

MOLECULAR AND ULTRAFINE STRUCTURE OF COTTON FIBRES.

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Differences among native cottons which have been recognized in the textile industry for many years and have formed the basis for cotton classification in commerce and ultimate utilization, include factors such as fibre length, fineness and spinnability. Recent detailed investigations have established that, in addition, cotton types vary in their fundamental mechanical properties. An attempt has been made to determine the level (s) of structural organization where such differences exist. Furthermore, with the advent of man-made fibres, modifications of the properties of natural fibres has become a compelling requirement for their survival in the competitive world market; and for this reason a detailed study of the structure of the cotton fibre has particular relevance.

The ultrafine and molecular structure of several varieties of cottons have been examined by means of transmission electron microscopy and X-ray and electron diffraction techniques.

It has been possible to establish that there are no significant differences in:

- (i) the size of the particles (obtained after hydrolysis) whose dimension may be taken to represent the combined crystalline and paracrystalline regions, and
- (ii) the crystal structure (Cellulose I),

between different cotton types. However, X-ray studies have shown that differences in the orientation of the 'Crystallites' have an effect on the mechanical properties of the fibre. Thus the evidence leads to the conclusion that variation in fibre properties are due to differences at higher (fibrillar) levels of the structural organization.

Electron diffraction results have also conclusively shown the inadequacies of the widely accepted model for the fundamental structural unit of crystalline native cellulose.