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Water-repellent functional coatings through hybrid SiO_2/HTEOS/CPTS sol on the surfaces of cellulose fibers

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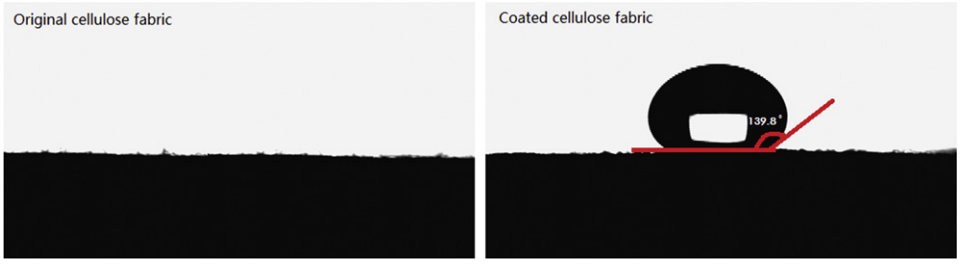
GRAPHICAL ABSTRACT

.



HIGHLIGHTS

- A water-repellent coating is deposited from a hybrid SiO_2/HTEOS/CPTS sol.
- The contact angles of water on the coated fabric are improved.
- The breaking strengths of the coated fabric are increased.
- The droplet shapes analysis indicates the water repellent is universal.

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ABSTRACT

A water-repellent functional hybrid coating is deposited on the surfaces of cellulose substrates from a hybrid SiO_2/HTEOS/CPTS sol prepared by acid-catalyzed hydrolytic co-polycondensation of tetraethoxysilane (TEOS), γ-chloropropyltriethoxysilane (CPTS) and hexadecyltrimethoxysilane (HTEOS). The contract angles of water on the fabric coated with hybrid SiO_2/HTEOS/CPTS sol are improved to 139.8°, and the enhancement are mainly achieved by the combination of low surface energy chemical compositions (HTEOP and CPTS) and rough surface geometrical structure which is demonstrated by Atomic force microscopy (AFM) and Scanning electron microscope (SEM). The hydrostatic pressure analysis confirms that the hydrostatic pressure of fabric coated with hybrid SiO_2/HTEOS/CPTS sol is 4.1 kPa, which is significantly higher than that of the control sample (1.7 kPa). The droplet shapes analysis indicates that the water repellent of the fabric sample is universal. The breaking strengths of the fabric coated with hybrid SiO_2/HTEOS/CPTS sol are increased 3.4% in the warp direction and 15.4% in the weft direction comparing to that of the untreated sample, respectively. Whereas, the elongation rates of in the warp direction and weft direction are decreased by 5.6% and 7.7%, respectively.

1. Introduction

Hydrophobic and water-repellent coatings derived have been investigated in recent years because of their high commercial and

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