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Nano-fabrication of polymer-based antibacterial textiles for biomedical applications

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The demand for advanced textiles with inherent antibacterial properties has grown significantly in recent years, driven by the increasing need for effective infection control measures in biomedical settings.[1] Electrospinning, a versatile and scalable technique, has emerged as a promising method for fabricating antibacterial textiles with precise control over fiber morphology and surface characteristics.

Electrospinning involves the application of an electric field to a polymer solution, leading to the formation of ultrafine fibers through a jetting and stretching mechanism. These fibers exhibit a high surface area-to-volume ratio, conducive to efficient functionalization with antibacterial agents. Various polymers, including biocompatible and biodegradable materials, can be employed as the electrospinning matrix, allowing for the developing of diverse textile formats, such as nonwovens, membranes, and scaffolds. [2]

Electrospun textiles are often modified with antibacterial agents, such as nanoparticles, enzymes, or antimicrobial peptides, to confer antibacterial properties. The controlled release of these agents from the electrospun fibers imparts long-lasting antibacterial activity to the textiles, making them suitable for applications in wound dressings, implants, personal protective equipment, and hospital linens.

Furthermore, the tunability of the electrospinning process allows for the optimization of fiber diameter, porosity, and surface roughness, all of which play a critical role in the overall antibacterial performance of the textiles. Recent advancements in electrospinning technology have incorporated multiple antibacterial agents into a single textile, providing a multifunctional approach to combat a broad spectrum of pathogens.

In conclusion, electrospinning offers a versatile and efficient platform for fabricating antibacterial textiles tailored to meet the specific requirements of biomedical applications. These textiles promise to enhance infection control, promote wound healing, and improve patient care in healthcare settings. Further research and development efforts in this field are expected to yield innovative solutions that address the evolving challenges of antibacterial textile fabrication for biomedical purposes.

References:

1. Zakrzewska, Anna, et al. "Nanotechnology transition roadmap toward multifunctional stimuli-responsive face masks." ACS Applied Materials & Interfaces 14.41 (2022): 46123-46144.
2. Qian, Ji, et al. "Highly stable, antiviral, antibacterial cotton textiles via molecular engineering." Nature Nanotechnology 18.2 (2023): 168-176.

CERTIFICATE

It is hereby confirmed that

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