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Light-induced antibacterial and UV-protective properties of polyamide 56 biomaterial modified with anthraquinone and benzophenone derivatives

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ABSTRACT: The bio-based material polyamide 56 (PA 56) is a new kind of biopolymer. Reactive Blue P-3R, which is a derivative of anthraquinone, can react directly with the amino groups on PA 56. 3,3',4,4'-Benzophenone tetracarboxylic acid (BPTCA), which is a photoactive derivative of benzophenone, can also react directly with the amino groups on PA 56 to form amide bonds. The modified bio-based PA 56 fabrics not only exhibited excellent ultraviolet (UV) protective property, but also exhibited important photochemical properties, such as producing reactive oxygen species, including hydroxyl radicals (HO•) under UV light exposure. The hydroxyl radical-generating abilities of these materials were measured, and their photochemical reactive mechanisms were discussed. The modified PA 56 fabrics demonstrated good antimicrobial activities against both *E. coli* and *S. aureus*. Reactive Blue P-3R and BPTCA exhibited good synergistic properties. These modified biomaterials could therefore be used in medical textiles and biological materials.

Keywords: Polyamide 56 fiber; Reactive oxygen species; Antimicrobial activity; Functional material; UV protection

1. Introduction

Polyamide 56 (PA 56) is a new kind of biopolymer material, which is made by the polymerization of cadaverine with adipic acid. Compared with the conventional polyamides, such as PA 6 (nylon 6) and PA 66 (nylon 66), the cadaverine monomer used to prepare PA 56 is prepared using a biological method and can therefore be classed as a renewable resource [1]. The production of cadaverine from renewable biomass using *Corynebacterium glutamicum* represents a promising alternative to the use of fossil fuel-based resources [2-4]. PA 56 is an odd-even PA with a peculiar hydrogen-bonding scheme [5].

PA 56 fiber has similar strength and heat resistance properties to other conventional PA fibers made from petrochemical derivatives. Furthermore, the moisture regain of PA 56 fiber is almost identical to that of cotton fiber. Based on these properties, PA 56 can be used in clinical and medical applications, as well as the textiles, electronics, environmental and high-technology industries. Clothing can be regarded as a second skin or protective outer layer for humans. In this regard, UV protective and antimicrobial properties are important considerations for human health

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