ECP 2025 Conference

The 4th International Electronic Conference on Processes

20–22 October 2025 | Online

MDPI

Biofabrication of ZnO and MgO Nanoparticles Using - Dracaena trifasciata derived Reducing Agents and Their Antimicrobial Activity Against Pathogens

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INTRODUCTION & AIM

❖ **Introduction:**

- Dracaena trifasciata (snake plant) offers benefits like air purification, including producing oxygen at night from CO2 present in atmosphere.
- Filter toxins like formaldehyde, xylene and benzene present in house.
- Can also help regulate humidity, reduce allergies, boost mental well-being by lowering stress, and requires very little maintenance.
- Zinc oxide (ZnO) nanoparticles reported for strong antimicrobial, antifungal, and antiviral properties which were used in medical applications like wound dressings and antibacterial creams.
- It also have antioxidant, anti inflammatory and antidiabetic properties which can be used in drug formulation.
- MgO nanoparticles are also reprted for their antibacterial, antifungal, and antioxidant properties.
- In medicine, MgO-NPs are used for antibacterial coatings, drug delivery, and bioimaging.

❖ Aim:

- Synthesized Nanocomposites of ZNO and MgO mediated with extract of ***Dracaena trifasciata*** which blend with biodegradable polymer get prepared in form of thin film.
- Prepared biofilm were used for food packaging materials and enhancing **mechanical strength**, **barrier properties**, and **antimicrobial activity**, ultimately **extending shelf life** and improving **food safety.**

METHOD

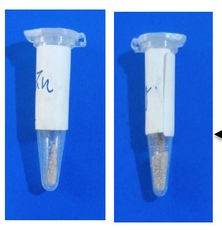
A- Synthesis of nanoparticles:

Chopping and grind the leaves

Leaf paste add in distilled water and boiled 2 hours

Leaf extract

Synthesis of Zno and MgO NPs



ZnO MgO

Dry the filter sample in muffle furnace

Filter the solution

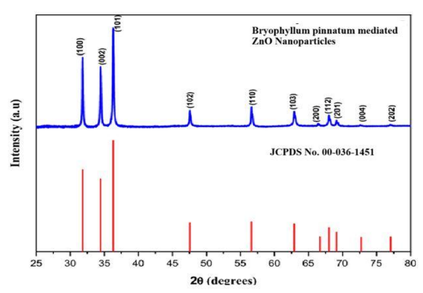
B- Biological activity of ZnO and MgO NPs:

The agar well diffusion method was used to assess the antibacterial activity of samples SRNP-1, SRNP-2, SRNP-3 and SHNP-1 against gram positive (Bacillus subtilis) and gram negative (Escherichia coli) bacterial strains. Nutrient agar medium (NA) plates were equally swabbed with bacterial cultures, and 5 mm diameter wells were filled with three different amounts of samples. Using a spectrometer (Eppendorf, AG, Germany), the bacterail cell suspensions were adjusted to an optical density of 0.1 at 600nm, or roughly 10^ 8 colony-forming units per milliliter (CFU/mL). The inhibitory effects of samples at different concentrations (50, 75, and 100 µg/mL) were evaluated in comparison to a control. Gentamycin (1µg/mL) served as the positive control and DMSO (dimethyl sulfoxide) as a negative control in the

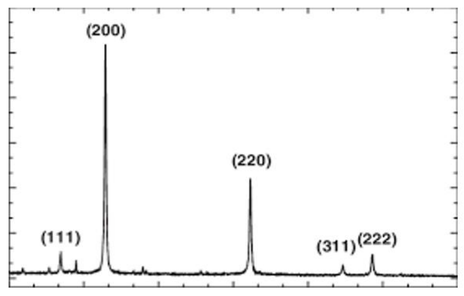
experiment.

RESULTS & DISCUSSION

A: XRD analysis of ZnO and MgO:

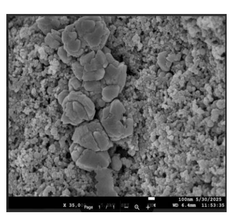


XRD of ZnO Nanoparticles

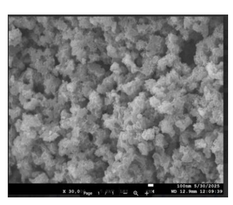


XRD of MgO Nanoparticles

B: SEM analysis of ZnO and MgO:

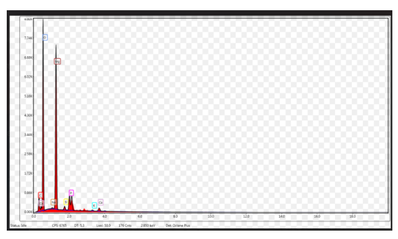


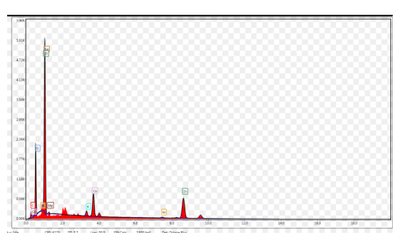
MgO



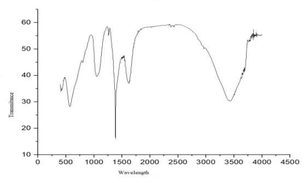
ZnO

C: EDX analysis of MgO and ZnO

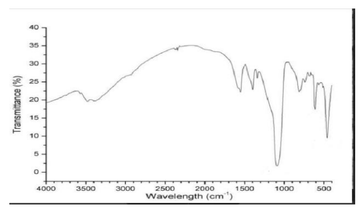




D: IR spectrum analysis of MgO and ZnO:

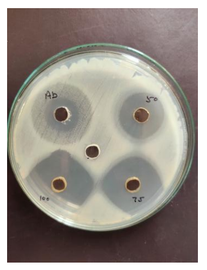


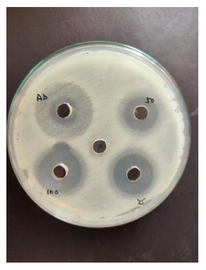
MgO



ZnO

Antimicrobial activity against Gram positive (Bacillus subtilis) and Gram negative (Escherichia coli)





The antibacterial efficacy of synthesized nanoparticles (NPs) was evaluated against Escherichia coli and B. subtilis using three concentrations (50, 75, and 100 µg/mL). All tested strains exhibited concentration-dependent inhibition zones. Among the isolates, SRNP-1 showed the highest activity against E. coli with an inhibition zone of 30.33 ± 0.58 mm at 100 µg/mL, comparable to the standard antibiotic Gentamycin (30.67 ± 0.58 mm). SRNP-2 and SRNP-3 also displayed activity, with inhibition zones of 26.67 ± 2.31 mm and 24.33 ± 0.58 mm, respectively, at 100 µg/mL In the case of Bacillus subtilis, SRNP-1 again demonstrated strong inhibition, particularly at 75 µg/mL (29.33 ± 0.58 mm), while activity at 100 µg/mL was lower (14.00 ± 0.58 mm). SRNP-2 and SRNP-3 showed moderate antibacterial effects, with inhibition zones decreasing at higher concentrations. SHNP-1 exhibited the lowest activity among all tested strains. No inhibition was observed in control treatments using DMSO.

CONCLUSION

The above research work gives idea that synthesized plant mediated synthesized nanocomposites can be blend with any biodegradable polymer and thin film can be used as food packaging material which also increases food shelf life can also be very useful maintain food scarcity problem of InIdia.

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