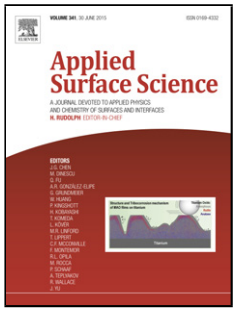

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Double layer approach to create durable superhydrophobicity on cotton fabric using nano silica and auxiliary non fluorinated materials

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Highlights

Superhydrophobicity using nonfluorinated agents on cotton roughened with nanosilica
Solgel method to hydrophobize with HDTMS, SA, OTES, and HDTMS/SA HDTMS/OTES hybrids
WCA of 150 ° or greater with the treatment
Increased hydrophobicity and soil repellency obtained when a hybrid mixture is used
Combinational treatment is effective when compared with the fluorosilane treatment

Abstract

Creation of differential superhydrophobicity by applying different non-fluorinated hydrophobization agents on a cotton fabric roughened with silica nanoparticles was studied. Cotton fabric surface has been functionalized with silica nanoparticles and further hydrophobized with different hydrophobic agents such as hexadecyltrimethoxy silane (HDTMS), stearic acid (SA), triethoxyoctyl silane (OTES) and hybrid mixtures of HDTMS/SA and HDTMS/OTES . The cotton fabrics before and after the treatment were characterized using scanning electron microscopy (SEM), atomic force microscopy (AFM) and thermogravimetric analysis (TGA). The wetting behavior of cotton samples was investigated by water contact angle (WCA) measurement, water uptake, water repellency and soil repellency testing. The treated fabrics exhibited excellent water repellency and high water contact angles (WCA). When the mixture of two hydrophobization agents such as HDTMS/OTES and HDTMS/SA is used, the water contact angle has increased (145°- 160°) compared to systems containing HDTMS, OTES, SA alone (130 °-140°). It was also noted that this fabricated double layer (silica + hydrophobization agent) was robust even after applying harsh washing conditions and there is an excellent anti-soiling effect observed over different stains. Therefore superhydrophobic cotton surfaces with high WCA and soil repellency could be obtained with silica and mixture of hydrophobization agents which are cost effective and environmentally friendly when compared with the fluorosilane treatment.

Keywords

Superhydrophobicity, Silica nanoparticles, , Hydrophobization agents, Cotton fabrics

1. Introduction

There has been an increased tendency on the development of high performance functional textiles over the years and the creation of superhydrophobic surfaces has gained a considerable attention [1,2]. The production of superhydrophobic textiles has been the subject of many research [3,4] as it has opened up the pathway for obtaining self- cleaning, water proof, and soil- repellent garments [5,6]. In order to achieve a superhydrophobic surface it generally requires the presence of specific surface topography that creates the roughness and a specific material to lower the surface energy [7-