Abstracts

T. ITOH: **Recent Advance in the Biosynthesis of Cellulose,** Wood Research and Technical Notes, No. 21, 1 (1985) (in Japanese)

Recent advances in the study of cellulose biosynthesis are reviewed in Japanese from the following point of view: Historical aspects on the study of the structure of cellulose and the advance of its related instruments; Cellulosic organisms; Width of cellulose microfibrils; Degree of polymerization of cellulose microfibrils; Arrangement of cellulose chains within each microfibril; Biochemical pathway of cellulose and its precursors; Site of the assembly of cellulose microfibrils; Terminal synthesizing complexes (TCs); Bacterial cellulose and inhibitors of cellulose crystalization.

T. ITOH, R.L. LEGGE and R.M. BROWN, Jr.: **The Effects of Selected Inhibitors on Cellulose Microfibril Assembly in *Boergesenia forbesii* (Chlorophyta) Protoplasts,** J. Phycol. **22,** 224 (1986)

Protoplasts of *Boergesenia forbesii* (harvey) were treated with inhibitors of protein synthesis in order to investigate their effects on cellulose synthesis. Cellulose synthesis was reversibly inhibited by 10 μM cycloheximide as assayed by fluorescence microscopy of Tinopal binding to cellulose. Freeze fracture and image analysis of cycloheximide-treated cells indicated a reduction in the number of intramembrane particles; however, the terminal synthesizing complexes remained at all times. Treatment with 10 μM actinomycin D, when applied during the first hour of protoplast formation, irreversibly inhibits cellulose synthesis and terminal complex formation. *De novo* protein synthesis is required for cell wall regeneration by protoplasts. The data suggests that the structural subunits visualized in the terminal complex do not undergo significant turnover, but that there may exist an essential proteinaceous component of cellulose synthesis which must be continually renewed.

T. ITOH and R.M. BROWN, Jr.: **Initiation and Development of Terminal Synthesizing Complex in Boergesenia Aplanospores,** Proc. XIth Int. Cong. on Electron Microscopy, Kyoto, **4,** 3305 (1986)

The development of terminal synthesizing complexes (TCs) is investigated by the freeze fracture technique in the protoplasts of *Boergesenia forbesii* from right after wounding to 20 hr after wounding. The following changes in TC organization occurred during the wounding cycle: (A) the pre-established TCs disappear from the plasma membrane of the aplanospores immediately after wounding of mother cell; (B) TC subunits may be conveyed by cytoplasmic vesicles from cell interior to the plasma membrane; (C) a large number of subunits are discharged into the plasma membrane; (D) these subunits spread into small groups; (E) the first nuclea-

tion of TC subunits into a linear complex occurs in the cell in 2 hr after wounding.

TC length follows an exponential increase for the first 6 hr after wounding. However, no significant increase in TC length was observed after 6 hr.

H. KURODA and K. SHIMAJI: **User's manual for the Data Input of Fiber Length by a Digitizer/Microcomputer,** Mokuzai Kenkyu Shiryo (Wood Research and Technical Notes), No. **21,** 114 (1985) (in Japanese)

This is an instruction manual for a fiber length measuring system, which was composed of a projector/digitizer/microcomputer system and was developed by the authors (Wood Research No.72, 52 (1986)). This manual was described for technical assistants or inexperienced persons who want to handle it. This system has mainly been operated by technical assistants for over three years. Twenty-thousand fibers or about two handled sample-lots have been measured by using this system without any trouble except only one case, i.e. wrong naming of a sample-lot.

S. HAYASHI and K. SHIMAJI: **Tree Species of Wood Charcoals Excavated from Hirono-Kita Site,** Educ. Committee of Toyoda Chou, Shizuoka Pref. ed., Report of Excavated Research on Hirono-Kita Site, Toyoda Chou, Shizuoka Prefecture, 540 (1985) (in Japanese)

Very small charcoals were excavated from the third layer of Hirono-Kita site (B.C. 20,000). Comparatively large sized samples (about 3 mm cube) were selected, washed and embedded in celloidin. Cross-, radial- and tangential-sections were cut with microtome, and identified by microscope. Microscopic examinations revealed that tree species of these charcoals are *Pinus* sp. (Diploxylon) PINACEAE and *Quercus* sp., Lepidobalanus, Sect. Prinus, FAGACEAE. Although, a half is *Pinus* sp. and other half is *Quercus* sp. of all thirty-six samples but the number is not so significant, because it is easily expected that these samples were crushed out in the earth among long term.

S. HAYASHI and K. SHIMAJI: **List of Species Represented by Wood Specimens in the Xylarium, Wood Research Institute, Kyoto University (KYOw) No. 6001–8000,** Mokuzai Kenkyu Shiryo (Wood Research and Technical Notes), No. 21, 122 (1985) (in Japanese)

Our wood collection is rapidly expanding by the exchange of authentic wood samples with institutional wood collections all over the world. Collections of domestic wood samples and their herbarium vouchers are also proceeding extensively, and total number of our wood samples amounts over 10,000 at present. This list consists of the botanical names of KYOw samples No.6001 to No.8000 in the alphabetical order of the families, genera and species, containing 127 families, 557 genera and 1240 species. Exchange is available for fairly large numbers of domestic sam-

ples. Small blocks for sectioning are also available for almost all samples.

E. MAEKAWA, T. KOUSAKI and T. KOSHIJIMA: **Properties of Cellulose Hydroxamic Acid Derivative and its Metal-Chelating Complexes,** SEN-I GAKKAISHI, **42**, T-460 (1986)

Hydroxamic acid derivatives were prepared from dialdehyde celluloses obtained by periodate oxidation of cellulose according to an improved method for the preparation described by Gal'braikh and Rogovin (Vysokomol. Soedin., 5, 693 (1963)). Mild oxidation of the dialdehyde celluloses with acidified sodium chlorite led to 2,3-dicarboxy celluloses, which gave the dimethyl esters by treatment at room temperature under the presence of large amounts of methanol containing 0.06–0.1N hydrogen chloride without causing degradation by methanolysis. The esters were converted into the corresponding hydroxamic acid derivatives by the action of an absolute methanol solution of hydroxylamine adjusted at pH 9.2–3 by newly prepared sodium ethylate. The hydroxamic acid derivatives were found to be isolated in a yield of more than 80% as sticky massive solid from the reaction mixture by shaking with a mixture of EtOH: H_2O (80 : 20, v/v). The formation of the hydroxamic acid derivatives was confirmed by analyses of the nitrogen content and the characteristic coloration with ferric chloride solution. Some properties of the metal chelating complexes of hydroxamic acid derivatives prepared were investigated. The hydroxamic acid derivatives formed chelating complexes of colored precipitates with copper or ferric ion, but the chelating complexes formed by such ions as cobalt, nickel and zinc gave no precipitate. After uptake of metallic ions by the hydroxamic acid derivatives from the mixture, the contents of metallic ions remaining in the supernatant separated by centrifugation were determined by the chelatometric titration method. By this determination, it was proved that the hydroxamic acid derivatives had a high ability to take up such specific ions as ferric or copper ion preferencially from their mixture with other kinds of metallic ions. This findings suggest that the hydroxamic acid derivatives from cellulose may be useful as a material for recovery of the specific ions.

F. TANAKA: **Characterization of Cellulose,** Wood Research, No. 72, 119 (1986)

The fiber textures and the characteristics of *Valonia* and wood celluloses were quantitatively investigated by correlating the fine structure of them to their bulk properties. To be more quantitative the pole figure analysis, which had been successfully applied in the study on the textures of metals, was modified and applied in this study. First, the whole features of orientation distributions of cellulose crystallites in them was observed, and secondly the orientations was quantitatively

evaluated.

The precise orientational features of *Valonia* cellulose was obtained by the pole figure method. Especialy, two mutually antiparallel arrays of cellulose crystallites in each orientation unit of microfibrils were found experimentally. The threedimensional orientation distributions of cellulose crystallites in the wood were, then, measured, and the orientation of the wood cellulose were evaluated. The correlations between the orientation of the wood cellulose and the bulk properties of the wood were also discussed.

J. AZUMA, A. OZAKI and T. KOSHIJIMA: **Microwave Irradiation of Lignocellulosic Materials VII. Microwave Irradiation and Enzymatic Saccharification of Celluloses** Mokuzai Kenkyu shiryo, **21** 78 (1985)

Avicel SF Cellulose (particle size 6～10 μm) and Cellulose Powder D (particle size 150～400 μm) were heated by microwave irradiation in the presence of water and enzymatically saccharified.

The aidity of the microwave-irradiated solution increased with increasing temperature and reached about 0.09 meq at 230°C. Reducing sugar productions initiated at 180°C, and reached 10.5% (Avicel SF Cellulose) and 6.5% (Cellulose Powder D) at 235°C. A portion of cellulose was degraded into glucose and cellooligosaccharides. The extent of decomposition of cellulose was also evaluated by measuring ultraviolet spectra of the watersoluble fractions. A small amount of hemicellulosic polysaccharides contaminated in these commercially available cellulose preparations could be removed by microwave irradiation at 235°C.

Although the enzymatic susceptibility of the microwave-irradiated celluloses slightly dropped up to 210°C, it rapidly increased with increasing temperature above 220°C. The extent of saccharification reached 81% (Avicel SF Cellulose) and 60% (Cellulose Powder D) at 245°C. The present results indicate the applicability of microwave heating pretreatment for enzymatic saccharification of celluloses.

J. AZUMA, T. ASAI, M. ISAKA and T. KOSHIJIMA: **Effect of Microwave Irradiation on Enzymatic Susceptibility of Crystalline Cellulose.** J. Ferment. Technol., **63,** 529 (1985)

We compared the usefulness of various treatments in the enzymatic saccharification of microwave-irradiated crystalline cellulose (Whatman CF11). The variations include the extent of enzymatic saccharification, the treatment temperature suitable for enzymatic saccharification, and the effects of acetic acid, lignin, and monomeric lignin model compounds on the extent of enzymatic saccharification. The effects of microwave irradiation alone were evaluated. When cellulose suspended in water was heated above 180°C, partial acid hydrolysis was found to occur.

The extent of hydrolysis increased with an increase in temperature but did not exceed 3% even at 235°C, where 0.03 meq of acid and cello-oligosaccharides having a degree of polymerization of 2 to 6 as well as glucose were produced. Although the presence of acetic acid increased the reducing sugar production by a factor of 2.2–3.8, lignin did not induce degradation of cellulose.

The extent of enzymatic saccharification of cellulose was greatly enhanced by microwave irradiation pretreatment in the presence of water above 220°C and reached 43.2% at 240°C at cellulose and enzyme concentrations of 2.0% and 0.2%, respectively. The presence of acetic acid facilitated the enzymatic susceptibility and the extent of saccharification reached 69.2% at 240°C. Lignin also facilitated the enzymatic susceptibility but its action was limited to temperatures below 200°C, above which lignin inhibited enzymatic attack. The enhancement of the enzymatic susceptibility by lignin was further promoted by the addition of acetic acid. In this case the maximal extent of saccharification was 41.5% at 200°C, indicating that the temperature needed to reach 42–43% saccharification could be lowered for 40°C by a synergistic effect between lignin and acetic acid. Combinations of acetic acid and monomeric lignin model compounds also show synergistic effects. However, lignin model compounds did not inhibit the enzyme reaction above 200°C in contrast to the case of lignin. An unsaturated carbon carbon double bond in the substituent of benzene ring seems to be important in the synergistic effect, while phenolic hydroxyl groups are of minor importance.

J. AZUMA, J. HIGASHINO and T. KOSHIJIMA: **Microwave Irradiation of Lignocellulosic Materials VI. Enhancement of enzymatic susceptibility of softwood barks.** Mokuzai Gakkaishi, **32**, 351 (1986)

Five domestic softwood barks (akamatsu ezomatsu, hinoki, karamatsu, and sugi) were heated by irradiation with microwaves in the presence of water and enzymatically saccharified. The pH values of the irradiated solutions decreased with increasing temperatures because of the acids formed during the microwave heating. The acidity and the pH value at 234–235°C were 0.4–0.9 meq and 3.6–4.0, respectively. The formation of oligosaccharides by microwave-irradiation became prominent at temperature greater than 160°C, and the amount of reducing sugars in the reaction mixture reached a maximum with irradiation up to 210–215°C. The amount of the reducing sugars produced from the inner bark of karamatsu was about twice of that from the outer bark.

All of the microwave-irradiated samples, including the oligosaccharide fraction, were saccharified enzymatically. The extent of saccharification increased with an increasing preheating temperature by irradiation. The maximal extents of sac-

charification were attained by preheating up to 210–215°C and were in the range of 35.3% (outer bark of karamatsu) to 73.5% (ezomatsu) on the basis of polysaccharide contents, similar to the values obtained for sapwood of the same wood species. The inner bark of karamatsu could be saccharified about 1.7 times greater than its outer bark. These results indicate that the method of microwave heating followed by enzymatic saccharification may be a useful initial process directed toward utilization of the bark polysaccharides as chemicals.

J. AZUMA, T. KATAYAMA and T. KOSHIJIMA: **Microwave Irradiation of Lignocellulosic Materials VIII. Microwave Irradiation of the Neutral Fraction (C-I-M) of Pine Björkman LCC.** Wood Res., 72, **1**, (1986)

Effect of microwave irradiation on the partially acetylated galactoglucomannan bearing a small amount of lignin (C-I-M) isolated from pine Björkman LCC was investigated. When the native C-I-M was heated above 180°C by microwave irradiation in the presence of water, its carbohydrate portion was hydrolyzed into oligosaccharides having d.p. of 2–5 and monosaccharides. The degree of depolymerization of carbohydrates strongly depended upon the heating temperature and did not reach a maximum below 237°C, at which the reducing sugar content attained to 45.7%. The lignin molecules precipitated during microwave irradiation and a substancial amount of their β-*O*-4 linkages were splitted. The lignin-carbohydrate bondings were also splitted at the heating temperature above 230°C. The hydrolysis of the carbohydrate portion of C-I-M was found to be remarkably enhanced by addition of 0.5% acetic acid during microwave irradiation. In this case, the reducing sugar production showed a maximum (74.2%) at about 210°C. Acetic acid was an excellent reagent for enhancement of the extent of depolymerization of galactoglucomannan in C-I-M.

T. KOSHIJIMA: **Forecast in Future of Wood Saccharification,** Ringyo Gijutsu, No. 510, 2 (1984)

Problems invoved in wood saccharification industry and direction of the possible development are discussed.

T. KOSHIJIMA: **Growth Acceleration of Eatable Mashroom,** J. Brewing Soc. Japan, **79**, 851 (1984)

By addition of a fraction from softwood sulfite waste to the cultivation medium, growth of most of estable mashrooms was prompted by 20 to 500%. Examination on mashroom yield, and effective components of the fraction indicated sulfonated lignin-carbohydrate complex to be the most effective components.

T. KOSHIJIMA: Wood Research Institute, Kyoto University, Seni Gakkaishi (J. Soc. Fiber and Technol., Japan), **42**, 249 (1986)

Wood Research Institute are introduced briefly.

T. KOSHIJIMA: **Recent Development of wood chemicals,** Report of the Shikoku Engineering Assoβiation, No. 36, 12 (1985)

Wood chemicals in a broader sense are surveyed.

T. KOSHIJIMA: **Hemicellulose** "Science of Wood" ed. by H. Harada and T. Haraguchi (Buneido Publishers Co., Tokyo), p. 66–103 (1985)

Recent development of isolation, analysis, chemical structure, and reaction of polysaccharides contained in wood himicellulose are described.

T. KOSHIJIMA: **Present Situation and Forecast of Cellulose Biomass** "Development of Functional Cellulose" (CMC Co., Tokyo), p. 1–18 (1985)

Difference of celluloses due to their origin, direction of cellulose biomass utilization and enzymatic sacchrification of lignocellulose by using microwave irradiation are surveyed.

S. FUJISHIMA, F. YAKU and T. KOSHIJIMA: **Recovery and Reutilization of Celluloses Used for the Hydrolysis of Woods III.** Adsorption of cellulase activity on substrate, Mokuzai Gakkaishi **32**, 119 (1985)

The adsorption of Cellulase Onozuka R-10 from Trichoderma viride, cellulosin AP from Aspergillus niger and their mixture on Akamatsu (Pinus densiflora S. et Z.) and cellulose was studied. The Avicelase activity of Cellulase Onozuka R-10 was adsorbed five times that of Cellulosin AP. On the contrary, the CMCase activity of Cellulosin AP was adsorbed more than that of Cellulase Onozuka R-10. β-Glucosidase activity of both celluloses was adsorbed, especially that of Cellulase Onozuka R-10. The adsorption of Avicelase activity of mixed cellulases was equivalent to that of Cellulase Onozuka R-10, and the adsorption of CMCase activity was less than that of Cellulase Onozuka R-10. The activities adsorbed on Akamatsu were equal to or more than those on cellulose.

K. TANAKA, F. YAKU, J. IODA, J. AZUMA and T. KOSHIJIMA: **Enzymatic Degradation of Acetylglucomannan. III.** Identification of 6-O-acetyl group in acetylglucomannan by ^{13}C-NMR spectrum, Mokuzai Gakkaishi, **31,** 859 (1985)

O-β-D-Mannopyranosyl-((1→4)-O-β-D-mannopyranosyl-(1→4)-O-β-D-glucopyranose containing 6.1% acetyl was isolated from enzymatic degradation products of native acetylglucomannan of pine. ^{13}C-NMR spectrum and periodate oxidation provided a proof indicating that acetyl group located at C-6 of non-reducing mannose residue

T. UMEZAWA and T. HIGUCHI: **A Novel C_α-C_β Cleavage of a β-*O*-4 Lignin Model Dimer with Rearrangement of the β-aryl Group by *Phanerochaete chrysosporium*,** FEBS Lett., **192,** 147 (1985)

Incubation of a β-*O*-4 lignin substructure model dimer, 4-ethoxy-3-methoxyphenylglycerol-β-guaiacyl ether (I), with a culture of *Phanerochaete chrysosporium* yielded 2-guaiacoxyethanol (II) as one of the main catabolites. It was demonstrated by isotopic investigation with β-^{18}O- and γ-^{13}C-labeled substrates that the guaiacyl group at the β-position of (I) was rearranged to the adjacent γ-position in the formation of (II) by C_α-C_β cleavage.

T. HIGUCHI: **Bamboo,** In, "Encyclopedia of Materials Science and Engineering", ed., M.B. Bever (Pergamon Press, Oxford), pp.266–274 (1986)

Recent information on anatomy, physical and mechanical properties, chemical properties, pulp and paper of bamboo, and bamboo-based materials for construction were described.

S. KAWAI, T. UMEZAWA and T. HIGUCHI: **Arylglycerol-γ-formyl Ester as an Aromatic Ring Cleavage Product of Non-phenolic β-*O*-4 Lignin Substructure Model Compounds by *Coriolus versicolor*,** Appl. Environ. Microbiol., **50,** 1505 (1985)

4-Ethoxy-3-methoxyphenylglycerol-γ-formyl ester (IV) was identified as a degradation product of both 4-ethoxy-3-methoxy-phenylglycerol-β-syringaldehyde ether (I) and 4-ethoxy-3-methoxy-phenylglycerol-β-2,6-dimethoxyphenyl ether (II) by a ligninolytic culture of *Coriolus versicolor*. Isotopic experiment with a ^{13}C labeled compound (II′) indicated that the formyl group of (IV) was derived from the β-phenoxyl group of β-*O*-4 dimer as an aromatic ring cleavage fragment. However, (IV) was not detected from 4-ethoxy-3-methoxyphenylglycerol-β-guaiacyl ether (III).

γ-Formyl arylglycerol (IV) could be a precursor of 4-ethoxy-3-methoxyphenylglycerol (VI), because 3-(4-ethoxy-3-methoxy-phenyl)-1-formyloxy propane (VII) was cleaved to give 3-(4-ethoxy-3-methoxyphenyl)-1-propanol (VIII) by *C. versicolor*.

4-Ethoxy-3-methoxyphenylglycerol-β,γ-cyclic carbonate (V) previously found as a degradation product of (III) by *Phanerochaete chrysosporium* was also identified from the cultures with (I), (II) and (III) and degraded to give the arylglycerol (VI). Isotopic experiment with ^{13}C labeled compounds, (II′) and (III′), indicated that the carbonate carbon of (V) was derived from the β-phenoxyl groups of β-*O*-4 substructure.

T. NOMURA: **A Proposal for the Expanse of Wood Science and it's related Industry,** Wood Industry, **39,** 594 (1984) (in Japanese)

As an abundant supply of wood have been possible, we have treated it carelessly

as yet. It was always used with the same way of other industrial raw material. But this wood is different from other inorganic industrial raw material. So, we have to make an effort how to use it as a biomaterial from now on. This report proposed how to use wood from a synthetic standpoint of both biomaterial and living culture.

T. NOMURA: **Wood and Japanese Life,** Kodansha, 130 (1985) (in Japanese)

Wood as a material of toy wihch is indispensable for children on the relation between Japanese life and wood was explained.

T. NOMURA: **Japanese Traditional Arts and Crafts (7) Kyoto,** Gyosei, 89 (in Japanese)

For the promotion of a mountain village which is the fundamental base of wood science and technology a local industry with hard wood was established through the production of woody toy. This local industry have recognized as the new traditional hand craft industry in Kyoto prefecture. In this book, it was explained that how to establish this local industry and it's background.

T. NOMURA: **Forest Situation in Brasil (I),** Wood Industry, **41,** 385 (1986) (in Japanese)

T. NOMURA: **Forest Situation in Brasil (II),** Wood Industry, **41,** 437 (1986) (in Japanese)

T. NOMURA: **Bamboo Cultivation in Brasil,** Kokusai Kyoryoku, **6,** 40 (1986) (in Japanese)

T. NOMURA: **Forest in Brasil,** Nation and Forest, **17,** 10 (1986) (in Japanese)

From March, 1985 to March, 1986 visited Brasil and surveid the present situation of forest resources and products in Brasil. In this country, forest denudation is in progress very rapidly. For example, the rate of forest in São Poulo state which is about 1.2 times of Japanese area is only 7%. These reports discussed about the present problems of the forest and it's means of settling with bamboo in Brasil.

F. MAKI, M. NORIMOTO, T. YAMADA: **Humidity Conditions in the House Lined with Wood Based Materials,** Mokuzai Kenkyu Shiryo (Wood Research and Technical Notes), No. 21, 87 (1985) (in Japanese)

Measurements were made of the relative humidity $H(T)$ and temperature T in closed boxes and a prefabricated wooden house lined with different combinations of plywood and vinyl film or galvanized steel. The logarithm of relative humidity $\log_{10} H(T)$ was a linear function of temperature T and the extent of humidity conditions caused by lined materials was estimated by the slope B of $\log_{10} H(T)$-T curve. The value B in the boxes and the house lined with different combinations of plywood and vinyl film or galvanized steel was increased nonlinearly with

increasing fraction of lined area of plywood δ_1. From the results, the nomograph for predicting the humidity range ΔH in a closed house at temperature range ΔT and plywood lining fraction δ_1 was made.

M. NORIMOTO and K. TAKABE: **On Noncrystalline Structure of Wood,** Mokuzai Kenkyu Shiryo (Wood Research and Technical Notes), No. 21, 96 (1985) (in Japanese)

On the basis of the informations on cellulose crystallites in microfibrils, proportion of chemical components, and moisture adsorption in the wood cell wall, average width of noncrystalline region around cellulose crystallites and average space between microfibrils in each layer of the wood cell wall were estimated.

M. NORIMOTO: **Application of Microwave Heating to Wood Processing,** Electro-Heat, No. 27, 50 (1986) (in Japanese)

Application of microwave heating to wood bending, pretreatment for enzymatic saccharification of wood, wood drying, adhesion, manufacturing of WPC, and so on was reviewed.

T. MOROOKA, M. NORIMOTO and T. YAMADA: **Cyanoethylated Cellulose Prepared by Homogeneous Reaction in Paraformaldehyde-DMSO System,** J. Applied Polm. Sci., **32**, 3575 (1986)

A series of cyanoethylated cellulose with various degree of substitution was prepared by homogeneous reaction of cellulose in PF/DMSO system. Their thermal deformation properties changed regularly with the degree of cyanoethylation. By comparing highly cyanoethylated cellulose in the series with that prepared by a traditional cyanoethylation method, it was seen that they were quite different in physical properties such as thermal deformation or tensile properties. Based on the results of dynamic mechanical measurements and infrared spectroscopy, cyanoethylated cellulose prepared in PF/DMSO system was found to be a new cellulose derivative, which includes oligo-oxymethylene groups at the position between the glucopyranose ring and the cyanoethyl group in the side chain. The maximum DS value of this cyanoethylated cellulose was estimated to be ca. 2.5.

T. OHGAMA, M. NORIMOTO and J. KOHARA: **Humidity Conditions by Wall Papers for Decorative Finish,** Mokuzai Kogyo (Wood Industry), **41**, 466 (1986) (in Japanese)

The extent of humidity conditions caused by wall papers, sheathings and laminations consisting of papers and sheathings was evaluated. Both the relative humidity $H(T)$ and the temperature T in the closed steel boxes lined with these wall materials were measured when the external temperature of the box was changed.

The extent of humidity conditions was estimated by the slope B of log $H(T)$-T curve; the smaller the value of |B| is, the better are the humidity conditions. Materials used were four kinds of wall papers; cloth, paper, olefin and vinyl, three kinds of sheathings; plywood, gypsum board and concrete, twelve kinds of laminations consisting of papers and sheathings, and so on.

The value of |B| for wall papers decreased in the order, cloth ($|B| \times 10^4$; ca. 50)<paper≈olefin (ca. 110)≪vinyl (>200). In the case of laminations with hygroscopic wall papers, sheathings acted so as to improve the humidity conditions. However, the overlaying with vinyl restrained this effect.

S. Ishihara: **Combustion of Wood and Wood-based Materials and their Controls by Chemical Treatments (5),** Kobunshikako (Polymer Application), **34,** 559 (1985), **(6),** *ibid,* **34,** 613 (1985), **(7),** *ibid,* **35,** 44 (1986)

S. Ishihara: **Fire Endurance of Wood and Wood-based Materials,** Zairyo (J. of the Society of Materials Science Japan), **34,** 1121 (1985)

A rieview of influence of fire on wood and wood properties is given.

S. Kawai and H. Sasaki: **Production Technology for Low-Density Particleboard I. Forming a density gradient and its effect on board properties,** Mokuzai Gakkaishi, **32,** 324 (1986)

Newly developed low-density particleboards were produced by the use of an isocyanate compound adhesive under various pressing conditions. Raw material used was strand-type particles of lauan with an air-dry density of 0.4 g/cm^3. The boards produced had the same density as that of the raw material so that its compaction ratio was only 1.0. Particles were mixed with the adhesive resin which formed 10 percent of the solids based on the oven-dry weight of the particles. The particle mats were hand-formed, then pressed at 160°C in a "two-step" pressing method. The effects of pressure and pressing time in the first step on the density profile through the board thickness, consequently on the physical properties of the board, were investigated. The results obtained were as follows: 1) With increases of pressure and the pressing time in the first pressing step, the density in the face layer of the board tends to increase, whereas the core density gradually decreases. The greater the pressure applied and the longer the pressing time, the steeper is the density gradient of the profile. 2) A steep density gradient does not improve the modulus of rupture (*MOR*) because the horizontal shear-failure occurs before the specimen fails in bending. 3) Thickness swelling and water absorption have a tendency to increase with increases of pressure and pressing time in the first pressing step; the former is due to the increase of the face density, whereas the latter is due to the decrease of core density. 4) Internal bond strength has a tendency to in-

crease with decreases in the pressure and the pressing time in the first pressing step. It shows a linear relationship with the minimum density in the thickness direction of the board. The lower limit of the compaction ratio used for the particles is estimated at 0.8 for building use.

V.C. MALLARI, S. KAWAI, H. SASAKI, B. SUBIYANTO and T. SAKUNO: **The Manufacturing of Particleboard I. Types of adhesives and optimum moisture content,** Mokuzai Gakkaishi, **32,** 425 (1986)

Properties and quality of seraya (*Shorea sp.*) boards bonded with different types of adhesives, namely, urea-formaldehyde (UF), urea-melamine-formaldehyde (UMF), phenol-formaldehyde (PF), phenol-melamine-formaldehyde (PMF), and isocyanate (IC), and varying amounts of particle moisture content were determined and observed. Results indicated that irrespective of the variation of the moisture content, isocyanate bonded boards had the highest mechanical properties and dimensional stability. For best mechanical properties, boards tend to have an optimum particle moisture-content range in hot-pressing except for PF-bonded boards because of the characteristics of the adhesive. Boards bonded with UF and UMF adhesives burst at the highest moisture content resulting in decreased values for properties. A scanning-electron microscope revealed different characteristics, particularly for UF and PF mixed with paraffin wax and IC adhesive. It is concluded that IC adhesive performed the best of all types of adhesive. It is recommended for all types of adhesives that the optimum moisture content of the particle mat be about 13% for producing good quality particleboard.

Y. NAKAMURA and K. NISHIMOTO: **Cutting Force of Knife Edges into Wood II. Cuts with Six Types of Knife Edges,** Mokuzai Gakkaishi, **32,** 19 (1986) (in Japanese)

Using six types of small knife edges, the cutting force (P) on eleven species of wood were measured.

The influence of (P) on the different cut surfaces of wood (tangential (T) and radial (R)) and the cutting angle (φ), which is the angle between the fiber axis and the knife edge, are discussed.

With the increase of φ (up to 90°) on both cut surfaces (T and R), an adequate correlations between φ and P (kgf/mm) with the six types of knife edges were recognized except with wood species of high specific gravity (more than 0.60); therefore, P increased linearly in proportion to φ.

In comparing the regression lines obtained for both cut surfaces (T and R) using the same knife edge, it was obvious that there were many species having steeper slopes by cutting R than T.

The relationships between P and φ had a tendency to follow a sigmoidal curve which has been represented by Hankinson's formula.

The average ranking of P obtained from the rankings of P of the individual species with respect to the six types of knife edges (A–F) when φ was inthe range of 0° to 30°, were as follows:

Oyster (A)<Elliptical (B)≒Circular (C)≒Sword (E)
<Chisel (F)<Crescent-shaped (D: crosstie use) (Table 3).

In cases of $\varphi \leqq 30°$ on the cut surfaces of wood (T and R), the correlation between P and the six types of knife edges and the specific gravity of wood was considered adequate; therefore, P increased linearly in proportion to the specific gravity.

H. TANAKA, A. ENOKI, G. FUSE and K. NISHIMOTO: **Succession and Interaction of Microorganisms Participating in Wood Decay V. Changes in the Chemical Components of Buna and Sugi Sapwood-Stakes during Exposure under the Floor of a House,** Mokuzai Gakkaishi, **32,** 637 (1986) (in Japanese)

Changes in extractives, lignin, holocellulose, α-cellulose, and pentosan contents of decayed stakes were determined to explain the relationship between changes in chemical components and fungal species which cause decay. Sapwood-stakes ($2 \times 2 \times 20$ cm) of buna, Japanese beech (*Fagus crenata* Bl.) and sugi, Japanese cedar (*Cryptomeria japonica* D. Don) were driven into the soil to a depth of 10 cm under the floor of an occupied house. Stakes were removed periodically, and each was cut into six parts. Changes in the chemical components were determined. The degree of decay greatly varied with wood species. After a 24 mo exposure weight losses were 51.9% for buna and 4.5% for sugi. Values for pH of buna and sugi stakes in above-ground zones were lower than those at ground-line and below-ground which had almost similar pH values. During the experimental period, the pH of the buna and sugi stakes ranged from 5.0 to 6.0 and from 4.0 to 5.0, respectively.

The buna stakes were attacked mainly by micro-fungi in the above-ground zone, and then very small amounts of extractives and polysaccharides were removed from them, although their decay could not be recognized visually. As the decay of buna wood proceeded greatly with time in the ground-line and below-ground zones, the lignin content increased, whereas the polysaccharide content decreased. The yield of the extractives increased slightly during the initial stages of decay; it then remained almost constant for 18 mo. It was a little higher after 24 mo of exposure. Changes in the lignin and polysaccharide contents suggest that the decay of buna sapwood-stakes in the ground-line and below-ground zones was a soft-rot type, although the changes in their solubility in various solvents might indicate a white-rof type or a soft-rof type. Thus the decay of buna stakes under the floor or a

house showed a mixed and complex decay type, different form laboratory decay studies with a single species of wood-decad fungi.

In the decay of sugi sapwood-stakes in the above-ground zone, a small increase in the yield of extractives and small decreases in the lignin and polysaccharide contents were caused by white-rot and micro-fungi. There were no changes in the chemical composition of stakes in the ground-line and below-ground zones.

M. TAKAHASHI: **Method for Testing Effects of Fungicides by Soil Treatment against *Serpula lacrymans*,** Mokuzai Hozon (Wood Preservation), **11,** 103 (1985) (in Japanese)

New laboratory technique to evaluate the effectiveness of fungicides to *Serpula lacrymans* as a soil poisoning agent is reviewed with some results obtained by the method. Treatment of soil with candiate chemicals, bioassay, evaluation of results are briefly described.

M. TAKAHASHI, K. TSUNODA, Y. IMAMURA, A. ADACHI and K. NISHIMOTO: **Studies on the Production of Preservative-Treated Plywood (1) Preservative Effectiveness of Glue-Line Treated Plywood with Low Toxicity Chemicals,** Mokuzai Hozon (Wood Preservation), **11,** 84 (1985) (in Japanese)

Preservative effectiveness of candidate fungicides for glue-line treatment was investigated using 4.0–and 5.6 thick lauan plywoods glued with melamin-urea formaldehyde resin. Non-weathered plywoods treated with the following three fungicides were able to inhibit effectively the decay by a brown rot fungus *Tyromyces palustris* Murr. at active ingredient retentions shown in the parentheses: 4-chlorophenyl-3'-iodopropagylformal (0.6 kg/m^3), 3-ethoxycarbonyloxy-1-bromo-1, 2-diiodopropene (1.0 kg/m^3), and mixture of tributyltinphthalate and potassium iodide (0.24 kg/m^3 +0.48 kg/m^3). Higher retentions of these fungicides were necessary to inhibit the decay by a white rot fungus *Coriolus versicolor* Quél. The enhancement of preservative effectiveness was recognized oftenly in any fungicide-treated plywoods after 3-month exposure to 60°C, followed by its decent after longer term exposure. Such an enhancement was found more oftenly in case of 90 repetitions of wet (6 hrs water soaking) and dry (60°C for 18 hrs) cycling than in 30 repetitions. It was probable that the amount of fungicides diffusing into veneer wood from resin adhesive was more than that of fungicide losses by liberating or leaching during a limited term exposure to 60°C.

From the results with preservative effectiveness after several weathering treatments, the first and second organic iodo compounds described above are considered to be the most promissing fungicides for glue-line treatment and the third organic tin compound is the next. However, improvement of curing condition should be

necessary to enlarge the fungicide distribution into veneer wood of treated plywood.

K. TSUNODA: **Some Recent Trends in Wood Preservation-New Chemicals and Improved Treatment Processes,** Mokuzai Hozon (Wood Preservation), **11,** 74 (1985) (in Japanese)

Japanese translation of a review article entitled, "Some recent trends in wood preservation-new chemicals and improved treatment processes" by John Butcher of New Zealand Forest Research Institute.

The introduction of low-toxicity wood preservative chemicals is discussed with particular emphasis on the limitations of broad spectrum activity and versatility in use. Improved application systems, coupled with improved formulations, are considered essential to overcome some of these limitations. Recent trends in treatment processes which lead to greater cost-effectiveness of wood preservation are described and the development of commodity treatments is discussed as a major goal of the industry.

K. TSUNODA and K. NISHIMOTO: **Effect of Timber Species on the Performance of Anti-Sapstain Chemicals in Controlling Mold and Sapstain Fungi on Wood,** Holzforschung, **39,** 331 (1985)

Three formulations were evaluated, using 7 timber species, for their effectiveness in controlling fungal development on wood by partly modified standard Japan Wood Preserving Association procedure. Effect of timber species on the efficacy of the formulations was obviously demonstrated when wood specimens were brushed evenly at a rate of 160 g/m^2, then inoculated with monocultures of 5 test fungi and incubated at 26°C for 4 weeks. Best performance was generally produced in *Cryptomeria japonica* D. Don and followed by the other 4 softwoods such as *Pinus sylvestris* Linn., *Tsuga heterophylla* Sarg., etc. The worst effectiveness of the formulations was always obtained with *Shorea* sp. or *Fagus crenata* Blume.

A new anti-sapstain chemical, containing 4-chlorophenyl-3-iodopropagyl formal and 2-(4-thiazolyl) benzimidazole, proved more effective than the trichlorophenol-base and amended trichlorophenol commercial products, and competitive in cost efficiency at the indicated treating strengths.

K. TSUNODA and K. NISHIMOTO: **Evaluation of Wood Preservatives for Surface Treatment,** International Biodeterioration, **22,** 27 (1986)

The fungicidal effectiveness of 13 wood preservatives was compared in loboratory decay tests when wood blocks were treated superficially and exposed to decay fungi for 8 weeks. The most effective conventional preservatives were organotin compounds, followed by an organoiodine compound and metallic naphthenates.

A new trihaloallyl compound (3-ethoxycarbonyloxyl-l-bromo-1,2-diiodopropene)

was as effective as organotin compounds if applied at 1% treatment strength. Pentachlorophenyl laurate, tribromophenol and copper-8-quinolinolate were ineffective in the present investigation, though they are commercially used for superficial applications. Two zinc soaps of the synthetic acids (zinc neodecanoate and zinc versatate) were equivalent in mycotoxicity to zinc naphthenate, which suggests realistic utilization of the zinc soaps in wood preservation.

K. TSUNODA and K. NISHIMOTO: **Japanese Standardized Methods for Testing Effectiveness of Chemicals Against Termite Attack,** The International Research Group on Wood Preservation Document No.: IRG/WP/1290 (1986)

Japanese standard termiticide testing methods are reviewed. There are some standard testing methods provided by Japan Termite Control Association (JTCA) and Japan Wood Preserving Association (JWPA), though most of them are common to two organizations.

Methods were standardized between JTCA and JWPA in 1981, and more recently examining system was established for authorizing efficacy of wood preservatives and termiticides determined by standard testing methods. English translations of Japanese standard testing methods are appended.

K. TSUNODA and K. NISHIMOTO: **Shipworm Attack on Logs Stored in the Sea Water and Its Prevention (5)-Practical Aspects on the Prevention of Shipworm Attack,** Mokuzai Kogyo (Wood Industry), **41**, 276 (1986) (in Japanese)

Practical aspects are briefly discussed to prevent shipworm attack on logs stored in the sea water. Maintenance of sea water, that is, removal of attacked timber and the introduction of fresh water to decrease the salinity of log-storing sea water should be considered to diminish the economic losses caused by shipworms during relatively short period of time for sea water storing. Preventive physical and chemical methods are described as well.

M. NOGUCHI, K. NISHIMOTO, Y. IMAMURA, Y. FUJII, S. OKUMURA and T. MIYAUCHI: **Detection of Very Early Stages of Decay in Western Hemlock Wood Using Acoustic Emissions,** For. Prod. J., **36** (4), 35 (1986)

It is difficult to detect wood decay as early as 5 percent weight loss or less by conventional techniques. But monitoring the acoustic emissions (AEs) of western hemlock specimens in very early stages of decay and in bending stress indicated that even slightly decayed specimens will begin to emit AEs between loads of 4 percent and 32 percent of the failure load. Sound specimens will not begin to emit AEs until 50 percent of the failure load is reached. These results suggest that cumulative AE counts are a sensitive indicator of early decay in specimens stressed in bending.

M. NOGUCHI, Y. FUJII and Y. IMAMURA: **Use of Acoustics Emission in the Detection of Incipient Stages of Decay in Western Hemlock Wood,** Acoustic Letters, **9,** 79 (1986)

Generation of AE proved to be a sensitive indication of the incipient stages of wood decay when the specimens were stressed in bending; however, there still remains problems when we apply this AE monitoring in a field test. This study was directed towards establishing the potential usefulness of AE for nondestructively testing wood at incipient stages of decay through a partial compression test.

Decayed specimens of western hemlock began to generate AE at lower levels of load, less than 15 kgf when partially compressed. In comparison, sound specimens did not begin to generate AE until a load of 100 kgf was exceeded. This suggests that the decay in components of wooden structures could be detected in its incipient stage by AE monitoring in a partial compression test.

Research Facility for Wood Protection: **Biology of Termites (7, 8, 9)-Principles of Termite Control,** Kankyo Kanri Gijutsu (Jour. Environ. Control Tech.), **3**(2) 58, **3**(4) 65, **3**(5) 46, (1985) (in Japanese)

Epitomized Japanese translations of chapter 13-"Principles of termite control" in the book, "Biology of termites (Vol. 2)" are concerned with detection of damage caused by termites, protection of buildings from subterranean termites, soil poisoning, treatment of timber and other related matters.

Research Facility for Wood Protection: **Biology of Termites (10, 11, 12, 13)-The Digestive System,** Kankyo Kanri Gijutsu (Jour. Environ. Control Tech.), **3**(6) 59 (1985), **4**(1) 69, **4**(2) 52, **4**(3) 55 (1986) (in Japanese)

Japanese translations of chapter 3-"The digestive system" in the book, "Biology of termites (Vol. 1)" are related to general structure of the digestive tube, comparative anatomy, physiology, digestion of wood and others.

Research Facility for Wood Protection: **Biology of Termites (14)-Feeding Relationships and Radioisotope Techniques,** Kankyo Kanri Gijutsu (Jour. Environ. Control Tech.), **4**(4) 53 (1986) (in Japanese)

The first epitomized Japanese translations of chapter 12-"Feeding relationships and radioisotope techniques" in the book, "Biology of termites (Vol. 1) is concerned with the radioisotope studies of food exchange.