Abstract

H. KURODA and T. HIGUCHI: ***O*-Methyltransferase as a tool to evaluate the lignin evolution,** Wood Research No. 68, 1 (1982).

The ratios of sinapate (SA)- to ferulate (FA)-formation (SA/FA ratio) by *O*-methyltransferases (OMTs) were surveyed over fifty plant species of 43 families. The OMTs are roughly classified into three groups by using the SA/FA ratio, *i.e.* gymnosperm-, angiosperm- and grass-types. OMTs in gymnosperm only catalyze FA-formation whereas angiosperm ones catalyze both FA- and SA-formation. Monocotyledons and herbaceous plants showed the apparent ratios which lay between typical gymnosperm- and angiosperm-ones. These substrate specificities well explain why gymnosperm lignin contains almost entirely guaiacyl lignin whereas angiosperm one contains both guaiacyl and syringyl lignins. A few exceptional cases were found in Cupressaceae, *Trochodendron*-, and grass-OMTs, which were discussed in relation to lignin biosynthesis. The ratios of the OMT activities are discussed with respect to the usefulness as an evolutional marker for analyzing lignin evolution.

K. SHIMAJI and T. ITOH: **Illustrated Textbook of Wood Structure.** Chikyu-sha, pp. 176 (1982). (in Japanese)

In the first half, fundamental knowledges on the characteristics of microscopic structure of wood essential to the wood identification were given with 99 photomicrographs and 8 drawings.

In the latter half, microscopic structures of 18 softwood species of 17 genera in 9 families and 40 hardwood species of 38 genera in 27 families were minutely explained with 4 photomicrographs for each species, laying the stress on the identification. Natural distribution and dendrological characteristics of the species, as well as mechanical characteristics and utilization of the wood, were also given for each species. Besides, a dicotomous key for identification of Japanese softwoods was presented.

T. ITOH and K. SHIMAJI: **Lignification of Bamboo Culm (*Phyllostachys pubescens*) during its growth and maturation.** Proceedings Cong. Gr. 5.3A, XVII IUFRO World Cong., pp. 104~110 (1981).

Transverse and longitudinal progresses of lignification in the culm of *Phyllostachys pubescens* was pursued from the sprout stage through one growing season, combined with the change of external morphology of the culm. Aging effects on the lignification was also investigated on the 2 to 14 years old culms.

The results obtained are as follows: For every tissues, (1) lignification within every one internode proceeds downward from top to bottom, (2) transverse progress

of lignification proceeds inward from outside to inside, (3) longitudinal progress of lignification along the culm as a whole proceeds upward from the basal internode to the top one during its height growth. (4) During the height growth, lignification of epidermal cells and fibers precedes that of ground tissue parenchyma and sclerotic parenchyma cells. (5) Lignification proceeds progressively during the growth of new lateral shoots and bud flush, and reaches its highest level after the full opening of new leaves. (6) Full lingification of bamboo culm is completed within one growing season, showing no further aging effects by the increase of culm age.

N. YOSHIZAWA, T. ITOH and K. SHIMAJI: **Variation in features of Compression Wood among Gymnosperms.** Bull. Utsunomiya Univ. For. **18**, 45 (1982).

Variation in some features of compression wood were examined on 38 gymnospermous species covering 31 genera, in order to obtain general systematic appreciation on the characteristics of compression wood.

Any helical checks could not observed in *Ginkgo, Taxus, Torreya* and *Cephalotaxus.* Helical checks were occasionally observed in *Araucaria brasiliana,* although it has been believed that helical checks are not formed in their tracheids. Instead of helical check formation, the transition from normal to compression wood tracheids in some species such as *Taxus, Torreya* and *Cephalotaxus* entailed a preservation of helical thickenings, and the direction of the latter have changed from S to Z helix. Differing from the reaction of the above-mentioned three species, helical thickenings have been replaced with helical checks in the compression wood of *Pseudotsuga,* and it was often observed that both helical checks and helical thickenings occurred together in the same tracheid at the end of the annual ring. It is considered that helical checks have developed secondarily in the course of the phylogenic development of compression wood in gymnosperms.

On the basis of these results, differences in the reaction to the stimulus for compression wood formation among gymnosperms was also assumed.

N. TAKAHASHI, J. AZUMA and T. KOSHIJIMA: **Fractionation of Lignin-Carbohydrate Complexes by Hydrophobic-Interaction Chromatography,** Carbohyd. Res., **107**, 161 (1982).

Hydrophobic properties of lignin-carbohydrate complexes (LCC) isolated from *Pinus densiflora* Sieb. et Zucc. have been analysed by hydrophobic-interaction chromatography on Phenyl- and Octyl-Sepharose CL-4B gels. The ability of LCC to be adsorbed by these hydrophobic gels was exclusively dependent on their lignin content. Materials adsorbed on Octyl-Sepharose were desorbed with a lower concentration of 2-ethoxyethanol than those adsorbed on Phenyl-Sepharose. In the adsorption of LCC by Phenyl-Sepharose, π–π interactions between the aromatic

ligands and the benzene skeletons of lignin play an important role, whereas hydrophobic interaction is the exclusive driving-force for adsorption in the case of Octyl-Sepharose.

J. AZUMA and T. KOSHIJIMA: **^{13}C-NMR Spectroscopy of Carbohydrates I. ^{13}C-NMR Spectroscopy of Cellulose and Related Carbohydrates,** Wood Res. and Tech. Notes, **16**, 63 (1981).

^{13}C-N.M.R. spectroscopic data of cellulose and related carbohydrates were summarized and utilisation of ^{13}C-N.M.R. for structural analysis of cellulosic carbohydrates were also reviewed.

K. KANAI, J. AZUMA and K. NISHIMOTO: **Studies on Digestive System of Termites. I. Digestion of Carbohydrates by Termite *Coptotermes formosanus* SHIRAKI.**

To clarify the role of protozoa in termites, various carbohydrates were given to the termite *Coptotermes formosanus* SHIRAKI. Protozoa were normally maintained during 8 weeks with cellulose and Avicel. However, no protozoa were observed with amylose, cellobiose, sucrose, maltose, glucose and fructose. Termites devoid of protozoa survived as well as with cellulose. This seems to indicate that protozoa take part in digestion of native cellulose and termites themselves are able to utilize these disaccharides and monosaccharides without aid of protozoa. Almost all termites died within 8 weeks with xylan, glucomannan and arabinogalactan. This seems to indicate that termites cannot utilize these hemicelluloses efficiently.

M. FUJII, J. AZUMA, F. TANAKA, A. KATO and T. KOSHIJIMA: **Studies on Hemicelluloses in Tension Wood I. Chemical Composition of Tension, Opposite and Side Woods of Japanese Beech (*Fagus crenata* Blume).** Wood Research, **68**, 8 (1982).

Three different types of woods, tension, opposite and side woods, were isolated from *Fagus crenata* Blume and their anatomical and chemical properties were compared. Tension wood was composed of well developed gelatinous fibers and was characteristic in its low lignin and pentosan contents as well as its high ash, alpha-cellulose and uronic acid contents. Carbohydrate portion of tension wood has been found to be peculiar in that tension wood contains the highest amount of galactose in contrast to the lowest amount of mannose among three types of wood. Each wood was further subjected to sequential fractional extractions. The peculiarity of the chemical composition of the tension wood reflected the differences in the carbohydrate compositions of the extracted hemicelluloses. In analysing the molecular weight distribution of the extracted hemicelluloses by gel filtration on Sepharose 4B, it has been found that all components included in the gel matrices have quite

similar molecular weights in spite of the differences in the carbohydrate compositions. These results may give a clue in ellucidation of the distribution and function of hemicelluloses in wood.

S. MUKOYOSHI, J. AZUMA and T. KOSHIJIMA: **Lignin-Carbohydrate Complexes from Compression Wood of *Pinus densiflora* Sieb et. Zucc.,** Holzforshung, **35**, 233 (1981).

Water soluble lignin-carbohydrate complex (LCC-W) was isolated from milled compression wood of *Pinus densiflora* Sieb. et Zucc. By gel filtration on Sepharose 4B, LCC-W was fractionated into three fractions (W-1, W-2 and W-3). W-1 was excluded from the gel, while W-2 and W-3 were included in the gel and had apparent weight average molecular weights of 6.5×10^5 and 3.4×10^3, respectively. W-2 and W-3 were homogeneous in both electrophoretical and ultracentrifugal analyses. The chemical composition was 40.3% neutral sugar, 1.8% uronic acid and 56.5% lignin in W-2, and 67.4%, 4.8% and 30.2% in W-3, respectively. The neutral sugar composed of L-rhamnose, L-arabinose, D-xylose, D-mannose, D-galactose and D-glucose in weight % of 3.2, 11.9, 11.9, 15.1, 50.1, and 7.8 in W-2, and 4.7, 24.3, 14.6, 17.1, 32.5, and 6.8 in W-3, respectively. When the neutral sugar composition of the LCCs from compression wood is compared with that from normal wood, former is peculiar in the abnormally high content of galactose. Methylation and Smith degradation analyses indicate the presence of galactan with a main chain of β-1,4-linked D-galactopyranose residues slightly branched at C-2,3 and 6. Hydrophobic interaction chromatography of the LCCs on Phenyl- and Octyl-Sepharose gels indicates the presence of π–π interactions between the aromatic ligands and the benzene skeletons of lignin moiety.

E. MURAKI, F. YAKU, R. TANAKA and T. KOSHIJIMA: **Enzymatic Degradation of Finely Divided Wood Meal II. Rollmilling and the subsequent enzymatic degradation of *Pinus densiflora* wood.** Mokuzai Gakkaishi, **28**, 122 (1982). (in Japanese)

For the purpose of preparing finely divided wood meal with a minimum of energy consumption, milling wood with a three-roll mill was investigated. Akamatsu (*Pinus densiflora* S. and Z.) wood could be divided to less than ten micrometers in diameter using the three-roll mill which was more effective than a vibratory-ball mill. With increasing milling frequency, the reaction rate of enzymatic hydrolysis and the extent of saccharification increased when the roll-milled wood meal was used as a substrate. When wood meal roll-milled twenty two times was subjected to enzymatic hydrolysis by using a mixed enzyme preparation of Cellulosin AP-Cellulase Onozuka R-10 (1:1), about ninety percent of the available polysaccharides

in the wood could be converted into reducing sugars without delignification even in a 4 g/100 ml substrate concentration. It was demonstrated in this experiment that three-roll milling was advantageous in obtaining a high saccharification rate and a high reaction velocity, especially in a high substrate concentration.

K. INABA, Y. IIZUKA and T. KOSHIJIMA: **Acceleration of Fruiting-body Formation by Edible Mushrooms with Sulfite Waste Components from Soft- and Hardwood Cooking.** Mokuzai Gakkaishi, **28**, 169 (1982). (in Japanese)

LVD (hardwood) and LSD (softwood) fractionated from commercial sulfite solid waste have been found to accelerate fruiting-body formation and growth of *Pleurotus ostreatus* (Jacq.) Sacc. and *Flammulina velutipes* (Curt.) Fr. The sawdust media used was from buna, acacia, and a domestic hardwood mixture (nara thirty percent, shii, buna, kashi, kunugi, soyogo, abemaki, kusu, haze, isunoki, and sarusuberi seventy percent), to which one to two percent LVD or LSD was added. The mycelium growth, rudiment formation, and fruiting-body formation of *P. ostreatus* and *F. velutipes* were fastest with the buna sawdust medium. Compared with the yield of fruiting bodies grown under a standard condition, the effect of LVD or LSD was predominant with *P. ostreatus* (1.4–1.5 times) and *F. velutipes* (1.2–1.3 times) when one percent LSD was added to the sawdust medium as an accelerator. Abnormal fruiting bodies appeared in the case of *P. ostreatus* when two percent LVD or LSD was added to the sawdust medium, but this never occurred in the case of *F. velutipes*.

K. INABA, Y. IIZUKA and T. KOSHIJIMA: **Acceleration Effect of Sulfonated Polysaccharides and LCC on the Growth of Edible Mushrooms.** Mokuzai Gakkaishi, **28**, 319 (1982). (in Japanese)

Acetylglucomannan, Björkman lignin carbohydrate complex (Björkman LCC), lignin carbohydrate complex (LCC-W), and milled wood lignin (MWL) prepared from akamatsu (*Pinus densiflora* S. and Z.) wood as well as glucuronoxylan from buna (*Fagus crenate* Bl.) was sulfonated for eight hours with an aqueous solution of $NaHSO_3$ and Na_2SO_3 at 135°C and pH 6.0. Sulfonated substances were dialyzed with distilled water, and the parts permeating through a gell-cellophane membrane were collected as calcium salts, among which the precipitates formed with the addition of five volumes of ethanol were used for the acceleration of mycelial growth of edible mushrooms. Sulfur contents of sulfonate calcium salts were 4.92 percent (glucuronoxylan), 4.85 percent (acetylglucomannan), 4.20 percent (Björkman LCC), 6.01 percent (LCC-W), and 5.11 percent (MWL).

Glucuronoxylan, acetylglucomannan, Björkman LCC, and LCC-W sulfonates have been found to accelerate the growth of mycelium of *Lentinus edodes* (Berk.) Sing., *Pleurotus ostreatus* (Jacq.) Sacc. and *Flammulina velutipes* (Curt.) Fr. with a ca one

percent addition to a culture medium. Compared with the yield of mycelium grown under standard conditions, the effects of these sulfonates were significant on *L. edodes* (2.9 times by LCC-W), *P. ostreatus* (2.0 times by Björkman LCC), and *F. velutipes* (1.4 imes by LCC-W and Björkman LCC). But the mycelia of these three did not grown at all with the addition of MWL sulfonate alone or a mixture of MWL sulfonate and acetylglucomannan sulfonate or glucuronoxylan sulfonate.

E. MAEKAWA, I. UENO and T. KOSHIJIMA: **Properties and Thermal B-Behaviors of 2,3-Dicarboxy Cellulose Metallic Salts.** Sen-i Gakkaishi, **37**, T-509 (1981). (in Japanese)

2,3-Dicarboxy cellulose oxidized to nearly 100% of the theoretical was prepared by the selective oxidation of commercial cellulose powder with periodate, and by following oxidation with acidified sodium chlorite solution.

The 2,3-dicarboxy cellulose prepared was completely soluble in water, but formed precipitate or massive solid in the aqueous solution of most metallic ions other than alkali metals.

2,3-Dicarboxy cellulose metallic salts of metallic ions having 6Å effective ionic radii in an aqueous medium gave sticky, gel-like products on heating with addition of water.

Thermal analyses of these products showed that 2,3-dicarboxy cellulose metallic salts had higher thermal stability than the original dicarboxy cellulose, and that considerable differences in the thermal stability depended on the kind of metallic ion. From a view point of the thermal stability, the zinc salt was the highest and the copper one the lowest. On the other hand, calcium salt had the anomalous thermal behavior.

M. TANAHASHI and T. HIGUCHI: **Possible Formation of L.C.C. via Quinonemethide Intermediates of Lignols.** 1982 Canadian Wood Chemistry Symposium (Naigara Falls), p.67 (1982).

The formation of ether and ester linkages between sugars and quinonemethides from guaiacylglycerol-β-guaiacyl ether (I) and from isoeugenol (II) was investigated. Hexoses and pentoses were linked to the quinonemethide from I *via* C6 and C5 primary hydroxyl groups respectively to form guaiacylglycerol-α-D-sugar-β-guaiacyl-di-ethers. The results suggested that L.C.C. could be formed by the addition of primary hydroxyl- and carboxyl groups of sugar residues of hemicelluloses to the quinonemethide intermediates of lignols during lignification.

T. HIGUCHI: **Biosynthesis of Lignin,** Plant Carbohydrates II. Encyclopedia of Plant Physiology, New Series, Vol. **13B** ed. by W. Tanner and F. A. Loewus, pp. 194–224, Springer-Verlag, Berlin, Heidelberg, New York (1981).

Recent studies on lignin biosynthesis were reviewed and discussed.

T. HIGUCHI: **Biodegradation of Lignin: Biochemistry and Potential Applications,** Experientia, **38**, 159 (1982), and New Trends in Research and Utilization of Solar Energy through Biological Systems ed. by H. Mislin and R. Bachofen, pp. 87–94, Birkhäuser Verlag, Basel, Boston, Stuttgart (1982).

Recent studies on biodegradation of dilignols by *Fusarium solani* M-13-1 and *Phanerochaete chrysosporium* were reviewed and discussed in relation to lignin biodegradation.

T. HIGUCHI: **Synthesis of Plant Phenolic Products,** CRC Handbook of Biosolar Resources Vol. I. ed. by A. Mitsui and C. C. Black, Jr., pp. 479–499, CRC Press Inc., Boca Raton, Fl., U.S.A. (1982).

Recent studies on biosynthesis of plant phenolics were reviewed.

T. HIGUCHI: **Biosynthesis of Plant Cell Wall Components,** Shokubutsu Seirigaku 7, ed. M. Furuya, pp. 49–69 (in Japanese), Asakura Publishing Co., (1982).

Recent investigations on biosynthesis of cell wall components were reviewed.

T. HIGUCHI: **Lignin and Its Evolution,** Shizenkagaku to Hakubutsukan, **49**, 56 (1982) (in Japanese).

Biochemical characteristics of lignin and its evolution were reviewed and discussed.

H. FUJIMOTO, F. NAKATSUBO and T. HIGUCHI: **Synthesis of Pinoresinol,** Mokuzai Gakkaishi, **28**, 555 (1982).

Pinoresinol was synthesized via 2,3-bis-oxyvanillylbutane diol-1,4 (tetrol). The desired racemoid tetrol was derived from the condensation of 4-benzyloxy-3-methoxybenzaldehyde and enolate anion formed by the Michael addition of 2-(4-benzyloxy-3-methoxyphenyl)-1,3-dithian to γ-butyrolactone. This method is applicable to the synthesis of other retrahydrofurofuran resinols.

T. UMEZAWA, F. NAKATSUBO and T. HIGUCHI: **Lignin Degradation by *Phanerochaete chrysosporium*:** Metabolism of a Phenolic Phenylcoumaran Substructure Model Compound **131**, 124～128 (1982).

The degradation of a lignin substructure model compound, 5-formyl-3-hydroxymethyl-2-(4-hydroxy-3,5-dimethoxyphenyl)-7-methoxycoumaran (I), in ligninolytic culture of a white-rot wood decay fungus, *Phanerochaete chrysosporium,* was investigated. It was found that I was hydroxylated or dehydrogenated in its coumaran ring to give 2-(5-formyl-2-hydroxy-3-methoxyphenyl)-3-hydroxypropiosyringone (II) and two coumarones, 5-formyl-3-hydroxymethyl-2-(4-hydroxy-3,5-dimethoxyphenyl)-7-methoxycoumarone (V) and 3,5-diformyl-2-(4-hydroxy-3,5-dimethoxyphenyl)-7-methoxy-

coumarone (VI). II was further converted to 2,6-dimethoxy-*p*-benzoquinone (IV), syringic acid (III), and 5-carboxyvanillic acid (VIII). These metabolic products were identified by mass spectrometric comparison with the authentic compounds. A proposed pathway for the degradation of I is presented on the basis of these metabolic products. The degradation could be catalyzed mainly by phenol-oxidizing enzymes.

T. HIGUCHI and F. NAKATSUBO: **The Pathways for Lignin Model Compkund Biodegradation,** Tappi R & D Conference p.231 (1982).

Studies have been made of degradation pathways of main dilignols, such as guaiacylglycerol-β-coniferyl ether, dehydrodiconiferyl alcohol, d,l-pinoresinol, and diguaiacylpropane-1,3-diol by lignin degraders, *Phanerochaete chrysosporium,* and *Fusarium solani* M-13-1 which was isolated from the soil by an enrichment technique using DHP as a sole carbon source. The results showed that by both fungi side chains of phenolic dilignols are mainly cleaved between Cα and C-1 (aromatic ring carbon) to derive methoxy benzoquinones, but the side chains of methylated non-phenolic dilignols are generally cleaved between Cα and Cβ by the *Phanerochaete* but not by the *Fusarium* to derive veratric aldehyde from non-condensed aromatic rings, and 5- carboxyveratric acid from condensed aromatic rings, respectively. A similar degradation pathway was found in the degradation of a trilignol, guaiacylglycerol-β-syringaresinol ether. The pathways and enzymes involved are discussed in relation to the lignin biodegradation.

M. SHIMADA, T. KATAYAMA and T. HIGUCHI: **Xenobiotic Aspects of Lignin Biodegradation in White-Rot Fungi,** Tappi R & D Conference p.241 (1982).

Correlation between lignin degradation and veratryl alcohol biosynthesis as a secondary metabolic event in *Phanerochaete chrysosporium* was examined by use of tyrosine$_2$ -copper^{+2} complex (TCC) as a cytochrome P-450 monoxygenase inhibitor. The results show that the TCC inhibitor significantly inhibited: a) lignin decomposition to CO_2, b) the ether cleavage of the dimeric ether model compound (4-ethoxy-3-methoxy-phenylglycerol-β-vanillic acid ether), c) demethylation of veratric acid to vanillic acid, and d) incorporation of C-14 of L-phenylalanine-U-^{14}C into veratryl alcohol in the *in vivo* culture experiments.

After cell-free extraction of the fungal culture grown under different conditions, glucose-6-phosphate dehydrogenase, cytochrome C reductase, and "cytochrome P-450" peroxidase activities were examined. The all enzyme activities were greatly enhanced by 100% O_2. The latter two enzymes were significantly activated by phenobarbital as a common xenobiotic inducer of cytochrome C reductase and P-450 and also by ethylene, whereas the latter two enzymes were completely inactivated by incubation of the ligninolytic cultures with 2.5 mM L-glutamate for 12 hrs. These

results strongly indicate that O_2/NADPH-requiring cytochrome P-450 electron transport system should be a regulatory key enzyme system shared by both the lignin degradation and veratryl alcohol metabolism.

H. KUTSUKI, M. SHIMADA and T. HIGUCHI: **Regulatory Role of Cinnamyl Alcohol Dehydrogenase in the Formation of Guaiacyl and Syringyl Lignins,** Phytochem., **21**, 19 (1982).

The substrate specificities of cinnamyl alcohol dehydrogenase (CAD) of angiosperms and gymnosperms were examined using coniferaldehyde and sinapaldehyde as substrates. Angiosperm CADs reduced both aldehydes to the corresponding alcohols almost equally, whereas those of gymnosperms were remarkably specific for the reduction of coniferaldehyde. The purified CAD of Japanese black pine (*Pinus thunbergii*) showed that the K_ms to NADPH and coniferaldehyde were 6.8 and 9.1 μM, respectively and the V_{max} to sinapaldehyde was only 2.2% of that for coniferaldehyde. The MW of the CAD was 67000 and the optimum pH was 6.8. It is thus presumed that CAD is one of the regulating enzymes which control the formation of guaiacyl and syringyl lignins.

M. TANAHASHI, T. AOKI and T. HIGUCHI: **Dehydrogenative Polymerization of Monolignols by Peroxidase and H_2O_2 in a Dialysis Tube. II. Estimation of Molecular Weights by Thermal Softening Method,** Holzforschung, **36**, 117~122 (1982).

Thermal softening was measured to determine the molecular weight and the molecular weight distribution of the insoluble lignins. The thermal softening temperature (T_s) of DHP prepared by dialysis membrane method (175°C) was higher than those of bamboo MWL (162°C), Zutropfverfahren DHP (162°C) and Zulaufverfahren DHP (134°C). The results indicated that the DHP by dialysis membrane method has a higher molecular weight and a higher degree of cross-linked structure than MWL and other DHPs.

M. H. GOLD, M. B. MAYFIELD, T. M. CHENG, K. KRISNANGKURA, M. SHIMADA, A. ENOKI and J. K. GLENN: **A *Phanerochaete cyrysosporium* Mutant Defective in Lignin Degradation as Well as Several Other Secondary Metabolic Functions,** Arch. Microbiol., **132**, 115 (1982).

A pleiotropic mutant of *Phanerochaete chrysosporium* 104-2 lacking phenol oxidase and unable to form fruit bodies and a revertant strain 424-2 were isolated after UV mutagenesis. Strains 104-2 and 424-2 had no apparent dysfunction in primary metabolism with glucose as a carbon source. Unlike the wild type strain and strain 424-2, strain 104-2 was unable to evolve $^{14}CO_2$ from ^{14}C ring, side chain and 3-O-^{14}C-methoxy labeled lignin. In addition, strain 104-2 was unable to evolve $^{14}CO_2$ from

a variety of lignin model compounds including ^{14}C-4′-methoxy labeled veratryl-glycerol-β-guaiacyl (V) ether, γ-^{14}C-guaiacylglycerol-β-guaiacyl ether (VI), as well as 1-(^{14}C-4′-methoxy, 3′-methoxyphenyl)1,2 propene (III) and 1-(^{14}C-4′-methoxy-3′-methoxyphenyl)1,2 dihydroxypropane (IV). The addition of peroxidase/H_2O_2 to cultures of strain 104-2 did not alter its capacity to degrade the labeled lignins. A variety of unlabeled lignin model compounds previously shown to be degraded by the wild type organism including β-aryl ether dimers and diaryl propane dimers were also not degraded by the mutant 104-2. The revertant strain 424-2 regained the capacity to degrade these compounds. The substrates described are degraded by oxygen requiring system(s) expressed during the secondary phase of growth, suggesting this pleiotropic mutant is possibly defective in the onset of postprimary metabolism. The inability of the mutant to produce the secondary metabolite veratryl alcohol and to elaborate enzymes in the veratryl alcohol biosynthetic pathway supports this hypothesis.

T. Higuchi, M. Shimada and K. Kuroda: **In, "Enzyme Handbook",** Chief Eds., B. Maruo and N. Tamiya, Asakura Publisher (1982). (in Japanese)

K. Sumiya, K. Shimaji, T. Itoh and H. Kuroda: **A Consideration on Some Physical Properties of Japanese Cedar (*Cryptomeria japonica* D. Don) and Japanese Cypress (*Chamaecyparis obtusa* S. and Z.) Planted at Different Densities.** Mokuzai Gakkaishi, **28**, 255 (1982). (in Japanese)

The relationship between the dynamic bending modulus of elasticity and density within each annual ring of Japanese cedar (*Cryptomeria japonica* D. Don) and Japanese cypress (*Chamaecyparis obtusa* S. and Z.) planted at different densities is discussed. The juvenile wood formed during the first ten years and the adult wood grown at higher planting densities (A.W.H.) do not follow the rule which is derived from adult wood grown at the lowest planting density (A.W.L.).

Some of the wood quality indicators in the cell walls themselves, in the cells as wholes, and in the annual rings then are considered. It is suggested that juvenile wood in general does not follow the rule of A.W.L. because characteristics of the wood quality indicators in the above-mentioned three categories all are unlike each other. On the other hand, the failure of A.W.H. to follow the rule of A.W.L. is considered to be caused by the difference in the characteristics of the last two categories, rather than those of the cell walls themselves.

M. Norimoto: **Structure and Properties of Wood Used for Musical Instruments I.** Mokuzai Gakkaishi, **28**, 407 (1982). (in Japanese)

In order to establish a simple method for selecting wood pieces suitable for piano soundboards, measurements were made of the dynamic Young's modulus E' and

internal friction Q^{-1} in flexural vibration and the static Young's modulus E in bending for the coniferous woods shown in Table 1. The suitability of the acoustic properties of wood samples was evaluated on the basis of the value of Q^{-1}/E', which is proportional to the energy dissipated as heat per cycle in each sample during forcing oscillations. The samples rated as having excellent qualities by an expert in the piano industry showed extremely low Q^{-1}/E' values. An excellent correlation was found between Q^{-1}/E' and the ratio of E' to specific gravity γ, E'/γ, which gives a measure of the average Young's modulus of the cell wall. As E/γ is excellently correlated with E'/γ, it can be used to select wood pieces for piano soundboards. Furthermore, an attempt was made to correlate E/γ with colors for spruce wood which is much used for piano soundboards. No good correlation was found between them. Consequently, it seems that the reason why reddish colored wood pieces are commonly regarded as being of inferior quality is not because of their acoustic properties but because of their appearance.

H. WADA, M. MATOBA and M. NORIMOTO: **Creep Deformation of Wood During Microwave Irradiation.** Mokuzai Kogyo, **37**, 431 (1982). (in Japanese)

Measurements were made of creep deformation in bending for wood initially in wet condition during microwave irradiation. The effects of microwave power, applied load and wood species on the creep deformation were investigated. The rate and extent of creep deformation of wood during microwave irradiation was considerably greater compared with that during hot-air-drying. It was suggested that this enhanced creep deformation may have arisen from both the thermal softening of the chemical constituents and the slipage of molecular chains accompanying moisture content changes. The creep deformation was greatly aflected by microwave power and applied load. The rate of creep deformation increased with increasing microwave power and applied load. Creep behavior varied markedly among the different wood species and species such as Robinia pseudo-acacia and Pinus teada showed extremely high creep deformation. A good correlation was found between the final creep deformation and the strain at the maximum stress in the stress-strain diagram in wet condition.

N. SHIRAISHI, T. AOKI, M. NORIMOTO and M. OKUMURA: **Thermoplasticization of Cellulose and Wood by Graft Copolymerization and Acylation.** ACS Symposium Series, **187**, 321 (1982).

A homogeneous grafting using an organic cellulose solvent as a reaction medium makes cellulose thermally meltable, while heterogeneous graftings examined do not convert cellulose or wood into a meltable material. When thermally unmeltable acetylated wood as well as acetylated-propionylated wood with low propionyl contents

are further chemically modified by grafting, the thermally meltable properties are rendered even by very low graft add-ons. These modified cellulose and wood with thermally meltable properties can be molded to form transparent sheets at adequate temperatures and pressing time not causing thermal degradation, under pressures usually used for the compression molding of plastics.

T. YAMADA: **Physical Aspects of Science of Woody Resource,** Wood Research and Technical Notes, No. 16, 26 (1981).

A brief review of the science of woody sources with special reference to mechanical and psychophysical works.

S. ISHIHARA: **Smoke and Toxic Gases Produced during Fire.** Wood Research and Technical Note, No. **16**, 49 (1981).

A review is given fire statics in Japan, generation, spread and behaviour of smoke during fire, toxic gases and vapors produced through combustion and thermal decomposition of organic materials, acute inhalation toxicity of gases and vapors from burning organic materials, and control of smoke by physical treatments and/or chemicals.

S. KAWAI, L. LANG, H. SASAKI and S. ISHIHARA: **Production of Oriented Board with an Electrostatic Field I. Factors affecting the alignment of wood particles.** Mokuzai Gakkaishi **28**, 295 (1982).

The effects of some processing variables on the extent of the alignment of electrostatically aligned particle-mats were evaluated by the use of an analysis of variance based on an orthogonal array L_{64} (4^{21}). Factors considered were species, particle shape, particle moisture content, and electrostatic field intensity. Aligned particle-mats were formed of strand-type particles dropped through an electrostatic field. The average angle between the direction of the electrostatic field and that of the longer axes of the particles on a mat surface was chosen as a measure of the extent of alignment of the mat. The results obtained were 1) Field intensity and particle moisture content are significant factors for particle alignment, whereas none of the other factors showed a statistically significant effect in this experiment. 2) With an increase of the field intensity, the average alignment angle decreased and better aligned mats were obtained. 3) The optimum moisture content for particle alignment was about ten percent. The best value of the average alignment angle, seventeen degrees, was obtained with a field intensity of 4kV/cm and a moisture content of ten percent.

L. LANG, S. KAWAI, H. SASAKI and S. ISHIHARA: **Production of Oriented Board with an Electrostatic Field II. Properties of oriented particleboard.**

Mokuzai Gakkaishi **28**, 301 (1982). (in Japanese)

With reference to the findings in Report I, oriented particleboards were prepared in the laboratory by the electrostatic method with combinations of the various factors of species, particle shape, and electric field intensity. The effects of these factors on the mechanical properties and the dimensional stability of the boards were evaluated. The results obtained were 1) With an increase of the field intensity, the modulus of elasticity (*MOE*) in bending increased in the direction parallel to the orientation of the boards, whereas it decreased in the lateral direction. 2) The ratio, $MOE_{/\!/}/MOE_{\perp}$ or $MOR_{/\!/}/MOR_{\perp}$ of the boards increased with an increase of the field intensity. 3) With increases in the degree of particle orientation, the internal bond strength decreased first, and then it increased to about those of randomly-formed boards, whereas the thickness swelling showed a result contrary to that of the internal bond strength.

K. Nishimoto, G. Araki, N. Haraguchi and K. Fushiki: **Quantitative Analyzing Method of Insecticides in the Treated Plywood (I) Quantitative Analysis of Chlordane Incorporated in the Glue-line.** Mokuzai Hozon (Wood Preservation), **21**, 44 (1982). (in Japanese)

New technique to determine the quantity of chroldane in the glue-line of plywood made in laboratory and factory scales was reported. Although the amount of chroldane in the glue-line was 960 g/m^3 in every case, a conventional Soxhlet extraction method with benzene could recover only 17% and 41.8% of the original amount for factory-made and laboratory-made plywoods respectively. However, the new method to extract chroldane with formic acid recovered 74.1% and 91.9%. Recovery rate was found not to be varied with the amount of chroldane incorporated in the additional experiments of which four levels of chroldane amount (600, 700, 800, 960 g/m^3) were investigated.

The new extraction method is therefore more reliable and simpler than the conventional method using Soxhlet's extractor.

R. Iwata and K. Nishimoto: **Observations on the External Morphology and the Surface Structure of *Lyctus brunneus* (Stephens) (Coleoptera, Lyctidae) by Scanning Electron Microscopy. I. Larvae and Pupae.** Kontyû, Tokyo, **49**, 542–557 (1981).

In order to understand the development of the powder-post beetle, *Lyctus brunneus* (Stephens), and to obtain detailed morphological knowledges, immature stages of this species were observed using scanning electron microscopy (SEM).

The following morphological features were detected and described: four main phases of larval development, some larval changes according to instar, e.g. in the

epicranium, maxillary palpi, antennae, etc., fine structure of larval mouth parts especially the mandibles, structure of larval spiracles, structure of pupal mouth parts, pupal sex characters, and possible presence of intact wood cell walls in frass grains, and so on.

R. IWATA and K. NISHIMOTO: **Observations on the External Morphology and the Surface Structure of *Lyctus brunneus* (STEPHENS) (Coleoptera, Lyctidae) by Scanning Electron Microscopy. II. Adults and Eggs.** Kontyû, Tokyo, **50**, 10–22 (1982).

Adults and eggs of the powder-post beetle *Lyctus brunneus* (STEPHENS) were observed using scanning electron microscopy (SEM).

The imaginal mouth parts, antennae, body surface structures, genital organs, and eggs were scrutinized. Among the new findings described and discussed are rasp-like structures on the underside of the elytron in three regions and their counterparts on the body surface. The possibility of the production of sound signals is also suggested.

R. IWATA and K. NISHIMOTO: **Studies on the Autecology of *Lyctus brunneus* (STEPHENS). IV. Investigations on the Composition of Artificial Diets for *Lyctus brunneus* (STEPHENS) (Col., Lyctidae).** Material und Organismen, **17**, 51–66 (1982)

For the development of mass culture methods for *Lyctus brunneus* (STEPHENS) the following approaches are dealt with: study to establish the most appropriate meridic diet, preliminary investigation of the nutritional requirements on a meridic diet, examination of the suitability of the diet under mass culture conditions. A series of meridic diets composed of lauan (*Shorea* spp.) sawdust, cellulose, starch and yeast were examined; their suitability for oviposition and for larval development were assessed separately. The results obtained indicated: diets which were too hard and not porous enough proved to be unsuitable for oviposition, starch is quantitatively more important than proteins and wood sawdust or cellulose powder added to obtain a suitable density and structure does not add to the nutritional quality. It is concluded that the suitability of diets should be assessed separately by oviposition and larval development.

M. TAKAHASHI: **Outline of Reports on Wood Preservation in 17th IUFRO World Congress,** Mokuzai Hozon (Wood Preservation), No. **20**, 60 (1982). (in Japanese)

Outline of reports on wood preservation, presented at the 17th IUFRO World Congress held in Kyoto, September, 1981, is described. Four invited papers, ten voluntary papers and nine poster displays are included in these reports.

K. TSUNODA: **JWPA Method for Testing Effectiveness of Surface Coatings with Preservatives against Decay Fungi.** The Int. Res. Group on Wood Pres., Document No. IRG/WP/2164 (1981).

Testing method established by Japan Wood Preserving Association in 1979 to evaluate the effectiveness of superficial treatment (brushing, spraying or dipping) was outlined with some results using a combination of *Coriolus versicolor*-treated *Fagus crenata* with a few preservatives. This method is simpler than JIS A 9302 in preparing specimens, and could be available for the potential screening technique.

K. TSUNODA: **The Japanese Wood Preserving Industry.** Proc. N.Z.W.P.A., **21**, 10 (1981).

Reviewed the history of wood preserving industry and the output of preservative-treated wood in relation to commodities in Japan with the emphasis on the increasing demand of preserved wood foundation sills and timbers immunised against insect attack (especially against powder-post beetles).

S. ISHIHARA, T. KOSHIJIMA, H. SASAKI, A. SATOH, K. SHIMAJI, K. SUMIYA, M. TAKAHASHI, K. NISHIMOTO, M. NORIMOTO, S. HAYASHI and T. HIGUCHI: In "Mokuzai Kogaku Jiten (Dictionary of Wood Technology)", edited by Committee of Wooden Materials of the Society of Materials Science, Japan (1982). (in Japanese)