

PHYSICAL-MECHANICAL AND THERMAL PROPERTIES OF POLYESTER FABRIC DYED IN DEEP EUTECTIC SOLVENT WITH DISPERSE DYE

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Abstract

Dyeing of polyester fabrics is usually done at high temperatures with the use of carriers and dispersants, which are often toxic. Standard dyeing methods not only consume large amounts of energy but also contribute significantly to environmental pollution. In this work, standard and alternative methods of dyeing polyester fabric with Disperse Red 60 were developed. 100% unprocessed polyester fabric with a mass per unit area of 75 g·m⁻² was used. Standard dyeing was performed in the presence of a carrier and dispersant, while alternative dyeing is in the presence of a deep eutectic solvent based on betaine hydrochloride as a dyeing medium. Both standard and alternative dyeing processes were performed at different dye concentrations (1-5%) and pH 4. The bath ratio for the standard method was 1:50, and for the alternative method was 70:30 (deep eutectic solvent/distilled water). Standard dyeing was done at 100 °C for 60 minutes, while alternative dyeing was performed at 80 °C for 30 minutes. The samples were analyzed using physical-mechanical characteristics and thermogravimetric (TGA) analysis. The values of tensile strength and elongation at break are similar for all samples (raw and dyed samples), which means that the mechanical structure was unaffected. Based on the TGA analysis, it can be concluded that the degradation processes took place in three phases, starting with (between 100 °C and 200 °C, 200 °C and 300 °C, and at 400 °C). It was observed that the thermal stability of undyed polyester is lower compared to polyester dyed by the standard method and in deep eutectic solvent. At a temperature of about 400 °C, mass residues of 81.519% for undyed polyester, 80.259% for polyester dyed by the standard method and 74.673% for dyed polyester in deep eutectic solvent are detected. These results indicate that deep eutectic solvent-dyed polyester is the most thermally stable.

Keywords: polyester, deep eutectic solvent, dyeing, betaine hydrochloride.