A Study on the Development of High-Performance Antimicrobial Composites Using Silver Nitrate

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질산은을 이용한 고성능 항균 복합소재 개발에 관한 연구

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Abstract

With the development of nanotechnology, electrospinning, as a simple and effective novel processing technology capable of producing nanofibers with smaller pores and higher surface area, plays an important role in various fields, such as, filtration application, environmental engineering, biomedical application (e.g. medical prostheses, pharmaceutical, tissue template, wound dressing), protective clothing application, electrical and optical application and other functional application. Especially in recent decades, electrospinning has become one of the main ways for the effective preparation of nanofiber materials due to its manufacture simplicity, low cost spinning, spinning a wide variety of materials, and process controllability.

In this study, AgNO3 crystal powder was used as an antibacterial agent against E. coli and S. aureus bacteria. All as-prepared spinning solutions(PAN/FA/AgNO3) were electrospun at 15kV of high-voltage electricity with an 18cm tip-to-collector distance, and the solution feed rate was 1mL/h. To fabricate the multifunction membrane with antibacterial activity, various amounts of AgNO3 (1%, 2%, 3% of weight ratio to PAN) were added to the PAN solution containing with 40wt% of CFA powder. The antibacterial activity of the different samples was evaluated by measuring a clear area around the tested samples. As 1wt% and 2wt% of the AgNO3 were added to the M4 solution, the antibacterial activity of the as-synthesized membranes increased gradually. This is mainly due to the presence of Ag nanoparticles (NPs) on the surface of electrospun membranes, and some Ag NPs release Ag+ with the help of oxygen and an aqueous solution. The Ag NPs and Ag+ can combine with negatively charged functional groups on the cell walls of bacteria and interfere with cell permeability and respiratory functions, which as a result damages the functional proteins in the bacteria and eventually leads to the loss of bacterial activity.

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