NANOSCIENCE APPROACH TO MIMIC WOOL FIBRE FOR STAIN PROOF TEXTILE

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ABSTRACT

Textile surfaces with fully customisable hydrophobicity or hydrophilicity are an elusive goal for textile researchers. Wool fibres and fabrics possess both hydrophobic and hydrophilic attributes, conferring their natural ability to absorb moisture and to breathe, and to offer partial resistance to staining (oil, dirt, wine). Technologies to further improve the stain-repellency of wool fabric are highly desirable. Numerous reports claim to have achieved tailored hydrophobicity by altering the chemical nature of the surface using technologies such as plasma treatment, or the addition of TiO2 or polysiloxane polymer coatings. The aim and focus of this study was to impart lotus leaf attributes to the wool surface using nanoscience technology, with the goal of maximising stain resistance while retaining wool's desirable natural properties.

In particular, this study describes an effort to mimic the wool through nanoscience approaches to create lotus leaf attributes onto its surface to maximise the natural attributes of wool surface. Therefore, wool textile or garment can naturally resist stain. A liquid dispersion with biopolymer consisting of wool keratin proteins (i.e. intermediate filament protein) and nano-particles comprises TiO2 based colloidal dispersion was prepared and applied to create a self-assembling layer onto wool fibre, resulting a rough surface similar to the lotus leaf texture on the fibre or fabric and generates superhydrophobic property. The wool fibre also shows a desirable handling property since it takes place at nanoscale level. The attenuated total reflectance (ATR) method was applied to quantify the chemically alteration of functionalities of the wool fiber surface such as hydrophilicity and hydrophobicity. Furthermore, the surface morphology of the treated and untreated wool fibre, observed by scanning electron microscope, atomic force microscope (AFM) and the contact angle measurement, is related to the superhydrophobic performance. This excellent superhydrophobic property was demonstrated onto the pre-treated wool fibre (contact angle, >140o) compared to control fibre (contact angle ~120°).