SHINSHU UNIVERSITY | Satellite Venture Business Laboratory

SVBL Mini-Symposium

Utilization of Cellulose as Renewable Resources

PROGRAM

Date: Monday, October 18, 2010 14:00 - 17:30
Place: Class room No.30 at the Faculty of Textile Science and Technology, Shinshu University

13:30	Registration	
14:00	Opening remarks	Hajime Konishi *Director, Satellite Venture Business Laboratory, Shinshu University*
14:10-15:00	Special Invited Lecture	
	Aging and Yellowing of Cellulosic Materials - A View at The Molecular Level **Thomas Rosenau** *Professor, Department of Chemistry, University of Natural Resources and Applied Life Sciences*	
15:00-16:00	Invited Lecture	
15:00-15:30	Development of Algal Flocculant for Water Treatment and The Effect of Their Sugar Components on The Flocculation Behavior **Makiko Enoki** *Assistant professor, Tokyo University of Marine Science and Technology*	
15:30-16:00	Cellulose-Based Photo- and Electro-active Nanostructured Materials **Keita Sakakibara** *Researcher, World Premier International (WPI) Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS)*	
16:00-16:15	Coffee Break	
16:15-17:15	General Lecture	
16:15-16:35	A Novel Cellulose Producing Bacterium, *Asaia Bogorensis* **Masahiro Mizuno** *Assistant professor, Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University*	
16:35-16:55	Utilization of Rod-like Nanowhiskers of Natural Crystalline Polysaccharides for Construction of Nanocomposite Materials **Jun Araki** *Assistant professor, International Young Researcher Empowerment Center, Shinshu University*	
16:55-17:15	Feasibility of Paper Yarn and Bioethanol Production from Mulberry Cellulose **Midori Takasaki** *Assistant professor, Satellite Venture Business Laboratory, Shinshu University*	
17:15	Closing remarks	Kunihiro Hamada *Dean, Faculty of Textile Science and Technology, Shinshu University*
17:45-	Banquet (Mulberry Hall)	

Hosted by: Satellite Venture Business Laboratory, Shinshu University
Cohosted by: Faculty of Textile Science, Technology and Cooperative Research Center, and Global COE Program International Center of Excellence on Fiber Engineering, Shinshu University

参加申込書（参加をご希望の方は、下記にご記入頂き、FAX または MAIL でご送付下さい）
申込先: FAX：0268-215325 / Mail：svbljim@shinshu-u.ac.jp 申込み〆切 10 月 8 日（金）

所属先		所属先住所	

参加者氏名	連絡先 TEL／連絡先 FAX	懇親会（会費 2,000 円）参加
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Abstract - SVBL Mini-Symposium on Utilization of Cellulose as Renewable Resources

Thomas Rosenau (Professor, Department of Chemistry, University of Natural Resources and Applied Life Sciences)

Aging and Yellowing of Cellulosic Materials - A View at The Molecular Level

The CRI method recently developed in the BOKU lab Vienna is the first generally applicable procedure for the isolation and identification of residual chromophores from cellulosic material. These chromophores are present in the ppb to ppb range only. Highly stabilized hydroxy-[1,4]benzoquinones, hydroxy-[5,8]naphthoquinones, and 2-hydroxyacetophenones are the key compound classes found both as the remaining chromophores in highly bleached pulps (residual yellowing) and as the re-condensated chromophores formed upon aging and brightness reversion. It was demonstrated that aging and chromophore formation in celluloses is directly dependent on the content of carbonyl groups ("CO effect"). Carboxyl groups, by contrast, are not chromogenic on their own, but they exert a strong promotive effect if carbonyl structures are present ("COOH effect"). The complete pathway from a single keto group in an oxidized anhydroglucose unit to the final hydroxy-[1,4]benzoquinone chromophore was elaborated by means of isotopic labeling combined with NMR and X-ray structures. The mechanisms were correlated both with bleaching results and computational studies.

Makiko Enoki (Assistant professor, Tokyo University of Marine Science and Technology)

Development of Algal Flocculant for Water Treatment and The Effect of Their Sugar Components on The Flocculation Behavior

Alginic acid, major component of most brown algae, has been used as a flocculant and others because of its gelation function. In our study, brown alga itself was found to reveal flocculation function by simple treatment: washing with dilute hydrochloric acid and mixing with alkaline solution. The optimum condition of algal-flocculant preparation varies with the genera and/or order of material algae. For example, *Laminaria* shouldn't be washed to keep the mannitol, and probably because of their tough tissue, *Sargassum* needs pretreatment with acidic solution to enhance the elution of alginic acid from inside of their tissue at alkaline treatment step. The best flocculation ability and behavior also vary with the material algae. The reason of this seems to depend on their sugar component, supported by the fact that all of the algal flocculants used in our study showed better ability than those of authentic alginic acid.

Keita Sakakibara (Researcher, World Premier International (WPI) Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS))

Cellulose-Based Photo- and Electro-active Nanostructured Materials

Advances in both nanomaterial science and cellulose chemistry have triggered new interest in cellulose derivatives with special properties, such as conductivity, semiconductivity, switchability, or photoelectroactivity. It is the aim of these approaches to construct electrical devices that combine the properties of electrical circuitry components with the advances of cellulose derivatives, such as film-forming properties, high chemical and physical resistance and solubility. Novel (semi)conducting and (photo)electrically active cellulose derivatives have been synthesized and their structure-property relationships established. Pyrrole and thiophene derivatives chemically linked to cellulose were used to convey (semi)conductivity after polymerization, while alkyl lipophilic substituents at the cellulose backbone are employed to maintain solubility and processability. Structure of the polymerization precursors and conditions of the polymerization of the heterocyclic moieties are crucial for determining the product properties. Synthesis and applications as well as properties of relevant model compounds and cellulose derivatives will be presented and discussed.

Masahiro Mizuno (Assistant professor, Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University)

A Novel Cellulose Producing Bacterium, *Asaia Bogorensis*

The properties of bacterial cellulose (BC) are quiet unique compared to that of plant cellulose, especially in ultra fine network of architecture, high hydrophilicity, and moldability during cellulose ribbon formation. We found that one of acetic acid bacteria, *A. bogorensis* produced BC and the width of cellulose ribbon was narrower than that of *Gluconacetobacter xylinus* which is a well-studied bacterium as BC-producing organism. However the production level of BC by *A. bogorensis* was lower than *G. xylinus* and the crystallinity of cellulose was also lower. Although many bacteria having the ability of cellulose production were reported by gene analyses to date, many of them can only produce a tiny amount of cellulose. The production level of BC in *A. bogorensis* is middle between *G. xylinus* and other bacteria like *Escherichia coli* and *Salmonella typhimurium*. Thus, it is thought that *A. bogorensis* is a suitable organism to study the cellulose-biosynthesis. To reveal the mechanism of BC synthesis and the cause of structural difference in cellulose fiver, we have carried out the study using morphological analyses by microscopy and gene analysis of cellulose-biosynthesis related genes.

Jun Araki (Assistant professor, International Young Researcher Empowerment Center, Shinshu University)

Utilization of Rod-like Nanowhiskers of Natural Crystalline Polysaccharides for Construction of Nanocomposite Materials

Cellulose and chitin, the two major natural crystalline polysaccharides, are present in natural resources as crystalline microfibrils with widths of 2–20 nm and lengths of up to several microns. After treatments of these polysaccharides by acid hydrolysis or mild oxidation, these microfibrils are released in forms of short rod-like micorcrystals or "nanowhiskers" to yield stable colloidal suspensions. These nanowhiskers are single crystals, in which the polysaccharide chains are highly oriented along with their long axis, and they are also high-strength nanofibers with Young's modulus of ~150 GPa and mechanical strength of several GPa. Interests in several recent investigations have focused on the utilization of these nanowhiskers as filler components of nannocomposite materials, i.e. composite materials composed of fillers with nanometer dimensional orders. In this presentation, several our results for preparations of nanocomposite materials using the nanowhiskers of cellulose and chitin are presented, as well as the steric stabilization of these nanowhiskers to use them in non-aqueous matrices.

Midori Takasaki (Assistant professor, Satellite Venture Business Laboratory, Shinshu University)

Feasibility of Paper Yarn and Bioethanol Production from Mulberry Cellulose

Mulberry which has a diverse collection of species including about 500 kinds of mulberry in Shinshu University has been cultivated for feeding silkworms in the production of silk fiber. Mulberry has comparatively high productivity and is easy to cultivate in the field. In addition, leaves and wood of mulberry are rich in alkaloid components including 1-deoxynojirimycin (1-DNJ) which is known as one of □-glycosidase inhibitors which act on preventing the glucose absorption in the small intestine. 1-DNJ is used as a dietary supplement for preventing diabetes because blood sugar level is decreased. Therefore, mulberry represents a potentially useful biomass resource. Our organization (SVBL) is promoting project studies on utilization of regional biomass focus on mulberry. For utilization of mulberry, we have been developed extraction method of 1-DNJ from mulberry and production method of paper yarn and biofuel etc.. This presentation will introduce our feasibility study on production of paper yarn and bioethanol using mulberry cellulose.