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Development of bacterial-resistant electrospun polylactide membrane for air filtration application: Effects of reduction methods and their loadings

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Abstract:
The antimicrobial activity of fibrous membranes with electrospun polylactide (PLA)/silver nanoparticles (AgNPs) depends on the accessibility of the AgNPs, among other factors. The challenge is therefore to develop a suitable method for loading the AgNPs onto the fibers. In this study, different techniques for determining the efficacy of the membranes in rendering AgNPs available for antimicrobial activity against Gram-negative Pseudomonas aeruginosa and Gram-positive Staphylococcus aureus bacteria are evaluated. Immersion coating, electrospray-coating, and in-situ loading techniques were used to load AgNPs onto hierarchical electrospun PLA fibers, and their antibacterial effect was evaluated based on a qualitative disc diffusion method. The reduction of AgNO3 (Agþ) to AgNPs was carried out through the use of UV irradiation and neem (Azadirachta indica) leaf extracts. The membranes were coated using an electrospray technique resulted in the best antibacterial activity owing to the uniform dispersion of the AgNPs. The AgNPs were also exposed on the surface of the membranes, as confirmed using scanning electron and transmission electron microscopes. An electrospray is, therefore, a promising technique for the preparation of antimicrobial nanofibrous membranes.