BIOGRAPHIES & ABSTRACTS

CELLULOSE NANOCOMPOSITES SYMPOSIUM

May 13, 2009
Monona Terrace Community & Convention Center
Madison, Wisconsin, USA

The symposium is hosted by the USDA Forest Service, Forest Products Laboratory and Forest Products Society.

In cooperation with Luleå University of Technology; Michigan State University; University of Tennessee in conjunction with Oak Ridge National Laboratory; Washington State University; University of Toronto, Faculty of Forestry and Centre for Biocomposites & Biomaterials Processing; ACS Division of Cellulose & Renewable Materials; and IUFRO D5.05 Composite Division.

nanocomposites for biodegradable packaging materials with enhanced mechanical properties, thermal stability and barrier properties, without adversely affecting the optical properties of the matrix polymer.

POSTER 2 – Electrospinning of Poly(vinyl) Alcohol/ Cellulose Nanowhiskers Bionanocomposites

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Abstract: True bionanocomposites in the form of aligned nanofibers were successfully prepared by electrospinning a 12 wt.% poly(vinyl) alcohol (PVA) solution containing cellulose nanowhiskers (CNW). The resulting CNW/PVA nanofibers contained up to 12.5 wt.% cellulose whiskers. The morphology and the dimensions of the PVA/CNW nanofibers were assessed using optical microscopy and atomic force microscopy. Their diameter was as small as 100 nm and fibers exhibited a bimodal diameter distribution. Their thermal properties were analyzed with the help of thermogravimetric analysis (TGA). DMA was used to measure the reinforcement capacity of the cellulose whiskers on the longitudinal mechanical properties of PVA nanofiber bundles. These fibers are biodegradable and biocompatible, making them an ideal choice for biomedical applications or disposable filtration devices. The electrospinning of PVA/CNW is also a first step towards large scale production of highly oriented CNW.

POSTER 3 – Preparation and Characterization of Films of Cellulose Whiskers Crosslinked with Poly(methyl vinyl ether-co-maleic acid)- Poly(ethylene glycol)

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Abstract: Cellulose nanowhiskers and their use as reinforcing materials in polymer systems is a growing area in bionanocomposite research. Though the reinforcing effect of cellulose nanowhiskers was studied in various polymers, the impact of crosslinking of the nanowhiskers has not been explored so far. This work is a new approach for the preparation of crosslinked cellulose nanowhiskers with a poly(methyl vinyl ether-co-maleic acid)- poly(ethylene glycol) matrix. This new material has been characterized using atomic force microscopy (AFM), water sorption studies, tensile testing, and dynamic mechanical thermal analysis (DMTA). These materials are expected to be useful as hydrogels in medical applications.

POSTER 4 – Biodegradable Nanocomposites from Central Appalachian Hardwood Cellulose Residues

Qingzheng Cheng, Post-Doctoral Fellow, *Jingxin Wang*, Associate Professor, and *Joseph McNeel*, Professor and Director, Division of Forestry & Natural Resources, West Virginia University, Morgantown, West Virginia, USA

Abstract: Renewable resource-based bio-nanocomposites are expected to be the next generation of materials for the future and open up opportunities to replace conventional petroleum-based composites as a new, high performance, and lightweight green material. A process to isolate cellulose nanocrystals from the central Appalachian hardwood residues was established by acid hydrolysis with assistance of high-intensity ultrasonication. The cellulose nanocrystals and biodegradable polymers were used to fabricate biodegradable nanocomposites by using casting method. Cellulose nanocrystals and by-products were characterized using atomic force microscopy (AFM), transmission electron microscopy (TEM), and High Performance Liquid Chromatography (HPLC). The mechanical, morphological, and thermal properties of the nanocomposites were analyzed by tensile test, AFM observation, and differential scanning calorimetry (DSC). The results would be useful to promote the value-added engineered wood products industry in the region.

POSTER 5 – Cellulose Whiskers from Coir Fiber

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Abstract: Cellulose is an abundant and naturally occurring polymer that is obtainable from numerous resources. The extraction of nanometric monocrystals of cellulose, commonly referred to as whiskers, from renewable sources has gained more attention in recent years due to the exceptional mechanical properties (high specific strength and modulus), environmental benefits and low cost. In this study, cellulose whiskers were extracted by acid hydrolysis of bleached unripe coconut fibers. The effect of the bleaching intensity and extraction time on characteristics of the whiskers was evaluated. Whiskers were characterized by thermal analysis (TGA), and transmission electron microscopy (TEM). The pretreatment resulted in opening of the fiber bundles. It was found that thermal stability of the nanowhiskers depends on the level of bleaching, but was not dependent on the extraction time. The nanowhiskers obtained by less strong treatment showed better thermal stability, attributed to higher lignin content, reminiscent of the treatment. For the same kind of bleaching, hydrolysis time influenced the efficiency of extraction of nanowhiskers. Size determination was challenging due to agglomeration, but from several images the length was between 100 and 500 nm and the width was between 4 and 6 nm.

POSTER 6 – Preferential Nucleation of Isotactic Polypropylene at Cellulose Nanocrystal Surfaces

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Abstract: There is a resurgence of interest in incorporating cellulose as fibrous reinforcement in semicrystalline melt-processed polymers. Potential natural cellulose sources range from flax and ramie fibers to whiskers and nanocrystals isolated from bacteria. It has long been observed that the crystallization of matrix polymers such as polypropylene may be preferentially nucleated by Cellulose I surfaces, leading to a "transcrystalline" layer around the fiber, but the relevance of transcrystallinity to the properties of composite remains controversial. Transcrystallization against macroscopic cellulosic fibers is readily observed by polarizing microscopy, and the progress of the crystallization processes may be followed by differential scanning calorimetry. Here, we present some complementary results indicating the preferential nucleation of polypropylene by cellulose I nanocrystals. These results confirm the role of preferential nucleation in this system, but the implications for composite reinforcement remain unclear.

POSTER 7 – Preparation and Characterization of Cellulose Whiskers from Bagasse, Rice Straw, and Sugar Beet Pulps and their use in Alginate Nanocomposites

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Abstract: Rice straw, sugar beet, and bagasse bleached pulps have been used to prepare cellulose nanocrystals (cellulose whiskers) which are characterized by high surface area and high length to width (high aspect ratio). These properties make the cellulose whiskers act as reinforcing elements in nanocomposites with high strength properties and biodegradability. Sulfuric acid and hydrochloric acids have been used to prepare the cellulose whisker by hydrolysis under different conditions of reaction time, acid concentration, and liquor ratio. The effect of these conditions on the yield of and dimensions of the cellulose whiskers has been studied using transmission electron microscopy