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An Intelligent Model to Predict Breaking Strength of Rotor Spun Yarns Using Gene Expression Programming

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ABSTRACT
Exploring relationship between characteristics of a yarn and influencing factors is momentous subject to optimize the selection of the variables. Different modelling methodologies have been used to predict spun yarn properties. Developing a prediction approach with higher degree of precision is a subject that has received attention by the researchers. In the last decade, Artificial Neural Network (ANN) has been developed successfully for textile nonlinear processes. In spite of the precision, ANN is a black box and does not indicate inter-relationship between input and output parameters. Hence, Gene Expression Programming (GEP) is presented here as an intelligent algorithm to predict breaking strength of rotor spun yarns based on draw frame parameters as one of the most important stages in spinning line. Forty eight samples were produced and different models were trained. Prediction performance of the GEP was compared with that of ANN using Mean Square Error (MSE) and correlation coefficient (R^2-Value) parameters on testing data. The results showed the better capability of GEP model in comparison with ANN model. The R^2-value and MSE were 97% and 0.071 respectively that means desirable predictive power of GEP algorithm. Finally, an equation was extracted to predict breaking strength of the yarns with high degree of accuracy using GEP algorithm.

Effect of Lycra Extension Percent on Single Jersey Knitted Fabric Properties

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ABSTRACT
This research studies the effect of the extension increase % of the bare Lycra yarns during the loop formation on the geometrical, physical and mechanical properties of plain jersey fabrics. Samples with 100% cotton yarns, lycra yarns in alternating courses (half plating) and lycra yarns in every courses (full plating) were produced on a circular knitting machine where the two latter cases were produced at five different levels of lycra extension. Thermal setting was carried out without any traverse tension during finishing to evaluate the full effect of Lycra extension. Results showed that there is a sharp increase in the courses density rather than the wales density, the fabric thickness and the weight per unit area were also increased with considerable decrease in the air permeability in the case of the half and full plating fabrics. The breaking load and the breaking extension also increased while the initial elasticity modulus decreased with the increase in the abrasion resistance in the case of the full plating rather than the half plating fabrics. A comparison between the half and full plating fabric, contributes in improving fabric quality by determining the optimal Lycra %.

A Note on the 3D Structural Design of Electrospun Nanofibers

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ABSTRACT
In this paper, various three-dimensional (3D) nanofibrous structures are constructed based on liquid support systems and alteration of the solution charge property. Structures fabricated from the liquid support system include a nanofibrous ring and spindle-shaped nanofibrous ones. The ease of fabricating fluffy, randomly organized nanofibrous structure by altering the charge capacity of the electrospun solution is also demonstrated. The set-up conditions for the design of the nanofibrous structures, using these techniques, are discussed.

Antibacterial Finishing of Tencel/Cotton Nonwoven Fabric Using Ag Nanoparticles-Chitosan Composite

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ABSTRACT
Silver nanoparticles-chitosan composite was prepared using microcrystalline chitosan gelatinous water dispersion as original materials at ambient temperature and its aqueous solution was applied to antibacterial finishing of Tencel/cotton nonwoven fabric. The size distribution of silver nanoparticles (AgNPs) was between 4 to 20 nm which show good stability in aqueous solution. The finished nonwoven fabric showed excellent water absorption ability, air permeability and antibacterial activity against *E.coli.*

Alkali Extraction of Kraft Pulp Fibres: Influence on Fibre and Fluff Pulp Properties

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ABSTRACT

The importance of hemicelluloses for the papermaking properties of pulp fibres is well documented. In the patent literature, it can be seen that there is also an interest in this type of modification of pulp fibres for use in absorption products. In this study, a Scandinavian softwood kraft pulp and a birch kraft pulp were alkali extracted at 3 different concentrations of NaOH (2%, 4% and 8% NaOH in the suspension). The alkali extraction removed a large part of the hemicelluloses from the pulp fibres and decreased the content of the charged groups. After extraction, the pulps were dried in the form of sheets (approx. 600 g/m^2). The alkali extracted pulp fibres exhibited a greater decrease in swelling when re-wetted than untreated pulp. A significant increase in the curl index after extraction with 4% and 8% NaOH was also noted. The tensile strength index of the formed sheets increased at the lowest concentration of NaOH and, at the higher concentrations, a decrease was observed. The pulp sheets were dry defibrated at different defibration intensities and the performance of the resulting pulps in fluff pulp applications was studied. The air-laid fibre networks of softwood pulp fibres showed higher network strength than the networks of birch pulps. The birch pulp extracted at the highest alkali level tended to give the highest network strength. The results from the network strength tests also indicated that the increased curl of the fibres from the softwood pulp extracted at the highest alkali level rendered a more flexible fibre network. In water absorption tests, the alkali treated softwood fibres tended to give networks with a somewhat enhanced water holding capacity under pressure.

Evaluation of the Function and Manufacturing Technique of Bamboo Charcoal Complex Yarns and Knitted Fabrics

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ABSTRACT

To satisfy the many requirements of our daily life, complex textiles that are both functional and beneficial have been successfully designed and developed. This research investigates the design of bamboo charcoal/spandex (BC/S) complex yarns, fabricated with a blend of spandex and bamboo charcoal polyester textured yarn, which possess superior elastic recovery. The expansion multiples of the spandex are 1.5 - 3.5, the wrap counts are 2 - 4.5 turns/cm, and the speed of the rotor twister is 4000 - 12000 rpm. When the speed of the rotor twister is between 4000 and 12000 rpm, the expansion multiple is 1.5 and the elastic recovery rate is maintained at 93% or above. Furthermore, the far infrared emissivity of BC/S complex knitted fabrics is over 0.9, but descends with the lamination number. The BC/S complex knitted fabric also contains an anion count of 356 anions/ cc.

Development of Electrospun Iminochitosan for Improved Wound Healing Application

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ABSTRACT

Chitosan is a well-known anti-microbial polymer. It is desired to develop and evaluate chitosan based structures with high surface area using electrospun nanofibers. To explore the properties of chitosan derivatives, iminochitosan was synthesized and electrospinning of its solutions was conducted. Nanofibers were obtained from iminochitosan solutions using trifluoroacetic acid (TFA) as a solvent. Nanofiberwebs of fiber diameter range of 70-400 nm were successfully obtained from 3%-8% iminochitosan solution in TFA using electrospinning technique of electric field of 2.5-6.0 kV/cm. Contact kill performance of the iminochitosan structures against a range of microbes was carried out using the disc diffusion method. The results indicated that the nanofiberwebs exhibited an excellent antimicrobial behavior. It was found that the inhibition zone is affected by the iminochitosan structure parameters namely covering power, surface area which was affected by diameter and basis weight. Viscosity of the solutions was determined and fiber formation was obtained in the range of 400-670cP.

Effect of Nozzle Structural Parameters on Hairiness of Compact-Jet Yarns

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ABSTRACT

Hairiness significantly influences the appearance of yarns and fabrics. New methods and spinning systems have been offered to reduce it. Nevertheless, there is still the quest for easy, low-cost processes to produce good quality yarns with reduced hairiness. Therefore, due to its considerable importance for spun yarns, we worked on a new spinning method to decrease yarn hairiness. Many researchers have been studying the use of air nozzles in the spinning and also the winding processes and they indicated that hairiness decreases by up to 40–50%. From this point, we investigated the use of an air nozzle on a compact spinning system and discussed the effect on yarn hairiness. The nozzle was positioned at the exit of the drafting system on a RoCoS compact spinning system and pressurized air was fed into the nozzle by the compressor during spinning. We called the combination of an air nozzle and a compact spinning system as a Compact-Jet spinning system. In the literature, there are no such trials. At the end of the study, it was determined that a Compact-Jet spinning system truly improves hairiness by up to 40% in comparison to the compact spinning system and by up to 70% compared with the conventional ring spinning system. Regarding the nozzle structural parameters, the changes in hairiness indicate that the main hole diameter and nozzle outlet design make the most important contributions in reducing yarn hairiness; whereas the injector angle and nozzle head type show weaker effects. As a result, the Compact-Jet can be considered as an innovative spinning system providing the opportunity to produce less hairy yarn. Additionally, we believe that this study makes an important contribution to the research activities in the spinning field and its associated literature.

Accreditation of Novel Roselle Grafted FiberReinforced Bio-Composites

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ABSTRACT

The reaction parameters for the graft co-polymerization of efficient Butyl acrylate (BA) monomer onto *Hibiscus sabdariffa* (Roselle) stem fiber were optimized and used to further explore the additive effect of methyl acrylate (MA), vinyl acetate (VA) and styrene (Sty) on percentage grafting, properties and the behavior of the fiber, in binary vinyl monomeric mixtures. The graft co-polymers were characterized by XRD, TGA, DTA, SEM and FTIR techniques and evaluated for physico-chemical changes like moisture absorption, swelling behavior, dye uptake studies and chemical resistance against 1N NaOH and 1N HCl. With increase in percentage grafting the percentage crystallinity, crystallinity index, hydrophylicity were reduced whereas there was an increase in physico-chemico-thermal resistance, hydrophobicity, miscibility with organic solvents as a result of morphological transformation in these fibers. These modified graft copolymers were then used as reinforcement in phenol-formaldehyde polymer matrix as reinforcement and evaluated mechanically for modulus of elasticity, modulus of rupture, stress at the limit of proportionality and hardness. The composites reinforced with grafted fiber had better strength than raw fiber reinforced composites and phenoplast.

Design and Characterization of Conformal Microstrip Antennas Integrated into 3D Orthogonal Woven Fabrics

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ABSTRACT

The integration of the antenna and textile materials is very important in the army protective or data transmission army clothing. In this study, a novel microstrip antenna integrated in the 3D orthogonal woven fabric was successfully designed and fabricated. This type of antenna is aimed to work in wearable or conformal antenna application. Simulation work using HFSS software was done for the determination of the size of the antenna. The antenna performances including return loss, radiation pattern and gain were measured and the simulated results have good agreement with the measured results. The measured return loss was -18.32dB with the resonant frequency of 1.75GHz. The gain under the frequency of 1.70GHz reaches as high as 6.47dB. These results are very valuable and this type of integrated antenna was expected to be wearable antenna in the telecommunication or smart textile antenna field.

Grey Relational Analysis to Determine the Optimum Process Parameters for Open-End Spinning Yarns

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ABSTRACT
This article focuses on an approach based on the Taguchi method with grey relational analysis for optimizing the process parameters for open-end spinning yarns with multiple performance characteristics. A grey relational grade obtained from the grey relational analysis is used to optimize the process parameters with multiple performance characteristics. Optimal process parameters can then be determined by the Taguchi method using the grey relational grade as the performance index. CV_m%, hair number per meter, and tenacity of yarn were selected as quality characteristics in open-end spinning. Using these characteristics, the process parameters, including rotor speed, rotor diameter, opener speed, yarn linear density and navel type are optimized in the study. The raw materials used in this investigation were cotton fibers (35%) and cotton waste (65%) collected from ginning machines. The Experimental results show parameter rotor speed has the most significant effect on the multiple performance characteristics.

The Effect of the Sliver Fibre Configuration on the Cotton Inter-fibre Frictional Forces

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ABSTRACT
The fibre surface properties have a significant effect on the yarn spinning. The frictional behaviour of the fibres greatly influences their processing, their performance and the performance of the final product. In order to investigate the effect of fibre surface properties and inter-fibre friction during spinning process, card slivers are taken and subjected to three drawing passages. Card and drawing frame sliver are then tested by Static Friction Tester (SFT), which has been developed earlier. Fibre fineness, maturity and fibre length are measured by using different testing instruments. Hooks content is calculated by utilizing fibre length data. The statistical analysis of results shows the same trend for different cotton fibres tested.

Preparation and Characterization of Porous Tio_2 Fibers and Their Photocatalytic Activity

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ABSTRACT

TiO_2 fibers were successfully prepared by combining electrospinning and calcination process without using the conventional sol-gel method. Polymethyl methacrylate (PMMA) and tetrabutyl titanate (TBT) were used as TiO_2 precursor blended with chloroform to form a homogeneous solution for preparing PMMA/TBT composite fibers. The electrospun fibers were calcinated at 500 ºC for 4 h in air atmosphere to obtain TiO_2 fibers. XRD, SEM TEM and Brunauer-Emmett-Teller (BET) were used to study structures and morphology of the PMMA/TBT and TiO_2 fibers. The photocatalytic property of TiO_2 fibers was evaluated by photocatalytic degradation of methyl orange (MeO) under UV irradiation. The results demonstrated that mesoporous TiO_2 fibers with larger specific surface area possessed pure anatase phase was successfully prepared and the average diameter of PMMA/TBT fibers decreased from 1.5 μm to 1.0 μm after calcination. The TiO_2 fibers showed high photocatalytic reactivity in photodegradation of MeO solutions.

Frictional Behavior of Plain Woven Fabrics Constructed from Polyester and Cotton Yarns in Different Environmental Conditions

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ABSTRACT

Frictional characteristics of woven fabrics can determine smoothness and softness values of the textiles. Moreover different environmental conditions can leads to change the properties of the weaves.

In this paper, we studied the effect of temperature and relative humidity variations on the frictional properties of cotton and polyester fabrics. Plain woven fabrics were produced with polyester warp yarn and two different weft yarns (cotton and polyester). Each woven were examined in various temperatures and relative humidity, then the frictional forces measurement was carried out on the fabrics in warp over warp direction. The results showed that there is a statistically significant difference between the frictional parameters. This difference relates to the type of fiber materials (weft yarns), temperature and relative humidity in warp direction.

In addition, the data revealed that cotton fabrics have more static and kinetic forces than polyester fabrics in all of environmental conditions. Moreover, polyester fabrics exposed to a temperature of nearly 45°C and 100% RH, have the maximum smoothness, but the highest roughness values of cotton fabrics were under conditions of 45°C and 20% RH.

Manufacturing Technique and Deodorization Effectiveness against Ammonia Gas of Bamboo Charcoal/Spandex Complex Knitted Fabrics

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ABSTRACT

This research creates bamboo charcoal/spandex (BC/S) complex yarns from spandex and bamboo charcoal polyester textured yarn. In order to manufacture a BC/S complex yarn with better mechanical properties in tensile strength and strain, the expanded multiples of the spandex are changed, as are the wrap counts of the BC/S complex yarn and the speed of the rotor twister. The resulting spandex has a maximum breaking strength of 4.52 g/d when the expanded multiple is 3.5, and the BC/S complex yarn has a wrap count of 2 turns/cm. Furthermore, the maximum breaking elongation is 24.57% when the expanded multiple is 3.5, and the wrap count is 4.5 turns/cm. This paper also explores the ammonia gas adsorption properties (deodorization) of BC/S complex yarn, and discovers that polyester knitted fabric is capable of deodorizing 39% of NH_3, while 1.2% bamboo charcoal/polyester knitted fabric can deodorize 53% of NH_3, and BC/S complex knitted fabric can deodorize 55%-61% of NH_3.

Effects of Electrospinning Setup and Process Parameters on the Nanofiber Morphology Intended For the Modification on Quartz Crystal Microbalance Surfaces

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ABSTRACT

To improve the performance of mass sensitive biosensors, the surface of transducer; a piezoelectric quartz crystal, is expanded by employing electrospun nanofibers to the surface. In the preliminary stage of this study, this manuscript covers the effect of vertical - horizontal electrospinning setups and electrospinning parameters on fiber morphology. Thus it is aimed to obtain finer and non-beaded fiber morphology via controllable and repeatable process parameters for the further applications of QCM surfaces to be used as high performance DNA-, Aptamer-, Immuno-sensors.