

**QUANTITATIVE ASPECTS OF COTTON
CLEANABILITY**

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Abstract

Progress on developing a scientific framework for quantifying the opening and cleaning of cotton is reported. This work addresses the basic questions: What is cotton cleanability ? How should cotton be cleaned ? The production and utilization of cotton as a raw material for textile manufacturing entails a long sequence of separate but related mechanical processes. These steps are applied in the field during harvesting, in the gin during bale production, and in the textile mill as preparation for spinning. Many of the fiber manipulations in this complex series of processing steps are aimed at opening and cleaning the lint. It has been hypothesized that opening and cleaning principles embodied in gin and mill machinery are sufficiently similar to allow a unified description of the cleaning process. In the proposed approach, cleanability is defined as an optimum trade-off between reduction of foreign matter on one hand, and the necessary mechanical damage which must be imposed upon the cotton to achieve a desired level of cleaning. It has been found that cleaning and damage indices can be defined so that cleaning is described mathematically as an algebraic extinction process, and damage is modeled as a saturation process. The practical significance is that a quantitative description of the cleaning-damage relationship can be used to rate the processing quality of a cotton, to predict its performance, and to design optimum processing strategies. An important technical finding is that a cotton's performance at any next stage of processing is composed of three factors: (1) the intrinsic properties of the cotton; (2) the intrinsic properties of the next machine; and, (3) the combined effect of all previous machines in the processing order, i.e., the processing history.