REGIONAL AND VARIETAL COMPARISON OF METAL CONTENTS OF SCOURED COTTON

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Abstract

It is well documented that some metal cations, including calcium and magnesium, may interfere with reactive and direct dyeing of cotton. These metal cations may be present in the water source or in the cotton material itself. Previous work (Brushwood and Perkins) has shown that a number of metal cations are present in raw cotton. Differences in metal cation content of raw cotton may be due to environmental, regional, or varietal factors. Moreover, the metal content may not be distributed evenly among the different structural layers of the fiber. Many soluble salts are present in the lumen as well as on the outer fiber surface (K2 malate, NaCl, etc.). Most of these salts will be removed by water washing or scouring. The primary wall is known to contain substantial calcium content, which serves to cross-link pectin, which is removed by scouring. The secondary wall may also contain metal cations, which are bound through hydrogen bonding to the cellulose. It is these metals, which would be expected to present the greatest interference with the dyeing process, assuming an efficient preliminary scouring process. The purpose of the present work is to determine the relative concentrations of 8 metal cations (Ca 2+, Mg 2+, Na +, K +, Cu 2+, Ni 2+, Fe 2+/ 3+, and Zn 2+) present as soluble salts, present in pectin, and present in cellulose, and to determine varietal, regional, or crop year variations in metal cation content present in cellulose. Two varieties of cotton (FM 832 and FM 966) were grown in three regions (Texas, Georgia, and Mississippi) in two different crop years. Each cotton sample was washed with deionized water and the resultant solution subsequently analyzed for the 8 metals. The washed cotton was subsequently subjected to scouring with tetrabutylammonium hydroxide and the resultant solution was analyzed for the 8 metals. Finally, the scoured cotton was digested in nitric acid and the digest was analyzed for metals. Metal analysis was performed using ICP-AES. The water extracts exhibit a dependence of K+ and Mg2+ content on micronaire, as does the Ca2+ content of the scour solution. A comparison of scoured cottons indicates possible regional differences in Ca2+ and possible variety differences in Mg2+. Though these observed differences are statistically significant, they are relatively small, and it is probable that any metal effects seen in dyeing are due to an inefficient scouring process. The large amount of Ca2+ in the remaining pectin could then released by the alkaline environment of the dyeing process. The metals bound by the cellulose itself appear to be stable in alkaline conditions, and will be released from the cellulose matrix only in acidic conditions.