Abstracts

H. Kutsuki and T. Higuchi: **The Formation of Lignin of Erythrina crista-galli,** Mokuzai Gakkaishi (J. Japan Wood Res. Soc.), **24**, 625 (1978).

The lignin of *Erythrina crista-galli* of Legminosae is known to be a gymnosperm type. It seems that the low activity of one of the enzymes involved in the biosynthesis of syringyl lignin, such as ferulic acid-5-hydroxylase, O-methyltransferase and the reducing enzymes of sinapic acid, is responsible for it. To elucidate these problems, ferulic acid-2-^{14}C and sinapic acid-2-^{14}C were administered to young shoots of *Erythrina crista-galli*. Then the wood meal was subjected to acidolysis to obtain β-oxyconiferyl alcohol-2-^{14}C and β-oxysinapyl alcohol-2-^{14}C. It was shown that the low activity of ferulic acid-5-hydroxylase may result in the formation of gymnosperm type lignin in *Erythrina crista-galli*.

The microstructural distribution of lignin was also examined with wood fibers, parenchyma cells and vessels separated by using ultrasonic waves. The results suggested that the lignin of wood fibers is slightly higher in syringyl lignin than that of parenchyma cells, and when *Erythrina crista-galli* becomes older, the ability to produce guaiacyl lignin becomes higher to a certain extent.

Y. Nakamura and T. Higuchi: **Ester Linkage of *p*-Coumaric Acid in Bamboo Lignin, II. Syntheses of Coniferyl *p*-Hydroxybenzoate and Coniferyl *p*-Coumarate as Possible Precursors of Aromatic Acid Esters in Lignin.** Cellulose Chem. Technol., **12**, 199 (1978).

Coniferyl *p*-hydroxybenzoate (V), *trans*-3-methoxy-4-hydroxycinnamyl 4-hydroxybenzoate, and coniferyl *p*-coumarate (X), *trans*-3-metoxy-4-hydroxycinnamyl *trans*-4-hydroxycinnamate, were synthesized in high yields. The former compound is presumed to be a possible precursor of the γ-ester structure of *p*-hydroxybenzoic acid in poplar lignin and the latter, of *p*-coumaric acid in bamboo lignin.

Y. Nakamura and T. Higuchi: **Ester Linkage of *p*-Coumaric Acid in Bamboo Lignin. III. Dehydrogenative Polymerzation of Coniferyl *p*-Hydroxybenzoate and Coniferyl *p*-Coumarate.** Cellulose Chem. Technol., **12**, 209 (1978).

Coniferyl *p*-hydroxybenzoate and coniferyl *p*-coumarate were dehydrogenated with peroxidase-hydrogen peroxide in the presence or absence of coniferyl alcohol to elucidate the mechanism of the formation of γ-ester structures of aromatic acids in lignins (*p*-hydroxybenzoic acid ester in poplar lignin and *p*-coumaric acid ester in bamboo and grass lignins). Large portions of *p*-hydroxybenzoic acid moiety and some portions of *p*-coumaric acid one were incorporated into DHPs as the ester

of A_1 structure, in which acid fractions were bound to polymer only with γ-ester linkage. In the case of coniferyl p-coumarate, the p-coumaric acid fragment of the ester and p-coumaric acid itself were further dehydrogenated, and formed the A_2 and/or A_3 structures.

In the former structure the acid fragments were connected to the polymer not only with the γ-ester linkages but also with the ether or C—C bonds at phenolic 0, C—5 in aromatic rings or C_β in side chain of p-coumaric acid, while in the latter structure the acid fragments were bound to the polymer in the same way as in the A_2 structure except for the connection with γ-ester linkages. The analytical and spectral data of the DHPs containing γ-ester structures of p-hydroxybenzoic acid and p-coumaric acid, especially A_1 structure, were well agreed with these of poplar or bamboo MWL and showed to be good models of those lignins.

A. SATO: **An Essay on Tropical Forests Products —Bush and Forest Products in Papua New Guinea observed by an Wood Chemist—** The Tropical Forestry, No. 50, 17 (1978). (in Japanese)

The essay is written by the author after experiences of two times field trips in Papua New Guinea. He observed chemically forest products and gives some coments in the future of them. The essay is composed six sections as follows: wood extractives in tropical woods, sap and resins, bark, medicinal trees, canes and sandalwood et al.

F. MAKI, M. NORIMOTO and T. YAMADA: **Relationship between Humidity Conditions and the Nature of Interior Wall Materials,** Mokuzai Gakkaishi (J. Japan Wood Res. Soc.), **24**, 797 (1978). (in Japanese)

In order to clarify the relationship between humidity conditions and the nature of interior wall materials, measurements were made of the relative humidity in prefabricated wooden houses lined with various interior board materials. As it was proved experimentally that the absolute humidity $h(T)$ in the houses is a linear function of temperature T, the relative humidity $H(T)$ can be expressed by the following equation.

$$\log H(T) = \log 20.1 h(0) + BT.$$
$$B = b - 0.0269.$$

where, $h(0)$ is the absolute humidity at $T=0°C$ and b is the slope of $\log h(T) - T$ curve. B is independent of T, and the smaller the value of $|B|$ is, the better the humidity conditions. Thus, the suitability of humidity conditions caused by wall materials can be quantitatively estimated using B. Wood based materials result in superior humidity conditions compared to synthetic and inorganic ones. Furthermore, suitable humidity conditions can be expected in houses lined with wood based materials even when ventilation is provided.

M. NORIMOTO, S. HAYASHI and T. YAMADA: **Anisotropy of Dielectric Constant in Coniferous Wood,** Holzforschung, **32,** 167 (1978).

The dielectric constants in the three principal directions for coniferous wood at various moisture contents were calculated and their anisotropy was discussed. The anisotropy in the longitudinal and transverse directions was mainly due to the difference in the arrangement of cell wall and lumen in addition to the anisotropy of dielectric constant in cell wall substance, while that in the radial and tangential directions depends mainly on percentage of late wood, ratio of cell wall area to cell area and irregular array of cells. The calculated values were in satisfactory agreement with the experimental ones.

T. AOKI and T. YAMADA: **Chemoreology of Wood IV. Relaxation Time and Rate Constant,** Mokuzai Gakkaishi (J. Japan Wood Res. Soc.), **24,** 784 (1978). (in Japanese)

Hinoki wood (*Chamaecyparis obtusa* ENDL.) was swollen with dimethyl sulfoxide and decrystallized with a mixture of diethyl amine, sulfur dioxide and dimethyl sulfoxide. Stress relaxation measurements on these materials were carried out during hydrolysis with sulfuric acid. The mechanism of stress decay was discussed, and the relationship between the relaxation time of chemical relaxation which would result from the scission of glucosidic bonds and the reaction rate constant of hydrolysis were examined. The results obtained were as follows:

(1) The relative stress $G(t)/G(0.1)$ for wood during hydrolysis was represented approximately by the following equation:

$$G(t)/G(0.1) = A_1 \exp\left(-t/\tau_1\right) + A_2 \exp\left(-t/\tau_2\right) + \ldots\ldots + A_5 \exp\left(-t/\tau_5\right)$$

where A_i is a constant and τ_i is the relaxation time $(\tau_1 < \tau_2 < \ldots < \tau_5)$. It was considered that each term in the above equation represented the stress decay behavior due to molecular motion in the amorphous region of both cellulose and hemicellulose, the scission of glucosidic bonds in the amorphous region, molecular motion of lignin, and the scission of glucosidic bonds in the crystalline region, respectively.

(2) The relaxation time τ_3 of chemical relaxation which would result from the scission of glucosidic bonds in the amorphous region was nearly equal to the inverse of the rate constant, $1/k$, obtained from measurements of the degree of polymerization. It was considered that the breaking of one glucosidic bond would result in a definite increment of stress decay. On the other hand, the value of τ_5 of chemical relaxation due to the scission of glucosidic bonds in the crystalline region was not equal to $1/k$, and it was considered that the scission of a few glucosidic bonds might result in disproportionately large increments of stress decay.

M. Takatani, Y. Kakimi and H. Sasaki: **Bending Fatigue Strength of Wood-Epoxy Besin Rond System,** ADHESION (J. Adhesion Soc. Japan), **14,** 380 (1978). (in Japanese)

Plate bending fatigue tests were carried out on Buna (*Fagus crenata* Blume)-epoxy resin bond system prepared by the reservoir method of gluing. Thickness of the glue-line of the specimen was changed from 0.1 to 1.5 mm, and flexibility of the glue-line was increased with addition of polysulfide (Thiokol LP-3) of 0, 20, 40 and 60 phr(symbol: EP-0, EP-20, EP-40 and EP-60).

Measurements and discussions were made on the M-N curves (the applied moment M as a function of moment cycles to failure N) of the specimens with different thicknesses and flexibilities of the glue-line.

The results are as follows: 1) Addition of the flexibilizer of 60 phr to the adhesive resin (EP-60) has shown the position of M-N curves for every glue-line thickness to be lower than all others for the other gluing condition. That is, fatigue strength at any moment cycles of EP-60 is found to be lower than that of any other gluing conditions. 2) The endurance limit of EP-0 was approximately constant without regard to glue-line thickness. But on the contrary, the endurance limit of EP-20, EP-40 and EP-60 was very changeable with glue-line thickness, namely, it decreases as increasing glue-line thickness. 3) The endurance limit of comparatively rigid glue-line (EP-0, EP-20) was greater than that of flexible glue-line (EP-40, EP-60). The ratio of the endurance limit to the static strength was about 0.30 for EP-0, 0.27 for EP-20, 0.21 for EP-40 and 0.12~0.21 for EP-60. 4) In short, bending fatigue strength of wood-epoxy resin bond system prepared by the reservoir method of gluing under the cyclic stress decreases generally with adding flexibilizer (polysulfide) and increasing glue-line thickness.