[バイオ・生分解性プラスチック]

B-1

Sphingomonas 属細菌由来のポリアスパラギン酸分解酵素群の機能と特性

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Characterization of poly(aspartic acid) degrading enzymes from *Sphingomonas* sp. KT-1

KAJIYAMA Mariko, Science Univ. of Tokyo

Poly(aspartic acid) (PAA) is a water-soluble polymer which is degraded in the environment. However, the mechanism of enzymatic degradation of PAA has not been investigated. PAA degrading enzymes, Type I and Type II, were purified from *Sphingomonas* sp. KT-1. Type I with molecular mass of 30 kDa can hydrolyze PAA into aspartic acid oligomers. Molecular weight of Type II is 42 kDa. This enzyme is able to degrade the oligomers, but possess little degradability of PAA.

B-2

Structure and Enzymatic Degradation of Poly(4-hydroxybutyrate)

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Lozenge-shaped lamellar single crystals of poly(41hydroxybutyrate) (P(4HB)), showing spiral growth, were grown from a dilute ethanol solution. The crystal structure of P(4HB) was determined by electron diffraction of single crystals and X-ray fiber diagram of a stretched-annealed film. Enzymatic degradation of P(4HB) single crystals was investigated by means of transmission electron microscopy (TEM), atomic force microscopy (AFM) and gel permeation chromatography (GPC).

B-3

再生可能資源からポリーL 一乳酸を工業的に製造する方法の開発

小原仁美・揮誠治・伊藤正博(㈱島津製作所基盤技術研究所)

Method of producing poly-lactate from renewable resources

OHARA Hitomi, Shimadzu

0ur concept of a work are “carbon cycle” and “nitrogen cycle”. Poly-lactate which is produced from renewable resources such as sugar conducts “carbon cycle”, while application of the microorganism used producing lactic acid conducts “nitrogen cycle”. We developed the method of producing poly-lactate under these conceptions that is to say under the concept or "Green sustainable chemistry”. In addition, the behavior or biodegradation of poly-L-1actate in compost was revealed in this work.

B-4

自然環境下の数種のプラスチックの生分解性評価

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Evaluation of Biodegradability of Some Plastics in Natural Environment

SANO Mitsuyo, Toyama Univ.

We have examined a biodegradability of some plastics in natural environments. In this study, we used 6 kinds of green plastics and the test pieces of these injection- molded plastics were placed in soil, river water, seawater, activated sludge and at the exposure to the air. Their degradation properties were investigated by the measurements of changes in weight and tensile strength, observations with a scanning electron microscope, and FT-IR measurements.

B-5

木質材料の完全加溶媒分解物の接着剤-の応用

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Application of the exhaustively solvolyzed woody materials to adhesives

Ono Hirokuni, Univ. of Tokyo

Several wood wastes were treated in phenol at 150˚C in the presence or acid catalyst at atmospheric pressure to result in almost 100% liquefied product which dissolved in typical polar organic solvents. The reaction involves in solvolysis of major wood components, i.e. cellulose, hemi-cellulose and lignin・ Adhesives resins were prepared from the products by making a use or reactivity of their phenolic moiety with formaldehyde. The wood adhesive performance of the solvolyzed product based resins was as excellent as that of a commercial phenolic resin adhesive.

B-6

生物触媒合成と低環境負荷化学反応の相乗的利用

鈴木麻珠三、木村真弓、須貝 威（慶應義塾大学理工学部）

Integrated Process of Combined Biocatalytic and Chemical Synthesis

KEIO University

Recently, chemists look upon enzymes as elegant reagents in molecular transformation in synthetic organic chemistry. Remarkable advantages are: 1) the high performance and selectivity of catalysis at ambient temperature and pressure; 2) the catalysts whose supply from microorganisms, animals, and plants never quit, as the resources can be reproduced in a self-production manner. Here we present an integrated combination of enzyme-catalyzed reactions and deaminohydrolytic reaction, the latter yields only nitrogen gas as the leaving group.

B-7

天然油脂成分を含む硬化性ポリフェノールの合成と硬化

宇山　浩、辻本　敬、小林四郎 （京大院工）

Synthesis and Curing Behaviors of Crosslinkable Polyphenols Having a Natural Oil Moity

Uyama, H.; Tsujimoto, T.; Kobayashi, S. (Kyoto University, Kyoto)

This study deals with synthesis and curing of crosslinkable polyphenols having a natural oil moiety. The oxidative polymerization of naphthol derivatives with an unsaturated group derived from the natural oil proceeded by Fe-salen catalyst to give soluble prepolymers. The

curing readily took place by thermal treatment or cobalt naphthenate catalyst to give the crosslinked film with high gloss surface. The present method is highly significant to contribute global sustainability without depletion of scarce resources.

B-8

葉緑体形質転換法を利用した植物での生分解性ポリエステルの合成仲

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Production of Polyhydroxybutyrate in Plant by Chloroplast Transformation

NAKASHITA Hideo, RIKEN

The chloroplast (plastid), one of the major organelles in the plant cell, has its own genome. Both the structure of the genome and the mechanisms for decoding genetic information within plastids are similar to those of modern prokaryotes. The *phb* operon from *Ralstonia eutropha, encoding* three genes for the biosynthesis of the biodegradable polyester, polyhydroxybutyrate (PHB), was introduced into tobacco plastid genome. The obtained transformant successfully produced PHB in its leaves.

B-9

ペルオキシソームに生分解性ポリエステル PHA を蓄積するタバコの分子育種

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Transgenic Tobacco Producing Copolymer in Peroxisomes

ARAI Yuko, RIKEN

We studied on the production of PHA in plant by the utilization of β-oxidation in peroxisome. The PHA synthase gene was modified with peroxisome targeting signal sequences and introduced into tobacco and Arabidopsis plants. The transgenic plants produced PHA that contained 3-hydroxybutyrate, 3-hydroxyvalerate and 3-hydroxyhexanoate units, which is expected have better characteristics as plastic.

B-10

ACCase 阻害による形質転換タバコの生分解性ポリエステル PHB 合成の促進

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ACCase inhibition enhances polyhydroxybutyrate accumulation in transgenic tobacco

SUZUKI Yoshikatu, RIKEN

We studied a new method for an improvement of PHB productivity in transgenic plants. Our strategy is to increase a proportion of acetyl-CoA that flows into PHB synthesis, through an inhibition of acetyl-CoA flows into other native pathways by the use of bioactive agents. We showed that an ACCase inhibition by Quizalofop significantly enhances PHB accumulation in the tobacco.

B-11
In vivo assay system を用いた PHA 重合酵素変異体の機能解析

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([1]東理大・基礎工) ([2]理研・高分子化学)

Functional analysis of PHA polymerase mutants usian an in vivo assay sustem

HIROFUMI, N. (Dept. of Biol. Sci., Science Univ. of Tokyo)

Polyhydroxyalkanoates(PHAs) are bacterial storage compounds, and PHA polymerase is a central key enzyme involved in the biosynsesis of PHA. In this study, we have established an in vivo assay system to analyze mutational effects of *Ralstonia eutropha* polymerase on the level of PHA accumulation in recombinant *Escherichia coli*. By using this system, we were able to acpuire many mutants and performed functional analysis of arbitrarily selected mutant enzymes in terms of enzyme thermostability and PHB granule formation.