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Adsorption Properties and Structural Features of Alkali Treated Wood

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Abstract: In order to investigate the influence of alkali treatment on structural features and on hygroscopic properties, weight and dimensions were measured after wood samples (*Picea jezoensis* Carr.) were treated with aqueous solutions of various NaOH concentrations and conditioned at various relative humidity conditions. In the oven-dry condition, volume and cross-sectional area of wood samples treated at NaOH concentrations ranging from 0 to 15% decreased, and at NaOH concentrations ranging from 15 to 20% they remained constant. Longitudinal contraction occurred in wood samples treated at NaOH concentrations ranging from 12 to 15%. These observations were due to both dissolution of wood components and wood structure deformation resulting from transformation of cellulose microfibrils.
The equilibrium moisture content of treated wood samples was larger than untreated wood samples except when the wood samples were treated with aqueous solutions of 5% NaOH concentration and conditioned below 71% RH. The water sorption isotherms of untreated and treated wood samples were analyzed by using the Hailwood & Horrobin equation. The number of sorption sites per 1 g of wood sample decreased in the NaOH concentration range of 0 to 5% and increased at the NaOH concentration of 20%. The equilibrium constant of formation of hydrated water increased in the NaOH concentration range above 10%. It was speculated that the hygroscopicity at low relative humidity was reduced due to dissolution of hemicellulose in the NaOH concentration range of 0 to 5% and increased due to increases in the proportion

of amorphous components in the NaOH concentration range above 10%. Cluster size increased in the NaOH concentration ranges of 0-5% and 10-12% at high relative humidity. It is suggested that the changes in hygroscopicity at high relative humidity were due to increased void spaces as a result of dissolution of hemicellulose and of intermicellar and intramicellar swelling.

Keywords: alkali treatment, contraction, structural features, microfibrils, adsorption properties

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