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The paper reports on an investigation on the ductility of a sustainable green structural concrete material developed in recent research works that were conducted at the American University of Beirut. Eighteen structural beam specimens were prepared and tested to fail in flexure, shear, and bond splitting modes. A control mix and two hemp-concrete mixed with hemp fibers but less coarse aggregate content were adopted. The objective was to investigate the synergetic performance of hemp-concrete material when cast in reinforced concrete members. The results indicate that regardless of the mode of failure, hemp-concrete beams prepared with hemp fibers and less coarse aggregate had similar peak loads as the control beams; moreover, the hemp-concrete beams exhibited better load-deflection ductile behavior after the peak load. The ductile behavior was determined by calculating the area under the load-deflection curves.

3032 | Influence of compounding conditions on defibrization of lignocellulosic fiber and mechanical properties of reinforced composites (28. Natural Fibre Composites (Raul Campilho))

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The main topic is Natural Fiber Composite with a focus on composite mechanical enhancement by controlling the processed fibre factor ratio (L/D), under extrusion process. We also proposed an optimization of the defibrization that take place during the process, accordingly to the screw profile, by an energy approach (Specific Mechanical Energy).
One of the major driving force for studying either the fibre decohesion plus fragmentation, as 'defibrization', is the striving of controlling WPC properties.
The wood and non wood fibre defibrization behavior is known to be influenced by intrinsically properties as well as external conditions (environmental conditions, often relied to process used, like temperature or water).
The objective of the work is to established, if any, relationships between these parameters and the fibre aspect ratio (L/D) which reflect in some extent the fibre morphology.
To estimate values of parameters that can not be measured during the compounding process, we have used a flow simulation software dedicated to twin screw extrusion (Ludovic© software).
We provided evidence that a composite mechanical enhancement is achievable by controlling the processed fibre factor ratio (L/D). Accordingly, we have varied the extrusion process, which was characterized by the SME. When a similar SME is applied on the fibre elements composed of bundled or individualized fibre cells, the defibrization can drastically differ, accordingly to the screw profile.

3466 | Interphase crossing of natural fibers and polylactide by use of dicumyl peroxide (28. Natural Fibre Composites (Raul Campilho))

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The scientific and technological objective of this work was to design and produce biocomposites with improved mechanical strength and biodegradability. Due to new techniques that allow economical production of high molecular weight polylactide (PLA), this polymer has recently attracted big attention being considered as one of the most promising materials for replacing synthetic polymers. In this work, processing technique which leads to improved mechanical strength and biodegradability of biocompositesis is proposed. For successful realization of this technique, two main processing steps had to be performed: selective location of crosslinking agents at the interface of PLA and flax fibers (step A) and inducing crosslinking between the PLA chains and natural fibers (step B). The first mentioned step was realized by wetting the fibers with solution of dicumyl peroxide and acetone. Then, the dried fibers were mechanically mixed with PLA granulate, extruded by use of single-screw extruder and granulated. The second processing step was initiated by thermal decomposition of dicumyl peroxide during processing. Testing samples were produced from the granulated biocomposites, using a laboratory injection moulding press. Tensile and impact strength measurements, dynamic mechanical analysis (DMA), thermogravimetry (TGA), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) were performed to assess interphase crossing of flax fibers and polylactide.

4093 | Investigation of Mechanical Properties of the Olive/PP(Mah-g) Thermoplastic Composites (28. Natural Fibre Composites (Raul Campilho))

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Olive tree is widely grown in the mediterranian zone and very important crop for the mediterranian countries. In this study olive seed was used for the reinforcement material and grafted polypropylene was used as matris of the composite. Olive/PP(Mah-g) thermoplastic composites were produced by using hot press compression machine. Mechanical properties of the olive/PP(Mah-g) thermoplastic composites were investigated.

4099 | Investigation of Mechanical Properties of the Rattan/Polyurethane Foam Compoites (28. Natural Fibre Composites (Raul Campilho))

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Rattan fiber is a tropical fiber and it has excellent mechanical properties. In this study rattan fiber/polyurethane foam thermoplastic composites were produced by using hot press compression machine. Mechanical properties of the rattan fiber/polyurethane foam thermoplastic composites were investigated.

3773 | Lignin as compatibilizer in polypropylene/sugarcane bagasse cellulose composites (28. Natural Fibre Composites (Raul Campilho))

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The interest in natural fibers as reinforcing agents in polymer composites has grown drastically during the past decades. These materials are considered to be very promising for various applications, mainly in the automotive and construction industries. Although natural fibers can offer the resulting composites many advantages, the usually polar fibers have inherently low compatibility with non-polar polymer matrices. This incompatibility may cause problems in the composite processing and material properties. Due to its structure, lignin has been investigated as a compatibilizer in composite materials, this can be justified by the presence of both aliphatic and polar groups, which may provide compatibility between non-polar polymers and lignocellulosic fibers. The aim of this work was to investigate the thermal properties of polypropylene composites reinforced with bleached cellulose, obtained from sugarcane bagasse, using sugarcane bagasse lignin as a compatibilizer. For this, sugarcane bagasse was pretreated by diluted acid, delignified, treated with xylanase and bleached. Lignin was obtained by the acid precipitation of the black liquor from the delignification step. Polypropylene (PP) composites reinforced from 5 to 40 wt/wt% of bleached cellulose fibers and from 5 to 20%wt/wt of lignin from sugarcane bagasse were prepared in a thermokinetic mixer. Thermogravimetric analyses (TGA) was performed in order to evaluate the thermal properties of the obtained materials.

3590 | MECHANICAL CARACTERISATION OF POLYESTER AND SUNFLOWER NATURAL FIBER COMPOSITE (28. Natural Fibre Composites (Raul Campilho))

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The use of natural fibers as reinforcement in polymer matrix composites is gaining popularity in the development of renewable products. Although glass and other synthetic fiber-reinforced plastics possess high specific strength, their fields of application are very limited because of their inherent higher cost of production. This work deals with the characteristics of natural fiber composites that can offer several advantages, like low cost, weight savings and relatively good mechanical properties. It focuses on the effects of sunflower fibers as reinforcement agents in composites. Mechanical testing of Sunflower natural fibers composite was performed to qualify and quantify the reinforcement properties. At same time, Glass fiber composite sample tests have been produced and characterized and both results have been compared.
From results comparison we can affirm that the produced polymeric sunflower fiber composite has adequate mechanical properties for lots of industrial applications even, as expected, these are lower than glass fiber composites. Using this natural fiber content this product become a more ecological substitute and environment friendly that the traditional polymeric glass fiber composites. For other way, once stems from sunflower plants are wastes that traditionally are left in the field, shredded and incorporated in to the soil, acting like natural low cost substrate, by collecting them and giving them some commercial value will make crops more profitable.

3532 | Mechanical characterization of composites of PLA/PHA matrix reinforced with cellulosic fibers (28. Natural Fibre Composites (Raul Campilho))

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In this work the mechanical and impact behavior of PHA/PLA blend matrix reinforced with cellulosic fibers is investigated. It was also study the Heat Deflection Temperature.

The composite mechanical properties can be optimized trough the variation of the fiber content on the composite. It's possible to predict the tensile properties recurring to modified Halpin-Tsai equation and Rule-of-Mixtures Model. According with this model it's possible to validate the experimental obtain values and anticipate that the incorporation of 30% (weight fraction) of fibers will drive to composite with an irregular fiber distribution.

The composite constituents' wf was optimized to tailor the composite to replace the petrol-based polymers used into interior door trims (mainly ABS and PP).

3726 | MECHANICAL PROPERTIES OF NATURAL FIBERS REINFORCED EPOXY MATRIX COMPOSITES (28. Natural Fibre Composites (Raul Campilho))

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Key-words: Composites, natural fibers, mechanical properties, vacuum bagging

Composites with natural fibers have been widely used in the manufacturing of components for the automotive industry. These eco-friendly materials have good mechanical properties, a relative low cost, processing facility, low density, possibility of being recycled and components with relatively complex geometries can be processed.

The aim of this work was to study a new concept of a cargo trailer for passenger using composite materials reinforced with natural fibers in the construction of a top door. Thus, a set of epoxy materials composites with different types of jute fibers (G, M and F) and glass fibers were processed by vacuum bagging. In the development of the new concept a prototype, with aid of addictive manufacturing techniques, were produced.

The composite materials were characterized in terms of physical and mechanical properties (maximum stress and flexural modulus). The effect of immersion time in water on the properties of the processed composites was also analyzed. As expected, composite materials reinforced with glass fibers present values of mechanical strength and rigidity higher than composite materials with jute fibers (G, M and F). It was also observed a great reduction in mechanical properties with an increase of the immersion time in water.

3710 | Mechanical, thermal and morphological characterization of HDPE/ Brazilian natural fibers using chemical compatibilizers (28. Natural Fibre Composites (Raul Campilho))

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Fibers derived from annual plants, such as banana or coconut are potential substitutes for non-renewable synthetic fibers as filler in plastic composites presenting many advantages over traditional filler materials. Despite these excellent advantages, composites with natural fibers have drawbacks as low mechanical properties and poor compatibility with most common thermoplastics. Some of these problems are caused by differences in polarity between polar natural fibers and nonpolar polymer matrix generating weak interfacial interaction. Some treatments have been used intending to solve this problem mainly chemical ones. This paper describes the preparation of composites of high density polyethylene (HDPE) and natural fibers in the presence of interfacial agents. Coconut and banana fibers were impregnated with interfacial agents dissolved in acetone/toluene and kept at 50 °C for 8h. After impregnation fibers were blended with high HDPE and after extrusion, the pelleted samples were injection molded into specimens for mechanical test procedures. Through optical and scanning electron microscopy analysis a rougher fiber surface as well as interweaving fibers with interfacial agents were observed. Thermal stability improved by approximately 50°C to fibers were treated with stearic and lauric acids. As for the mechanical properties, Young modulus was going from 984.4 ± 15.0 MPa in the case of non-impregnated fibers to 1036.8 ± 29.6 Mpa for the composite with impregnated fibers.

2982 | Mineral-bonded composite made from mixture of bagasse and wheat straw (28. Natural Fibre Composites (Raul Campilho))

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Gypsum-bonded particleboard panels were made from various mixture of bagasse (Saccharum officinarum L.) and wheat (Oryza sativa L.) straw particles bonded with different ratio level of particles/gypsum. This study examined possible feasibility of bagasse and wheat straw particles in the production of gypsum-bonded particleboard (GBPB). One-layer experimental GBPB with density of 1.05 and 1.20 g/cm3 were manufactured at bagasse/wheat straw ratio of 100/0, 93.75/6.25, 87.50/12.50, 75/25, 50/50, 25/75 and 0/100 using two particle/gypsum compositions, namely 1/2.75 and 1/3.25 by weight. Thickness swelling (TS), water absorption (WA), modulus of rupture (MOR), modulus of elasticity (MOE) and internal bond strength (IB) properties of the boards were evaluated and a statistical analysis was performed in order to examine possible feasibility of these agricultural residues in commercial GBPB manufacturing. It was determined that water absorption of boards decreased as content of straw and LR/G ratio increased to 100% and 1/3.25, respectively, whereas thickness swelling of boards decreased as straw proportion and particle/gypsum ratio decreased to 0% and 1/2.75, respectively. The experimental results have shown that the modulus of rupture and modulus of elasticity of boards containing 0%, 6.25% and 12.5 % wheat straw with LR/G ratio level of 1/2.75 were higher than those of panels made from 25-100% wheat straw with LR/G ratio level of 1/2.75 and also from all of the percentages of straw with LR/G ratio level of 1/3.25. While, internal bond strength of boards containing up to 12.5% straw with LR/G ratio level of 1/2.75 and 1/3.25 were lower than those of panels made from 0-12.5 % straw with mentioned LR/G ratios. Panels consist of 0%, 6.25% and 12.50% wheat straw with LR/G ratio level of 1/2.75 and 1/3.25 met the minimum EN standard requirements of mechanical properties for general-purposes. All of the panels contain 0-100 % wheat straw with LR/G ratio level of 1/2.75 or 1/3.25 had the required level of thickness swelling for 24 h immersion.

3038 | Novel Bio-Composites: The Effect of Fibre Surface Treatments on Thermal and Mechanical Properties of Short Banana/Sisal Fibre Reinforced Poly Lactic Acid (PLA) Hybrid Composites (28. Natural Fibre Composites (Raul Campilho))

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