

Study on the development of composite fiber materials with excellent antibacterial properties by using natural tree extracts

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천연 나무 추출물을 이용한 항균특성이 우수한 복합섬유소재 개발에 관한 연구

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Abstract

Since the global COVID-19 outbreak in 2019, more and more people have begun to pay extensive attention to products with antibacterial properties. Microbes and bacteria are ubiquitous in our living environment. Keeping a good habit of washing hands frequently can reduce the invasion of bacteria. In addition, the use of antibacterial materials, such as an antibacterial mask, is also an effective way to block microbial invasion. Antibacterial is different from bactericidal. Antibacterial is a process that uses chemical or physical methods to kill bacteria or hinder the growth, reproduction and activity of bacteria. Sterilization is the process of killing pathogenic bacteria in objects, but objects also contain non pathogenic bacteria such as spores and thermophilic bacteria. At present, there are many antibacterial agents. Among them, there are many antibacterial materials with silver as antibacterial additive. The antibacterial principle of silver is mainly that when silver ions contact with microorganisms, they will penetrate their cell membranes, and then combine with the proteins inside the cells, making them irreversible denaturation. Microbes will also have metabolic disorders, and their growth and reproduction functions will be inhibited. After the death of microorganisms, the silver ions in the body will dissolve and participate in the next sterilization task, which can play a long-term bactericidal role. In addition, silver ion contact reaction causes damage to common components of microorganisms or dysfunction. When a small amount of silver ions reach the microbial cell membrane, because the latter is negatively charged, they are firmly adsorbed by coulomb gravity. Silver ions penetrate the cell wall and enter the cell, and react with SH group to coagulate the protein, destroy the activity of cell synthetase, and the cell loses its ability to divide and multiply and dies. Silver ions can also damage the electronic transport system, respiratory system and material transport system of microorganisms. Although silver nanoparticles have super permeability, they can quickly penetrate into the skin for 2 mm to kill bacteria, and they have good bactericidal effects on common bacteria, stubborn bacteria, drug-resistant bacteria and deeper tissue infections caused by fungi. However, the shedding of silver nanoparticles will cause great harm to liver and other organs after being inhaled by human body. Therefore, it is necessary to develop environment-friendly and efficient antibacterial additives. With the continuous updating of extraction technology, people began to pay attention to the extraction of antibacterial liquid from the roots, diameters, leaves, flowers, fruits and other parts of different plants, and comparative analysis of their antibacterial properties.

In this study, in order to prepare environment-friendly and efficient antibacterial composite fiber materials, a variety of plant extracts were used as environment-friendly antibacterial agents to fabricate different antibacterial fiber membranes through electrospinning technology. In addition, to study the inhibition of different concentrations of plant extracts on bacteria, mixed spinning solutions with different concentrations were prepared. The morphology and the crystal structure were investigated by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction patterns (XRD) and Fourier transform infrared spectroscopy (FT-IR).

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