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Studies on Microwave Non-Thermal Sterilization Enhanced by Ag@TiO_2 Core-Shell Particles

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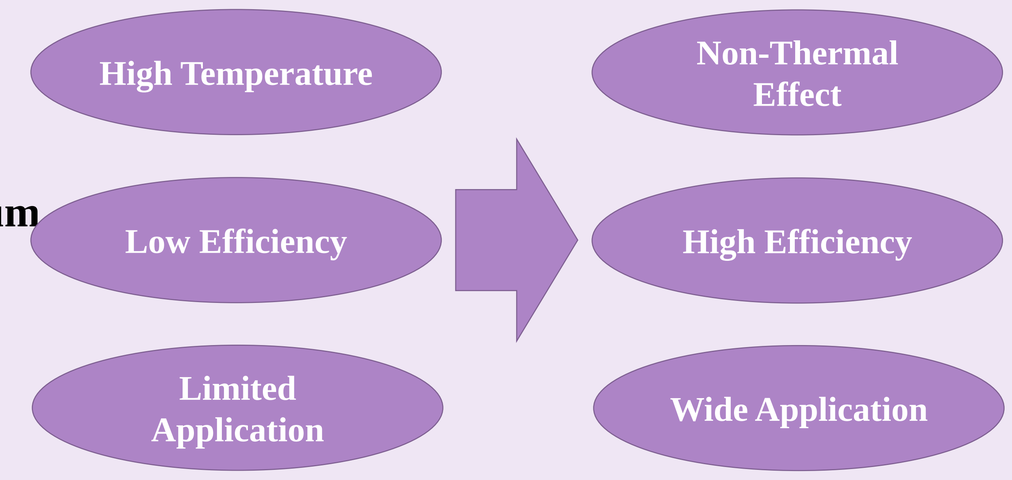
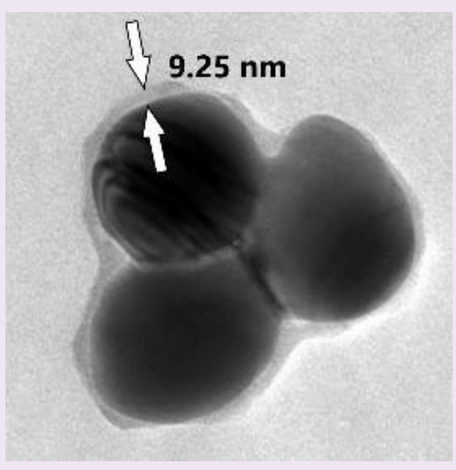
I. Introduction

- Necessity of cold chain sterilization in the context of COVID-19.
- Microwave sterilization has the advantages of efficient, safe, wide spectrum of disinfection bacteria.
- The participation of non-thermal effect in the microwave sterilization.
- Microwave sterilization was carried out at low temperature using non-thermal effect enhancer (Ag@TiO_2 core-shell particles).

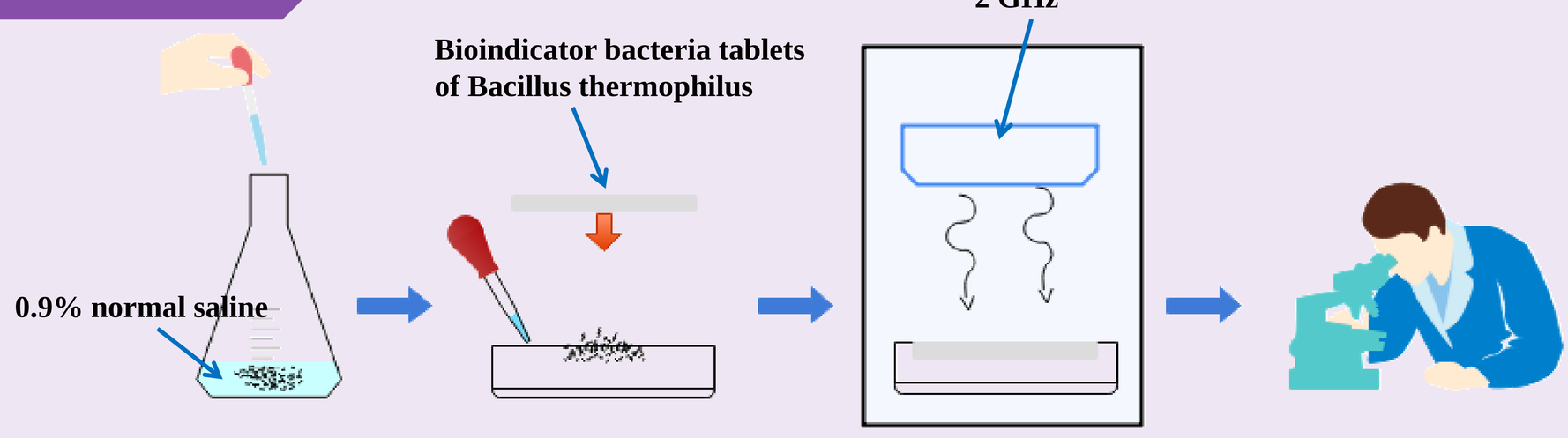


Comparison between traditional and new microwave sterilization

II. Materials & Methods

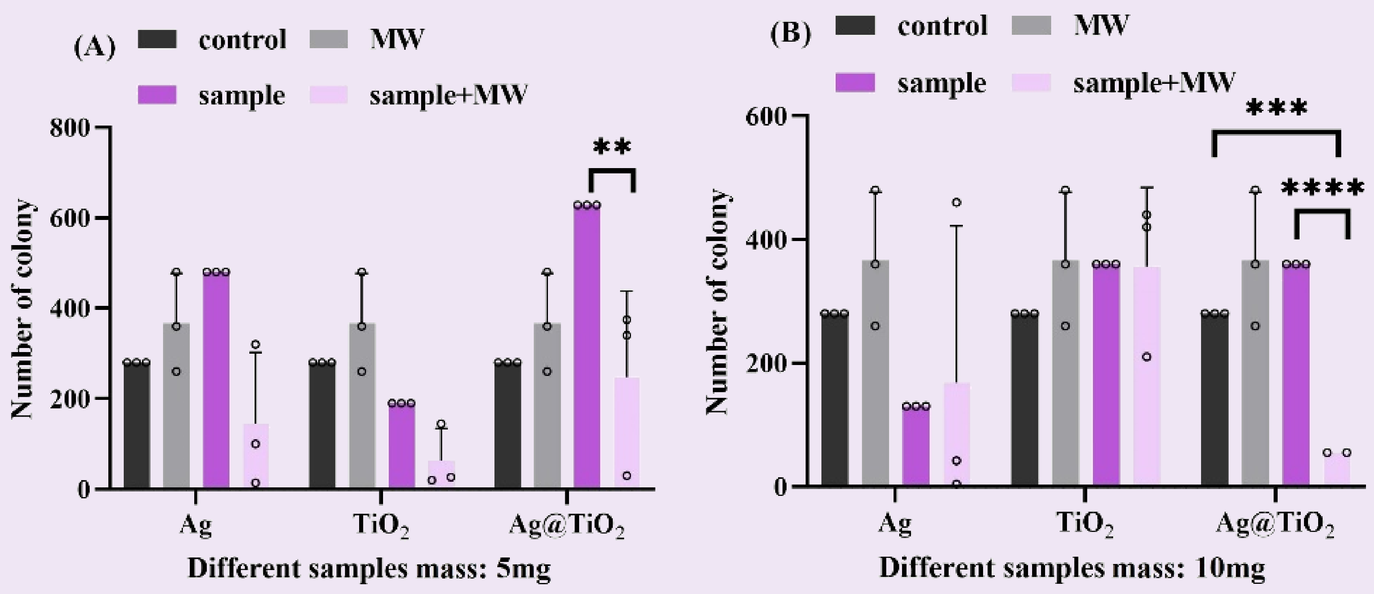


TEM images of rutile Ag@TiO_2

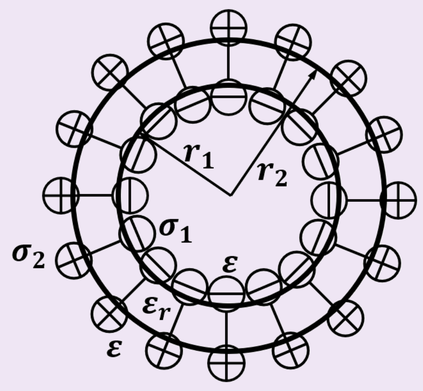


Preparation of enhancer sample groups | Microwave irradiation | Observation

III. Results & Discussion



Inactivation effect of different added mass microwave non-thermal enhancer samples on Bacillus stearothermophilus



Double electric layer cell membrane model

- When the added mass of Ag@TiO_2 is 10mg, the "sample + MW" group improved by 89.82% compared with the "sample" group.
- The synergistic sterilization effect of Ag@TiO_2 and microwave can be explained combined with the polarization effect of core-shell nanoparticles and bi-electric layer cell membrane model.

IV. Conclusions

- Ag@TiO_2 produces polarization under the microwave, and causes local charge accumulation, which further affects the surface charge density inside and outside the cell membrane, and increases the pressure difference in the cell membrane. All these finally result in the death of bacteria.
- Statistical analysis shows that, compared with nano-Ag and TiO_2, Ag@TiO_2 core-shell nanoparticles can produce a strong synergistic sterilization effect with microwave under a certain additive mass.

Acknowledge

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