

## The effect of sodium borohydride on the crystallinity of hemp cellulose

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**Abstract:** In this study, it was aimed to obtain high crystallinity cellulose from hemp fibers without damaging the raw material structure during the production of cellulose. For this purpose, hemp fibers obtained from Kastamonu Taşköprü district were cut to lengths of 10-15 mm and shorten to standard sizes for chemical paper pulp production. And then, chemical analysis of hemp fibers was carried out to determine the amounts of cellulose, hemi-cellulose, alpha-cellulose and inorganic materials. Then, paper pulp was produced from hemp fibers, according to the produce method of closed system paper pulp for 150 minutes at 160 °C. Sulfate (kraft) method was used for the production of paper pulp. Sodium borohydride was added to the cooking solution according to the completely dry fiber weight of 0,3-0,5-0,7% respectively. For cooking, a total of four cooks were made, one without sodium borohydride (control group) and three with sodium borohydride. And then, the pulp obtained after cooking was washed on the sieve with plenty of water until the black solution was removed. Then, obtained from chemical analyzes of the pulp were carried out to calculate the amounts of cellulose, hemi-cellulose, and alpha-cellulose. As a result of the calculations made, an increase of about 9% in the amount of alpha-cellulose of the celluloses obtained from the sodium borohydride added pulp according to the control group was observed. Then, X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) analysis of paper pulp, cellulose and alpha-cellulose were performed. According to the XRD and FTIR analysis results, the cellulose crystal cell structure of hemp fibers was found to be monoclinic. It was also found that the crystallinity index of sodium borohydride celluloses increased with respect to the control group. According to XRD analysis results, it was also observed that the crystallinity of pulp and alpha-cellulose obtained from hemp fibers increased with sodium borohydride added to the cooking solution. In addition to these, Thermo Gravimetric Analyzes (TGA) of pulp, cellulose and alpha-cellulose from hemp fibers were made. According to the TGA analyzes made, the addition of sodium borohydride to the cooking solution resulted in an increase in the degradation temperatures of the pulp. Consequently, to the results of the studies made, the crystallinity of cellulose obtained by the addition of sodium borohydride to the cooking solution increased.

**Keywords:** Hemp fiber, Sodium borohydride, Cellulose, crystallinity