

# Metal oxide –Ag based antimicrobial coating for masks and surfaces



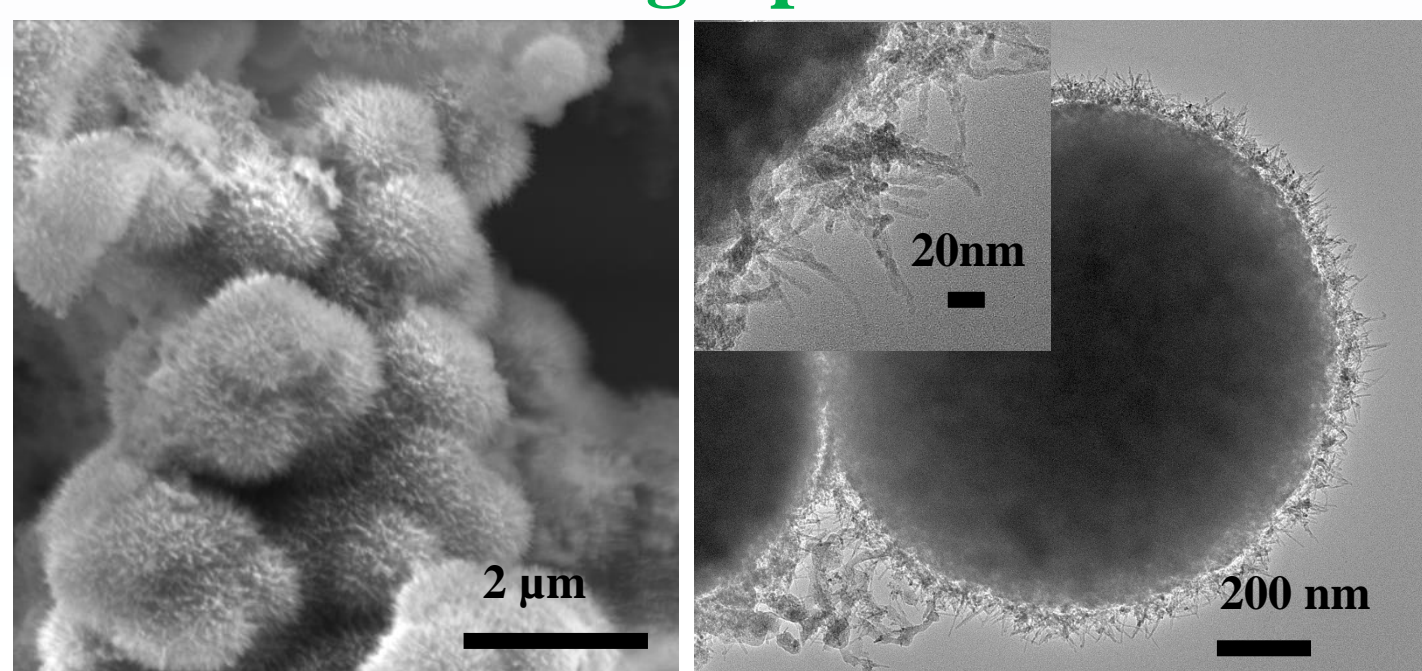
## Abstract

Nanoformulation consisting of a mixture of spiky metal oxides (MMO) with silver nanoparticles and surfactants is prepared by a wet chemical method. The nanoformulation possesses excellent antimicrobial property due to its physical effects from spiky morphology and chemical effects from binding of surfactants, metal and reactive oxygen.

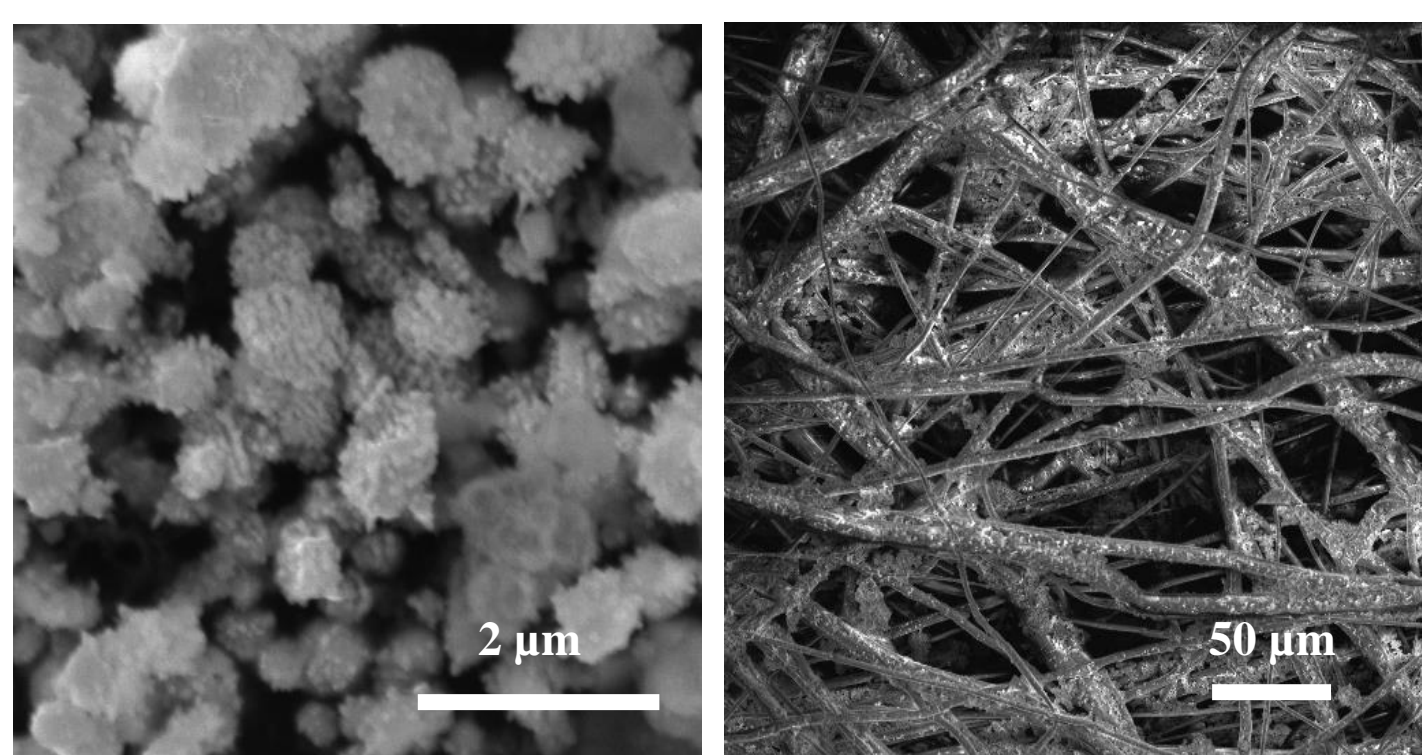
## Preparation of nanoformulation

- The nanoformulation is obtained by hydrothermal method & chemical deposition
- Synthesis method is facile, economical and easily scalable

## Electron micrographs of MMO



## Electron micrographs of nanoformulation coated substrate and meltblown fabric



- The synthesized MMO has a spiky morphology with spike diameter ~4-5 nm and ~60-80 nm length
- The size of the MMO is ~1-1.3 µm

## Future Scope

- Antiviral nanoformulation against air borne viruses (enveloped and non enveloped)
- Self-cleaning face mask
- Nanoformulation coated bandages and diapers

## Contributors

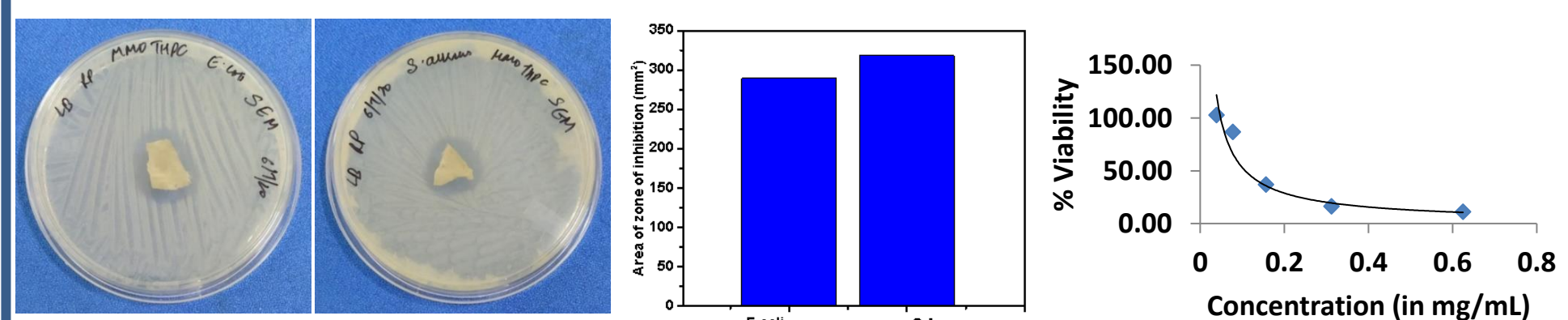
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## Antimicrobial Studies

### Antibacterial activity of nanoformulation coated mask fabric by plate diffusion method and MIC



- The synthesized material shows excellent inhibition against both gram positive and gram negative bacteria
- The minimum inhibition concentration (MIC) of nanoformulation is 107 µg/mL against S.aureus bacteria
- The minimum concentration of nanoformulation required to kill 99.9% of bacteria is 2.5 mg/mL
- The coated mask fabric is highly reusable by heating at 85 °C or exposing to sunlight or UV LED
- The healthy mouse fibroblast cells are highly viable in moderate dosage of nanoformulation. The developed nanoformulation is less cytotoxic to the healthy cells

## Prototypes developed

### Configuration of antimicrobial mask, prototype of developed face mask & antimicrobial spray for surfaces



### Plausible mechanism of deactivation of pathogens by the developed face mask

- The outermost (first) layer being hydrophobic repels the virus aerosols
- Second layer contains the developed nanocoating and any virus that comes in contact with the membrane gets deactivated by nanoformulation
- The oily lipid layer of the virus will be dissolved by the surfactant
- The silver nanoparticles will bind to the protein spikes and help to deactivate the virus
- Mixed metal oxides possess broad spectrum of antiviral and antibacterial properties responsible for deactivating the virus irreversibly