

## Ecofriendly Multi-Layer Polymer Treatment for Hydrophobic and Water Repellent Porous Cotton Fabrics

**Authors :** Muhammad Zahid, Ilker S. Bayer, Athanassia Athanassiou

**Abstract :** Fluorinated polymers having C8 chemistry (chemicals with 8 fluorinated carbon atoms) are well renowned for their excellent low surface tension and water repelling properties. However, these polymers degrade into highly toxic heavy perfluoro acids in the environment. When the C8 chemistry is reduced to C6 chemistry, this environmental concern is eliminated at the expense of reduced liquid repellent performance. In order to circumvent this, in this study, we demonstrate pre-treatment of woven cotton fabrics with a fluorinated acrylic copolymer with C6 chemistry and subsequently with a silicone polymer to render them hydrophobic. A commercial fluorinated acrylic copolymer was blended with silica nanoparticles to form hydrophobic nano-roughness on cotton fibers and a second coating layer of polydimethylsiloxane (PDMS) was applied on the fabric. A static water contact angle (for 5 $\mu$ l) and rolling angle (for 12.5 $\mu$ l) of 147 $\pm$ 2 $^\circ$  and 31 $^\circ$  were observed, respectively. Hydrostatic head measurements were also performed to better understand the performance with 26 $\pm$ 1 cm and 2.56kPa column height and static pressure respectively. Fabrication methods (with rod coater etc.) were kept simple, reproducible, and scalable and cost efficient. Moreover, the robustness of applied coatings was also evaluated by sonication cleaning and abrasion methods. Water contact angle (WCA), water shedding angle (WSA), hydrostatic head, droplet bouncing-rolling off and prolonged staining tests were used to characterize hydrophobicity of materials. For chemical and morphological analysis, various characterization methods were used such as attenuated total reflectance-Fourier transform infrared spectroscopy (ATR-FTIR), atomic force microscopy (AFM) and scanning electron microscopy (SEM).

**Keywords :** fluorinated polymer, hydrophobic, polydimethylsiloxane, water contact angle

**Conference Title :** ICMSPE 2016 : International Conference on Materials Science and Polymer Engineering

**Conference Location :** Istanbul, Türkiye

**Conference Dates :** December 19-20, 2016