Plant density influences fiber sucrose metabolism in relation to cotton fiber quality

Planting density plays an important role in improving cotton yield and regulating fiber quality. A 2-year experiment was conducted to investigate the effects of plant density on sucrose metabolism in relation to fiber quality of field-grown cotton. The results showed that lint yield increased with increasing plant density. Fiber micronaire, fiber maturity ratio, and fiber fineness decreased with the increasing of plant density, whereas fiber length, fiber uniformity index, fiber strength, and fiber elongation were little affected by plant density. Increased plant density decreased sucrose synthase (SuSy) activity, sucrose content, and cellulose content in cotton fiber, but increased invertase activity. Increased invertase activity would restrain SuSy activity in cotton fiber: therefore, SuSy activity was the most severely affected enzyme in fiber sucrose metabolism by cotton plant density during fiber development. Abundant sucrose content in fiber after 24 days post anthesis (DPA) and high activities of SuSy and sucrose phosphate synthase (SPS) at 38 DPA were beneficial for cellulose synthesis, and were propitious to optimize the fiber maturity properties. The results also showed that fiber micronaire, maturity ratio, and fineness decreased 0.11, 0.02, and 5.89 mtex, respectively, with each increase of 10,000 plants per hectare. It was concluded that high plant density decreased SuSy activity, sucrose content, and cellulose content, but increased invertase activity in sucrose metabolism, resulting in low fiber micronaire, fiber maturity ratio, and fiber fineness [Y. L. Meng, F. J. Lv, W. Q., J. Chen, L. L. Zhu, Y. H. Wang, B. L. Chen, Z. G. Zhou* (Nanjing Agr Univ, Minist Agr, Key Lab Crop Growth Regulat, Nanjing 210095, Jiangsu, Peoples R China) Acta Physiologica Plantarum, 2016, 38(5), DOI: 10.1007/s11738-016-2129-3].

Micron- and nano-cellulose fiber regenerated from ionic liquids

In this research, two types of ionic liquid, 1-butyl-3-methylimidazolium chloride (BMIMCl) and ionic liquid 1-ethyl-3-methylimidazolium acetate (EMIMAc) were used as recyclable solvents for dissolving raw cellulose in the spinning of micron- and nano-scale regenerated cellulose fiber. The approach for preparing the cellulose solution using these ionic liquids is described. A comparative study was also conducted on cellulose solubility, the spinning method, and cellulose fiber properties produced with each solvent. The experimental fibers are characterized in terms of fiber diameter, strength, thermal property, crystallinity, and content of solvent residual, using tensile test, thermogravimetric analysis, scanning electron microscopy, X-ray diffraction, and mass spectrometry. The study concluded that there was a significant difference in the tensile strength, but not in the elongation and modulus of the fibers regenerated from BMIMCl and EMIMAc. For crystal size, crystal orientation, and crystallinity index, the BMIMCl-generated fiber had higher values than the EMIMAc-regenerated fiber. For the thermal property, EMIMAc fiber was more stable at higher temperatures than BMIMCl fiber. It was also revealed that the EMIMAc fiber had significantly less solvent residual content than the BMIMCl fiber [Y. S. Vinogradova, J. Y. Chen* (School of Human Ecology, University of Texas, United States) Journal of the Textile Institute, 2016, 107(4), 472-476].

Development of acoustic nonwoven materials from kapok and milkweed fibres

Acoustic properties of textile materials have been studied for several decades. But, mostly used materials were synthetic, and hence, they were not eco-friendly in nature. Therefore, an attempt was put forward to try the sound absorption property of natural fibres and their
blends by needle-punched nonwoven techniques. Nonwoven fabrics of ideal materials are used as acoustical insulation products because they have high total surface area. The effect of blend proportion of kapok and milkweed fibres with cotton, fabric GSM, bulk density and distance of fabric from sound source on sound reduction of nonwoven fabrics was investigated. The sound reduction increases with increase in blend proportion of kapok and milkweed fibres. A nonwoven fabric of cotton/milkweed 40/60 shows the highest sound reduction potential. As the distance between the fabric and sound sources increases, the sound reduction also increases linearly due to reduction of sound intensity which reduces the transmission of sound through the fabric. There is a positive correlation between fabric GSM and sound reduction and negative correlation between bulk density and sound reduction. Further, the thermal conductivity of nonwoven samples decreases with increase in kapok and milkweed blend proportion due to increase in thickness of samples. Hence, the kapok- and milkweed-blended nonwoven samples provide sound as well as thermal insulation characteristics [P. Ganesan*, T. Karthik, (Department of Textile Technology, PSG College of Technology, India) *Journal of the Textile Institute*, 2016, *107*(4), 477-482].

NPARR, 7(3), 2016-240 Evaluation of properties of bast fiber extracted from *Calotropis* (Milkweed) by a new decorticator machine and manual methods

The majority of plant fibers which are being considered as reinforcements for polymeric composite are bast fibers. *Calotropis* bast fiber is one of these types that have been extracted manually up to now. The objective of this study was to investigate the effect of new decorticator machine on some properties of extracted fiber and compare with separated fibers manually. The mentioned decorticator machine was able to extract bast fiber without shattering stems and flowing latex. Some studied properties were morphological characterize, tensile properties (tensile strength, Young’s modulus and strain) and density of fiber. The results indicated that machinery extraction method had no significant effect on the fiber morphology. This means that the decorticator machine did not cause serious mechanical damage on the morphology of fiber, instead the cell length increased in decorticated bast fiber. Also a significant increase (P ≤ 0.01) was observed in the bundle lengths for fibers decorticated by the machine. Regarding tensile strength, the decorticated bast fibers show highest tensile strength (350.73 MPa) in comparison with the strength of extracted fibers manually (254.56 MPa). Also, it is shown that there is no significant difference between densities in two extraction methods [T. Nazilla, M. Hossein*, J. Ali, T. T. Jalil (Department of Agricultural Machinery Engineering, Faculty of Agricultural Engineering and Technology, University of Tehran, P.O. Box 4111, Karaj, Iran) *Industrial Crops and Products*, 2016, *83*, 545–550].

NPARR, 7(3), 2016-241 Study of the effect of matrix, fibre treatment and graphene on delamination by drilling jute/epoxy nanohybrid composite

Natural fibre-reinforced composites are being widely employed in many fields. These composites are preferred for their specific properties and eco-friendly nature. Natural fibres do not bond well with resin readily. Alkali treatment of these fibres has been reported to be effective in achieving better bonding. Addition of nanofillers has been reported to enhance the performance of composites. The current work investigates the machinability of jute fibre-reinforced nanophased polymer composite. Machinability is expressed in terms of delamination factor, which has been obtained using image processing technique. The influence of matrix, fibre surface modification and nanofiller on delamination is reported. Machining was done using high-speed steel tool. ANOVA has been performed to identify the parameter that
significantly influences the delamination factor. Fibre surface modification and graphene as nanofiller have improved the machinability [V. Sridharan*, T. Raja, N. Muthukrishnan (Sri Venkateswara Coll Engn, Dept Mech Engn, Nano Mat Res Cell, Sripurumbudur 602117, Tamil Nadu, India) Arabian Journal for Science and Engineering, 2016, 41(5), 1883-1894].

Effect of gamma radiation on the performance of jute fabrics-reinforced urethane-based thermoset composites

Cloth-reinforced urethane acrylate-based thermoset composites were prepared by compression molding. The composition of the matrix solution was formulated with different concentrations of urethane acrylate ((F1: 55%, F2: 65%, F3: 75%, F4: 85%, and F5: 95%) in solvent methanol (44.5, 34.5, 24.5, 14.5, and 4.5%) along with thermal photoinitiator benzyl peroxide (0.5%). Mechanical properties of the composites were examined. It was found that F4 with 85% urethane acrylate-based composite showed the best results. The maximum value of tensile strength (TS), bending strength (BS), tensile modulus (TM), bending modulus (BM), and elongation at break (Eb%) were found to be 47 MPa, 61 MPa, 1250 MPa, 1550MPa, and 9.38%, respectively, for F4-treated composites. Different intensities of gamma radiation (100-500 krad) were applied on F4-soaked hessian cloth-reinforced composites. The mechanical properties of the irradiated composites were found to increase significantly compared with those of nonirradiated composites. The maximum TS, BS, TM, and BM for the treated composites were found to be 66 MPa, 84 MPa, 1882 MPa, and 2250 MPa, respectively, at 300 krad dose. Water uptake and soil degradation test of the composites were also performed [P. Poddar, Y. Arafat, K. Dey*, R. A. Khan, A. M. S Chowdhury (Univ Dhaka, Fac Engn & Technol, Dept Appl Chem & Chem Engn, Dhaka 1000, Bangladesh) Journal of Thermoplastic Composite Materials, 2016, 29(4), 508-518].