The Effect of Aging on Lignins of Wood**

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Summary. Samples of different wood species varying in age from 900 to 4400 years and stored during this period under different conditions were analyzed for their lignin content. Lignins isolated from the samples were investigated by IR-spectroscopy. It could be shown that lignin in wood undergoes oxidative changes which lead to a decrease in the amount of lignin isolated by the hydrochloric acid procedure.

Introduction
In a previous publication [Borgin, Parameswaran, Liese 1975] the effect of aging on the ultrastructure of wood has been described. The authors investigated samples varying in age from 900 to 4400 years by electron microscopy (TEM, SEM) and polarized light microscopy as well as by the analysis of the mechanism of fracture. They came to the conclusion that the micromorphology of the old wood samples was affected only to a small extent compared with recent wood, causing a weakening in the border region between S1 and S2 of the secondary wall.

In the present study we have focused our interest on possible changes in the structure of lignin. Lignin is known to be very sensitive to oxidation [Chang, Allan 1971], and hence it might be expected that mere exposure to air during a prolonged period of time would cause a structural change in the lignin within the wood samples. To verify this assumption the lignin content of the samples was determined, and the lignin isolated was investigated by IR-spectroscopy.

Materials and methods
1. Description of samples
The samples used in this investigation were the same as in the previous study on ultrastructure [Borgin, Parameswaran, Liese 1975].

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2. Determination of lignin content
The lignin content was determined by the hydrochloric acid method [Browning 1967]. We preferred this method over the Klason determination since the amount of material available for the investigations was small and the lignin obtained had to be used also for further analytical investigations. Klason lignin is less suited for analytical investigations than is HCl-lignin because of the severe structural changes which lignin undergoes during the Klason procedure.

3. Determination of the methoxyl content
The methoxyl content was determined by the standard Zeisel method.

4. IR-Spectroscopy
Spectra of the lignin samples were taken using the KBr technique (2 mg/0.7 g KBr).

Results and discussion
In the following lignin analysis of old and recent wood samples are presented together with the main results obtained from the IR-spectroscopy. The corresponding IR-spectra are shown in Fig. 1.

Fig. 1. IR-Spectra of HCl-lignins of old and recent wood samples