

# Enzymatic Treatment of Raw Cotton Fibers with Whole and Mono-component Cellulase Solutions

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Enzymatic treatments have been a focus of interest for cotton finishing. Various types of enzymes are applied at different stages of the manufacturing process to obtain a product with desired properties. Cellulases are the most widely used. This is a group of enzymes that degrade cellulose to glucose by hydrolyzing  $\beta$ -1,4-glucosidic bonds in polysaccharide molecule. Generally, cellulases are a crude mixture of several enzymes: endoglucanases, exoglucanases, and  $\beta$ -glucosidases. All three types of enzymes exhibit different activity on cellulose. Endoglucanases cut at random amorphous sites of the cellulose chain, produces oligosaccharides of various lengths and new reducing and non-reducing ends. Exoglucanases attack the reducing or non-reducing ends of cellulose chain, liberating glucose or cellobiose as major products; and  $\beta$ -glucosidases remain in the solution hydrolyzing small chain reducing sugars to glucose.

Enzymolysis is also known to have a negative impact on the tensile characteristics of the cellulosic materials. At well-controlled conditions surface properties of cotton fabrics/fibers can be improved, but a decrease in tensile strength is also observed. To reduce the strength loss, less aggressive enzymes such as endoglucanases can be employed.

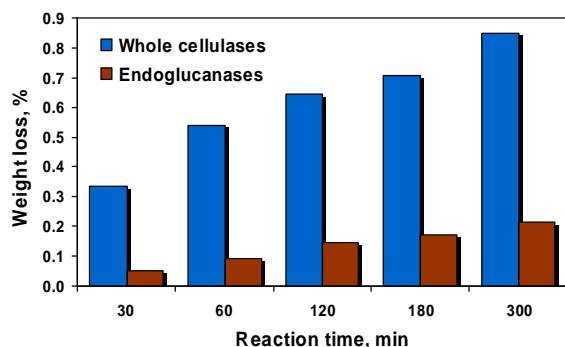


Figure 1: Weight loss measurement for raw cotton fibers during 5-hour enzymatic treatment with 0.25% owf of whole and mono-component cellulase solutions.

In this study, a series of experiments was carried with commercially-available whole cellulase and endoglucanase solutions. Such parameters as weight and fiber strength losses were monitored during the enzymatic reaction (Figure 1 and 2). To determine the degree of raw cotton fiber damage, the mean fiber length was measured before and after enzymatic reaction.

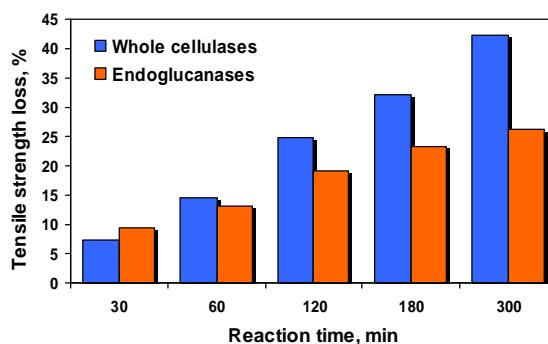


Figure 2: Tensile strength loss measurement for raw cotton fibers during 5-hour enzymatic treatment with 0.25% owf of whole and mono-component cellulase solutions.

Our preliminary results indicated that enzymolysis with monocomponent endoglucanase solution showed a better performance than the process with whole cellulase solution. The weight loss was approximately 4 times lower if raw cotton fibers were treated with endoglucanases. Moreover, the strength of the fibers deteriorated slower throughout the 5-hour reaction. If at first the tensile strength loss was observed to be similar, after 5 hours of treatment with whole and monocomponent solutions the fibers lost about 43% and 26% of their strength, respectively. In addition, we measured the mean length of the fibers throughout the enzymatic process. The results observed showed that after the treatment with endoglucanases the length of the raw cotton fibers remained almost unchanged. Whereas fiber modification with whole cellulase solution caused fibers to shorten, up to 33% (at the severest conditions tested in this work).

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