World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:19, No:02, 2025

Evaluate the Antibacterial Properties of Zinc Oxide Nanostructures Grown on PVDF-HFP Fiber Against S. Aureus

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Abstract : This study investigates the properties of zinc oxide (ZnO) as an antibacterial agent to combat Staphylococcus aureus (S. aureus), a significant public health threat due to its antimicrobial resistance (AMR). Contamination by S. aureus, particularly through food, poses substantial health risks to communities. ZnO, known for its antibacterial properties, was evaluated as an alternative to conventional antibiotics, which are increasingly ineffective against AMR strains of S. aureus. The study involved depositing S. aureus onto ZnO nanostructures grown on PVDF-HFP fiber micropillars fabricated using a nanoimprinting technique. These ZnO nanostructures created a sharp, textured surface capable of combating S. aureus through both physical contact and chemical interactions. Bacterial viability was assessed using the Live/Dead™ BacLight™ Bacterial Viability Kit and observed under confocal laser microscopy. The results showed a significant reduction in S. aureus levels, with bacterial cells largely eliminated and inhibited on the ZnO surface (3.8% ± 6%, $P < 0.00001$), confirming ZnO's effectiveness as an antibacterial agent. Additionally, ZnO's application in food packaging was evaluated, demonstrating its potential to improve food safety by reducing bacterial contamination. This study underscores ZnO as a sustainable and effective solution to address the challenges posed by AMR in S. aureus, offering promising applications in public health and food safety.

Keywords : S. Aureus, antibacterial, antimicrobial resistant, nanostructures, Micropillar, copolymers material, food packaging
Conference Title : ICMSE 2025 : International Conference on Materials Science and Engineering
Conference Location : Melbourne, Australia
Conference Dates : February 03-04, 2025