Abstract

This work describes the study of changes on the surface of cellulosic fibers during pretreatment processes and their effect on selected subsequent technological processes. Most of the technological operations in the chemical finishing processes of cellulosic fibers are carried out with anionic chemical compounds, which cause natural repulsive interactions between these substances and the fiber, whose surface in an aqueous environment gains a negative charge. Research has shown that at each of the stages of treatment of a cellulosic (cotton) fiber, the amount of negative charge on its surface changes to a greater or lesser extent. The value of this charge depends on the type, amount and availability of functional groups present in the cellulose, natural impurities and other substances introduced to the fiber surface. This results in a change in the electrokinetic potential and electron density at the fiber surface and, above all, in changes in the interactions between the fiber and the chemical compounds used for its chemical treatment.

These phenomena have been studied in the steps of alkaline pretreatment and enzymatic pretreatments, modification of the fiber by cationisation with various modifiers, and dyeing processes with reactive dyes. The results confirmed the hypothesis of the need to take into account the values of charge and electron density and their influence on the course of the reaction, especially concerning cationised cotton.

Studies of the dyeing of cationised cellulose with reactive dyes showed that the process can be carried out under ecological conditions: without the addition of electrolytes and alkali, and at room temperature. It was shown that under these conditions, the reactive dye forms a covalent bond between the hydroxyl group present in the modifier chain in a position adjacent to the quaternary group of the cationised cellulose instead of the hydroxyl group in the cellulose chain.

Based on the measurements of the charge value on the fiber surface, dyeing with acid and reactive dyes, extraction, TLC chromatography, FTIR and reflected light spectroscopy, electron density analysis and assessment of the light fastness of the dyes, the binding site of the reactive dye to the cationised cellulose was confirmed.