mM of 90 mL of silver nitrate solution and colour change was observed. The centrifuged silver nanoparticles solution was loaded in the wells of rose Bengal Agar plates. The zone of inhibition was observed after 48 h.







REFERENCES

1. Hamelian M, Varmira K, Veisi H. Green synthesis and characterizations of gold nanoparticles using thyme and survey cytotoxic effect, antibacterial and antioxidant potential. J Photochem Photobiol B 2018;184:71-9.
2. Angel Ezhilarasi A, Judith Vijaya J, Kaviyarasu K, John Kennedy L, Ramalingam RJ, Al-Lohedan HA, *et al*. Green synthesis of NiO nanoparticles using Aegle marmelos leaf extract for the evaluation of in-vitro cytotoxicity, antibacterial and photocatalytic properties. J Photochem Photobiol B 2018;180:39-50.

Source of support: Nil; Conflict of interest: None Declared