FIBRES (incl. Textile and other utility fibres)

NPARR, 7(1), 2016-33 Bark derived submicron-sized and nano-sized cellulose fibers: From industrial waste to high performance materials

In this study, the use of bark as a natural source for the production of cellulose nanofibers has been explored for the first time. The fibrillation using bleached and unbleached cellulose fibers from the bark yielded sub-micron scale (<1 \( \mu \text{m} \)) and nanoscale fibers (<100 nm). Previous attempts to break the cross-linked lignin barrier to produce fibrillated submicron sized or nano sized cellulose fibers with high lignin content (>20%) have never been possible from any other sources. The maximum elastic modulus value of 15.6 GPa and tensile strength value of 76 MPa were obtained for the films made from fibrillated bark cellulose fibers. The water vapour barrier efficiency for these films is comparable to nanocellulose films from other studies [Nair, S.S. and Yan, N. (Faculty of Forestry, University of Toronto, 33 Willcocks Street, Toronto, ON, Canada), Carbohydrate Polymers, 2015, 134, 258-266].

NPARR, 7(1), 2016-34 Cellulose fibers isolated from energycane bagasse using alkaline and sodium chlorite treatments: Structural, chemical and thermal properties

Cellulose fibers were successfully extracted from energycane bagasse by using a combined NaOH and NaClO2 treatment. After the delignification process, most lignin and hemicelluloses were removed with a 27.4wt% yield of cellulose fibers, and the mean diameter of cellulose fibers decreased from 137±46 (raw fiber bundles) to 12±5\( \mu \text{m} \) (unpacked fibers). The crystallinity of cellulose fibers first decreased and then increased during the transformation from cellulose I to II, and it gradually decreased after a further NaClO2 treatment. The raw bagasse fibers showed a three-step pyrolysis process, while isolated cellulose fibers had a one-step pyrolysis process. NaClO2 treatment caused the reduction of cellulose thermal stability due to its acting on lignin and cellulose [Yue, Y.*, Han, J., Han, G. , Aita, G.M. and Wu, Q.( School of Renewable Natural Resources, Louisiana State University Agricultural Center, Baton Rouge, LA, United States), Industrial Crops and Products, 2015, 76, 355-363].

NPARR, 7(1), 2016-35 Fast detection of wool content in wool/polyester blended fabric by near-infrared spectroscopy technology

To speed up the testing and analysis accuracy of textile fibers, 80 pure wool samples, 80 pure polyester samples and 150 wool/polyester blended fabrics were taken as research objects for analysis in this paper. Collecting the near infrared spectra of this samples, and selecting the mean value centralization and reciprocal and multiplicative scatter correction as the preprocess method, calibration models for wool content were established with Partial Least Square (PLS). To verify the models, wool content prediction of 50 samples was conducted. The experimental results showed that the absolute average value of wool content was 1.036 4%, and the standard deviation was 0.695 4%. This study provided powerful evidence of Near-Infrared Spectroscopy to detect the content of textiles [Liu, R.-X. (Jiangxi Institute of Fashion Technology, Nanchang, China), Wool Textile Journal, 2015, 43(12), 52-56].

NPARR, 7(1), 2016-36 Analysis of length and fineness of lotus fiber extracted by physical methods

To investigate the characteristics of lotus fiber length and fineness to provide theoretical basis for developing lotus fiber products, 1500 fibers were extracted by physical method from tip
part, middle part and bottom part of lotus stalks (500 fibers for each part) and measured. The analysis showed that the length range of lotus fiber was about 31-50 mm, generally, fibers from tip part are longer, fibers from bottom part are shorter, and fibers from middle part were average in normal distribution. The fineness range of single fiber was 3.963-4.516 μm (less than 5 μm, belongs to microfiber), and the finest fiber was from tip part, with smallest coefficient of variation. The ratio of lotus fiber length to fineness was about 10^4, which can meet the textile processing requirement [Zhao, L.*, Chen, D.S., Gan, Y.J., Yuan, X. and Wang, Y. (Faculty of Clothing and Design, Minjiang University, Fuzhou, China), Chemical Engineering Transactions, 2015, 46, 85-90].

NPARR, 7(1), 2016-37 The mechanical properties of soybean straw and wheat straw blended medium density fiberboards made with methylene diphenyl diisocyanate binder

A study was conducted to test the mechanical properties of medium density fiberboard (MDF) produced using soybean straw [Glycine max], wheat straw [Triticum aestivum], and a blend of the two fibers and the variations in properties that this blend produced. Additionally, the difference of soybean straw fibers compared to wheat straw fibers in the performance of MDF properties was investigated. Three formulations of the fibers were produced and tested to investigate the variation between properties of boards produced from the different fibers. The boards produced for testing were pressed using a hot press with 4wt% methylene diphenyl diisocyanate (MDI) resin used to bond the particles and 2wt% AW-50 wax emulsion used as a water retardant. The boards produced had a nominal density ranging from 579kg/m^3 to 646kg/m^3. Several test methods from ASTM standard D1037-12 were utilized to test the physical and mechanical properties of the boards. Initial results from the testing showed that several combinations of fibers could be used to produce boards with mostly no statistically significant difference between any one formulation, the only difference being a significantly higher difference in the screw withdrawal load needed for 100% wheat fiberboard compared to other formulations. The testing showed the viability of soybean stover fibers as a viable substitute or blend with wheat straw fibers with no appreciable decrease in the board properties except in the case of direct screw withdrawal resistance [Sitz, E.D.* and Bajwa, D. S. (Department of Mechanical Engineering, North Dakota State University, Dolve Hall 111, Fargo, ND, United States), Industrial Crops and Products, 2015, 75, 200-205].

NPARR, 7(1), 2016-38 Surface smoothening and characterization of silk fibers of Antheraea assamensis Helfer (muga) using some natural agents

Cocoons of Antheraea assamensis (muga) silkworm were treated with different classes of natural-acidic (Citrus limon and Dillenia indica) and alkaline (Musa balbisiana) materials with the aim to elucidate their effectiveness as degumming agents. The tensile strength of silk fibers increased significantly after bio-degumming compared to industrial degumming using sodium carbonate. Scanning electron microscopy of bio-degummed fibers appeared clean and even with clear individual fibroin filaments. FTIR studies confirmed that bio-degumming resulted in holding the innate nature of muga silk. Under the implemented experimental conditions, M. balbisiana and C. limon functioned as most efficient degumming agents, followed by D. indica. The findings of this study propose the use of such eco-friendly degumming practices over the usual harsh industrial treatments for obtaining applaudable quality of silk with robust strength necessary for both textile and biomaterial purpose, besides reducing the impact of chemical toxicity on the environment [Choudhury, M., Talukdar, B. and Devi, D. (Seri-biotech Unit, Life Sciences
Effect of water treatment on the fiber-matrix bonding and durability of cellulose fiber cement composites

This research analyzes the effects of the previous wetting and drying treatments of cellulosic fibers on the fiber-matrix bond strength of cement based composites. First, three kinds of fibers—abaca, cabuya and sisal—were subjected to five cycles of water wetting and subsequent drying. The resulting changes in the morphology, mechanical properties, drying kinetics and thermal stability were determined with scanning electronic microscopy (SEM), tensile tests and thermogravimetric analysis (TGA), respectively. A reduction in the cross section, an increase in Young's modulus and a decrease in tensile strength and tensile strain as well as a structure with thinner pores was found for the treated fibers. Second, cement based composites with untreated and treated fibers were prepared to evaluate the fiber-matrix bonding before and after accelerated aging. For this purpose the interfacial shear strength (IFSS) between the fibers and the matrix was determined by the single fiber pull-out test after seven days of curing in a humidity chamber and after four aging wetting-drying cycles. The treatment of the fibers results in an increase in the interfacial shear strength of the cement composites also improving the durability [Ardanuy, M.*, Claramunt, J., Ventura, H. and Manich, A.M (Departament d'Enginyeria Tèxtil i Paperera, Universitat Politècnica de Catalunya-Barcelona Tech, Colom, 11, Terrassa, Spain), Journal of Biobased Materials and Bioenergy, 2015, 9 (5), 486-492].

Extraction method of flax fibre and its uses

Flax (Linum usitatissimum) is a bast fibre plant cultivated for the production of fibres, for use in a wide range of woven and non-woven end uses. Bast fibres are also known as 'soft' fibres or skin fibres and are characterised by their fineness, strength and flexibility, which distinguishes them from the coarser and less flexible fibres of the leaf, or "hard," fibre. Flax is a renewable resource and has the potential to be much more eco-friendly than cotton. Linen fibres are obtained from the inner bark (or skin) of a plant. Flaxseed fibre is a high quality, organic, natural, unrefined whole food product that is naturally gluten free with a shelf life of two years, as reported by the manufacturers. The fibres support the conductive cells of the phloem and provide strength to the stem. Traditionally, the production of fibre from flax has focused on long fibres for use in the manufacture of linen yarns. However, short-fibre flax can also be produced and processed to be a ‘cottonised’ fibre for the production of textile yarns on cotton processing equipment. the production of a cotton compatible fibre from flax crops. Flax fiber is a raw material used in the high-quality paper industry for the use of printed bank notes and rolling paper for cigarettes and tea bags [Dhirhi, N., Shukla, R., Patel, N.B., Sahu, H. and Mehta, N. (Department of Genetics and Plant Breeding, I.G.K.V., Raipur-(C. G.), India), Plant Archives, 2015, 15 (2), 711-716].

Durable fragrance finishing on jute blended home-textiles by microencapsulated aroma oil

Jute fibres are conventionally treated with Jute Batching Oil (JBO), a petroleum based fibre lubricant prior to its processing into yarns. The typical kerosenic smell of JBO seriously affects the consumers’ acceptance of jute products particularly value-added hometextiles application. Eventually to invade into hometextiles market, jute products need to avoid such typical odour, though under current practice use of JBO is an integral part of jute fibre processing. To find out an alternate solution, innovative approach of durable aroma/fragrance finishing on jute based textiles has been thought of for masking its bad odour permanently in
regards to high-end applications. The present study envisages development of Jasmine oil containing aroma microcapsules from Melamine-Formaldehyde and application of aroma microcapsules on jute-cotton blended fabric in order to impart durable aroma finish. Suitable cross-linker (binder) has also been identified for attaching microcapsule effectively onto lignocellulosic textile surface. Effect of partial delignification of jute fabric has been examined to improve the effectiveness of binder as well as durability of aroma finishing. Characterizations of aroma microcapsules and washing durability of aroma finish have been carried out using both analytical and human sensory evaluation methods [Biswa, D. *, Chakrabarti, S.K., Saha, S.G. and Chatterjee, S. (Department of Textile Technology, Indian Jute Industries’ Research Association, Kolkata, India), Fibers and Polymers, 2015, 16 (9), 1882-1889].