MICROCRISTALYNE HYDROXIPROPIL CELLULOSE (HPC) INDENTATION IN POLYESTHER (PS) SUBSTRATES

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Polyester (PS) is a polymer with excellent mechanical properties, high tensile strength, and resistance to moisture and chemicals. Furthermore, as a synthetic polymer, the fibres have very uniform diameters in their production, which aids in better control over industrial textile processes. However, its hydrophobicity poses difficulties in the uniform absorption of dyes in dyeing processes, problems in the fixation of finishes, and lower adhesion to coatings or other materials.

In this study, the surface of polyester fibres from a non-woven fabric was modified by changing its polarity through the stable and uniform indentation of cellulosic structures. Different pretreatments were compared to activate the surface (ozone and alkaline aqueous solution). Additionally, different functionalization processes were tested: firstly, a simultaneous reaction between 1,1,4,4-Butanetetracarboxylic acid (BTCA), sodium hypophosphite (SHP) as a catalyst, and hydroxypropyl cellulose (HPC); secondly, two separate reactions, first reacting the BTCA-SHP with the fabric, and then the HPC-SHP.

The variation in hydrophilicity of the fabric at each step of the process was studied through water absorbance and TGA since contact angle measurements are not possible on porous substrates; greater water retention was observed in fabrics pretreated with ozone and fabrics functionalized with HPC, while more hydrophobicity was observed in fabrics pretreated with alkaline solution. The creation of ether bonds was evaluated using attenuated total reflectance infrared spectroscopy (ATR-IR) and weight loss through rinsing; it was observed that the fabric weight was stabilized after the fourth rinsing. IR spectra demonstrated the presence of HPC in the samples due to the -OH and -O- bonds. The distribution of HPC in the fibres within the fabric was also evaluated through staining with a cationic dye, optical microscopy (OM), and scanning electron microscopy (SEM). It was observed that the distribution of HPC nanoparticles was uniform in the fibres, although more HPC accumulated on the fabric surface due to the transport of reactants through the fabric and their reactivity during the process.

There are processes for surface modifications of polyester to achieve flame retardant, antimicrobial, antistatic, wrinkle-resistant textiles, among other properties. In general, these surface modifications do not generate changes in the macro properties of the fabric such as weight, compactness, flexibility, hardness, etc. Others, are composite materials based on polyester fabrics and resins or other polymers, which find application mainly in construction, aviation, etc. Furthermore, several processes have been defined for modifying the interface between polyester and polymer to improve the interaction between materials and enhance the mechanical properties of the final composite material, which is usually rigid and hard but lightweight.

Unlike composite materials made to date, this work prepares the fabric for future additions of polymers that would allow the obtaining of a composite material with increased weight, compactness, tensile and abrasion resistance compared to the fabric alone, while maintaining its properties in terms of flexibility, texture, and breakage.