Natural Fibres ‘09 is one of the final events of the United Nation’s designated International Year of Natural Fibres. This three day international conference will celebrate and highlight the increasing use of natural fibres around the world, raise awareness of their diverse engineering properties and take an in-depth look at the research work that is being carried out to quantify and improve the properties of these environmentally sustainable materials in engineering and textile applications.

This event will offer an opportunity for natural fibre industries to come together to foster international partnership and increased understanding of the role that natural materials can and must play in ensuring a sustainable future. Days one and two consist of two simultaneous streams of presentations featuring over 60 international presenters, whilst day three offers the delegates the chance to visit the Innovation Park at BRE in Watford to see first hand the use of natural materials in construction.

A register of stakeholders is being compiled in conjunction with this event. If you would like to register your interest as a stakeholder in this community, please complete the registration form on the conference website at www.iom3.org/events/fibres and return it to the event organisers.
Monday
14 December

08.30-09.25
Conference Registration

09.25-11.20
Conference Start and Opening by Lord Hunt, Department of Energy and Climate Change

11.20-11.50
Refreshment Break

13.10-14.00
Lunch and Exhibition Opening

15.40-16.10
Refreshment and Networking Break

17.30-18.30
Poster Session and Drinks
Reception for all delegates

1 Carlton House Terrace
(mince pies and mulled wine)

19.00-21.00
Conference Dinner, 1 Carlton House Terrace.
Ticket required. See Conference Registration Desk for further information.

Tuesday
15 December

08.30-09.30
Registration (for Day Two delegates only)

09.30
Conference Start

10.50-11.30
Refreshment and Networking Break

12.50-13.50
Lunch

15.30-16.00
Refreshment and Networking Break

17.50
Conference Close

18.45
Teas and Coffees for Public Lecture

19.00-20.15
Public Lecture and Launch of Composites Thematic Working Group
Lean, Mean and Green: The World’s First Environmentally Friendly Racing Car
Kerry Kirwan, University of Warwick, UK
Followed by Launch of Thematic Working Group on Bioomposites, by John Williams, NNFC
Refreshments to follow.

Wednesday
16 December

Visit to Innovation Park, BRE, Watford

09.15
Delegates who have booked to go to the Innovation Park at BRE in Watford meet at 1 Carlton House Terrace at 09.15 in order to catch the coach at 09.30.

14.30
Arrive back in London from Watford. Drop off at 1 Carlton House Terrace.
Welcome and Introduction to the Institute of Materials, Minerals and Mining

Barry Lye
President of the Institute of Materials, Minerals and Mining

Barry Lye has been President of the IOM3 since 2008. His background is in ceramic technology, and as President his major aims are to improve communication to members, to involve younger members in the running of the Institute, to encourage them to become involved in Institute affairs, and to continue to promote further education opportunities. He would like to welcome all of our national and international delegates to this conference.

Lord Hunt
Minister of State for the Department of Energy and Climate Change (DECC)

Lord Hunt is Minister of State for the Department of Energy and Climate Change (DECC), and Deputy Leader of the House of Lords. He leads for DECC on ensuring the UK has a secure, low-carbon and affordable energy supply. This encompasses DECC’s work on renewables. He previously served as a Minister in the Department of Environment, Food and Rural Affairs, so has an understanding of the other issues relating to natural fibres, including sustainability and agriculture. Lord Hunt will highlight the support the UK Government is giving to the renewable materials industry, and outline how this low carbon sector can help mitigate climate change and contribute to a range of other sustainability objectives. Lord Hunt also supports the Secretary of State on international energy, and represents DECC in the House of Lords.

Dr Brett C Suddell
Senior Materials Scientist ADAS Rosemaund, UK

Brett is a Chartered Environmentalist and a Senior Materials Scientist within the Sustainable Crop Management business unit within ADAS (the UK’s largest environmental solutions provider). He is responsible for all business relating to new material markets such as biocomposites and the industrial applications of natural materials.

Prior to joining ADAS Brett was Head of Materials at the BioComposites Centre located at Bangor University and part of the senior management team of the centre. He was responsible for all aspects of research conducted within the centre and at its pilot plant facility located on Anglesey whilst also being responsible for a multidisciplinary team of scientists, assistant scientists and technicians along with income generation within the group.

Brett trained as a Materials Scientist at Swansea University (Wales) sponsored through his postgraduate courses of Masters of Research (MRes) and PhD by Rolls Royce plc undertaking research in Aerospace materials. As a Senior Research Assistant Brett conducted research into the use of natural fibres within the automotive industry on a global scale, this is where his interest in natural materials began.

Following this research Brett worked on recycling agricultural waste materials into value added composite products and holds a patent as a result of this research.

He has received and given numerous conference plenary and keynote invitations and was also invited to address the United Nations Food and Agriculture Organisation (FAO) at their intersessional meeting in Brazil in 2005 and in October 2008 at the FAO HQ in Rome. He also received a Royal Society International Travel Fellowship in 2003. He has written numerous journal and conference publications including a book chapter in ‘Natural fibres, Biopolymers and BioComposites’ published in 2005.

Brett is a Fellow of the Institute of Materials, Minerals and Mining (IoM3) and was the longest serving chair of the Younger Members Committee for 6 years responsible for introducing a number of Younger member initiatives such as soft skills seminars, the IoM3 silver prestige award, ‘Young Persons’ World lecture competition and significantly raising the profile of younger members within the Institute. In 2008 he was appointed to the FEMS (Federation of European Materials Societies) executive representing the UK.

Brett sits on the organising committees of a number of international conferences and is also a steering group member of a number of networks including the Welsh Composites Training consortium (WECOTAC), Welsh Composites Network (WECON), Wealth out of Waste (WoW), Construction Knowledge Wales and Sustainable Composites Network (SusCompNet). He chaired the ‘Natural materials’ conference in March 2008 and the Materials and Design exchange event in London also in March 2008.

Brett is a reviewer for the European Science Foundation (ESF) and an invited reviewer for the Journal of Materials Science and the Journal of Biobased Materials and BioEnergy and an external PhD examiner for the University of New South Wales (Australia) and an MRes and PhD examiner for Swansea University. He has also acted as an external consultant for the United Nations Food and Agriculture Organisation.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1: Innovations</th>
<th>Session 2: Textile Fibres, Extraction and Production</th>
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<tbody>
<tr>
<td>10.00</td>
<td>Keynote. Natural Fibre Composites and All Green Composites for a Sustainable Manufacturing: Where We Are and Future Directions</td>
<td>Keynote. Natural Fibre Composites with 3D Woven Reinforcement for New Application Areas</td>
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<td></td>
<td>Professor A Mohanty: Department of Plant Agriculture and School of Engineering, University of Guelph, Ontario, Canada</td>
<td>Dr J Soden: School of Art and Design, University of Ulster, Belfast</td>
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<tr>
<td>10.40</td>
<td>The InCrops Enterprise Hub: Promoting Innovation in Fibre Crops in the East of England</td>
<td>The Production and Extraction of Flax-Fibre for Textile Fibres</td>
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<td></td>
<td>J French, N Corker, &amp; C Gonzalez- Esquivel: InCrops Enterprise Hub, University of East Anglia, UK</td>
<td>MRL Horne: De Montfort University, UK</td>
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<tr>
<td>11.00</td>
<td>Quantitative Life Cycle Analysis for Flax Fibres</td>
<td>Wool – Optimising the Unique Fibre Properties of Wool in Packaging Applications</td>
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<td>NPJ Dissanayake, J Summerscales, SM Grove &amp; MM Singh: University of Plymouth, UK</td>
<td>A Morris: Woolcool, UK</td>
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<tr>
<td>11.20</td>
<td>Session 3: Extraction and Structural Applications</td>
<td>Session 4: Textile Applications</td>
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<tr>
<td>11.50</td>
<td>DunAgro – A New Approach to Hemp Processing</td>
<td>From Field to Fashion, From Couch to Catwalk: the Story of Nettles</td>
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<td>S Amelynck &amp; H. Koether: Van Dommele Engineering, Belgium</td>
<td>J Harwood, M Horne, D Waldron &amp; J Williams: De Montfort University, UK</td>
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<tr>
<td>12.10</td>
<td>Jungle to People: Pineapple Leaf Fibre Leather Substitute</td>
<td>Mainstreaming Fibres in Fashion. A Case Study: Alpaca in Latin America and Jute in Asia</td>
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<td>C Hijosa: Royal College of Art, London</td>
<td>J Condor-Vidal: Trading for Development, UK</td>
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<tr>
<td>12.30</td>
<td>Sustainable Nano-enhanced Structural Biocomposites: A New Hope in Green Materials World.</td>
<td>Pineapple Leaves: From Agricultural Refuse To High Quality Fabric</td>
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<td>M Misra: University of Guelph, Ontario</td>
<td>W Srirachrusn &amp; C Silapasunthorn: Silpakorn University, Thailand</td>
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<td>13.10</td>
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<td>Session 5: Natural Composite Applications</td>
<td>Session 6: Construction Applications</td>
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<td><strong>Keynote. Market Overview:</strong> Modern industrial applications of natural fibres**</td>
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<td>M Carus: Managing Director of nova-Institute of Ecology and Innovation, Germany</td>
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<td><strong>A Story About Grass. The Production of Grass-Fibre Based Products in a Biorefinery Context</strong></td>
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<td>G O'Malley: Biorefinery Ireland</td>
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<td><strong>Hemp: a Novel Material for Use in the Friction Industry?</strong></td>
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<td><strong>Coir Fibre Reinforced Bio-Composite Concrete Panels for Low Cost Housing</strong></td>
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<td>M Sivaraja &amp; R Saravanan: Kongu Engineering College, India</td>
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**Session 7: Material Characterisation**

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<tr>
<td>Microstructural and Mechanical Aspects of Bagasse Fiber Reinforced Epoxy Composites at Liquid Nitrogen Temperature</td>
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<td>Optimisation of Interfaces in Biodegradable and Natural Fibre Composites</td>
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<td>A Hodzic: University of Sheffield, UK</td>
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<td>Characterization of Date Palm Fiber-Polypropylene Composite Material</td>
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<td>A Alawar: United Arab Emirates University</td>
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<td>Strain Rate Dependent Properties of Natural Fibres for Composite Materials</td>
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<td>DA Jesson, B Di Napoli &amp; PA Smith: University of Surrey, UK</td>
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<tr>
<th><strong>Session 8: Construction Applications Continued</strong></th>
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<tr>
<td><strong>Potential for Hemp Insulation in Construction Sector in the UK</strong></td>
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<td>Properties of Natural Fibre Reinforced Concrete</td>
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<td>M Ali: National Engineering Services Pakistan (NESPAK)</td>
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<tr>
<td>Effect of Animal Fibres Reinforcement on Stabilized Earth Mechanical Properties</td>
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<td>C Galán-Marín &amp; C Rivera-Gómez: University of Seville, Spain</td>
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<td>High Integrity Joints for Sisal-Epoxy Composites</td>
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<td>MP Ansell, C Gonzalez Murillo, M Fagan &amp; M Thomson: University of Bath, UK</td>
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| **Conference Poster and Networking Session followed by Conference Dinner (tickets required)** | **Conference Poster and Networking Session followed by Conference Dinner (tickets required)** |

**Session 6: Construction Applications Continued**

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### Event Programme • 15 December, Day 2

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 9: Fibre Extraction</th>
<th>Session 10: Natural Fibre Composites Industrial Applications</th>
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<tbody>
<tr>
<td>08.30</td>
<td>Registration</td>
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<tr>
<td>10.10</td>
<td>Extraction Methods for New Zealand Indigenous Fibres&lt;br&gt;N Hati, ALP Rickard &amp; A Keyte-Beattie: Scion, New Zealand</td>
<td>New Future and Perspectives for Natural Fibres in High Level Technology Industries and the Effects on Producing Poverty Alleviation&lt;br&gt;W Andrade: Sindifibras, Brazil</td>
</tr>
<tr>
<td>10.30</td>
<td>Use of Fibre Obtained from Banana Tree as Reinforcement of Polyethylene Matrix&lt;br&gt;Z Ortega, AN Benitez, MD Monzón, P Hernández, I Angulo &amp; MD Marrero: Universidad de Las Palmas de Gran Canaria, Spain</td>
<td>Manufacturing Methodology of Hemp Fibre Reinforced Sheet Mould Composites (H-SMC)&lt;br&gt;H Patel, TD Harpuarachchi, S Crowther, M Fan, PJ Hogg, &amp; G. Ren: University of Hertfordshire, UK</td>
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<tr>
<td>11.00</td>
<td><strong>Break</strong></td>
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<tr>
<td>11.30</td>
<td><strong>Session 11: Fibre Properties</strong>&lt;br&gt;Wetting Behaviour and Surface Energy of Coconut (Coir) Fibres&lt;br&gt;LQN Tran, CA Fuentes, C Dupont, AW Van Vuure, &amp; I Verpoest: Katholieke Universiteit Leuven, Belgium</td>
<td><strong>Session 12: Biocomposite Applications</strong>&lt;br&gt;Development of Aligned Natural Fibre-Reinforced Thermoplastic Biocomposite Materials for High-Performance Applications&lt;br&gt;BM Weager, EL Arnold &amp; GR Bishop: NetComposites Ltd, UK</td>
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<tr>
<td>11.50</td>
<td>Nanoindentation Contribution to Mechanical Characterization of Vegetal Fibers&lt;br&gt;A Bourmaud, C Morvan, &amp; C Bale: LIMATB Laboratoire d'Ingénierie des MATériaux de Bretagne Equipe Polymères, France</td>
<td>All-Cellulose Composites&lt;br&gt;T Peijs, N Soykeabkaew, R Arevalo: Queen Mary University of London, UK</td>
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<tr>
<td>12.10</td>
<td>Hemp Fibre Circular Tubes for Structural Applications&lt;br&gt;BT Weclawski and M Fan: Brunel University, UK</td>
<td>The Utilisation of Waste Fibres for Industrial Applications&lt;br&gt;RM Elias: BioComposites Centre, Bangor University, UK</td>
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<tr>
<td>12.30</td>
<td>Molecular and Cell Biological Analysis of Natural Plant Fibres&lt;br&gt;JP Knox: University of Leeds, UK</td>
<td>The Use of Raman Spectroscopy to Follow Interfaces in Natural Fibre Composites&lt;br&gt;S.J. Eichhorn: University of Manchester, UK</td>
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<tr>
<td>12.50</td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
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<tr>
<td>Session 13: Sisal Economics and Physical Properties (Sponsored by London Sisal Association)</td>
<td>Session 14: Natural Fibres in General</td>
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<tr>
<td><strong>Keynote</strong>. The Economic Significance and Contribution to Poverty Reduction of Sisal Production and Utilisation in Tanzania</td>
<td><strong>Keynote</strong>. Natural Fibres &amp; Renewability</td>
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<td>S Shamte: London Sisal Association / Katani Limited, Tanzania</td>
<td>J Williams: Head of Polymers &amp; Materials, NNFCC, UK</td>
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<td>Effect of Transcrystallinity on Microbond Shear Strength at Sisal Fibre – Polyactic Acid Interface</td>
<td>Potentials of Bast and Hard fibres in Technical Products</td>
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<td>M Prajer &amp; MP Ansell: Bath University, UK</td>
<td>J Steger: SachsenLeinen GmbH, Germany</td>
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<tr>
<td>Mechanical Behaviour of Natural Sisal Fibers</td>
<td>Fabrication of Jute Fibre Reinforced Composites using Cardanol-Based Resins as Matrix</td>
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<td>FA Silva, N Chawla, &amp; RD Toledo Filho: Technical University of Dresden, Germany</td>
<td>P Campaner, N Cronin, D D’Amico, L Longo, A Maffezzoli, C Stifani, A Tarzia: Elmira Ltd, UK</td>
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<td>Influence of the Natural Fibre Coating on Interfacial Adhesion Between the Fibres and the Polymeric Matrix in Composites</td>
<td>Effect of Underwater Shock Wave Treated Jute Fibres on Composite Properties</td>
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<tr>
<td>A Delille, KY Lee, A Bismarck and A Mantalaris: Imperial College London</td>
<td>GMS Rahman &amp; S Itoh: Kumamoto University, Japan</td>
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**Session 15: Textile Applications**

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<tr>
<td>A Matter of Life and Death ...Thinking Outside the Box</td>
<td>Characterisation of Biocomposites Manufactured from Natural Fibres, Sustainable Resins and Lignin as a Filler Nanoscale Toughness of Spider Silk</td>
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<td>BM Wood, SR Coles, K Kirwan &amp; SJ Maggs: University of Warwick, UK</td>
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<td>Linen and Hemp: Green Fibres Focused on Innovation and Performance Applications in the Field of Mobility</td>
<td>PLA and PP Composites with Cellulosic Fibres from Wood Industry and Peat</td>
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<td>K Immonen &amp; J Lampinen: VTT, Finland</td>
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<td>The Role of Cotton in Sustaining the Sudanese Rural and Urban Community Life over Decades and future look</td>
<td>Preparation and Properties of Wheat Flour Reinforced with Wheat Straw using Extrusion Processing</td>
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<td>H Ahmed: Africa City of Technology, Sudan</td>
<td>W Xia, YG Kang, K Tarverdi, &amp; JH Song: Brunel University, UK</td>
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<td>Public Lecture and Launch of Composites Thematic Working Group</td>
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Amar Mohanty is a Professor and holds Premier’s Research Chair in Biomaterials and Transportation and is the Director of the Bioproducts Discovery & Development Centre (BDDC), at the University of Guelph, Ontario, Canada. His research interests are biobased materials including natural fibre composites, bioplastics, green composites, nano-blends and green nanocomposites. He was the holder of the prestigious Alexander von Humboldt Fellowship, Germany. He was the recipient of Andrew Chase Forest Products Division Award from the Forest Products Division of the American Institute of Chemical Engineers. Dr. Mohanty serves as Editorial Board Member in the Journal of Polymers and Environment, Recent Patents on Material Science and Journal of Nanoscience and Nanotechnology. He is the Editor-in-Chief of the Journal of Biobased Materials and Bioenergy. Dr. Mohanty was the lead editor of the CRC book entitled “Natural Fibres, Biopolymers and Biocomposites” and American Scientific Publisher’s book entitled “Packaging Nanotechnology”. He is one of the Directors of the Forest Product Division, American Institute of Chemical Engineers and is the Vice-President (2009-10) of the BioEnvironmental Polymer Society.

The unpredictable price of crude oil, national security, reduced landfill space and escalating environmental threats are daily headlines. The government’s push for green products, consumers’ desire, and energy conservation are some of the key factors that drive research towards the development of renewable resource-based natural and green composite materials.

Biobased economy is challenging to agriculture, forestry, academia, government and industry. The incorporation of bio-resources, e.g. crop-derived green plastics and plant derived biofibers (natural fibres) into composite materials are gaining prime importance in designing and engineering green composites. Biocomposites derived from natural fibers and traditional polymers like polypropylene, polyethylene, epoxy and polyesters have been developed for automotive parts and building structures. Renewable resource based bioplastics like polylactic acid (PLA), polyhydroxyalkanoates (PHAs), biobased polytrimethylene terephthalate (PTT), cellulose plastics, soy/corn/wheat protein based bioplastics and vegetable oils derived bioresins need value-added and diverse applications to compete with the fossil fuel derived plastics.

Through reactive blends, composites and nanocomposites new biobased materials are under constant development. The door is opening and path is clearing-up for many emerging biopolymers and biobased composite materials that are poised to create a major break through in the commercial in-roads.

Natural fibres are lighter, less expensive, have superior specific strength, require comparatively less energy to produce, are good for the environment, biodegradable and have superior sound abatement characteristics as compared to synthetic glass fibres. All of these attributes are quite favorable, especially in the automotive sector where even a fractional weight saving can make a significant contribution to energy savings with reduced gasoline consumption and with added advantages of eco-friendliness. It is true that natural fibres are comparatively hydrophilic and less thermally stable as compared to glass fibers. However, the recent developments of natural fibre technologies overcome these disadvantages if used intelligently.

Hybrid and intelligently engineered green composites are going to be the major drivers for sustainable developments. Besides agricultural natural fibers like kenaf, jute, flax, industrial hemp, sisal and henequen, inexpensive biomasses such as wheat straw, rice stalks, corn stovers, grasses, soy stalks and lignin (the byproducts from pulp and paper and lingo-cellulosic ethanol industries) have great potential for use in sustainable biobased composite materials.

This presentation will highlight the current status, opportunities and challenges of bioplastics, natural fibre composites and green composites for uses in car parts, consumer goods and sustainable packaging.

Natural fibre reinforcements in conjunction with nanotechnology are poised to create major breakthroughs. Chemistry plays a vital role and thus possesses several opportunities and challenges like effective chemical modification of reinforcements (fibre/clay), use of novel coupling agents, and matrix modifications.

Some of the important challenges in the design and engineering of green composites for structural/semi-structural applications are: 1) Supply chain of natural fibres, 2) High yield crops and biomass, 3) Engineered bioresins, 4) Intelligent uses of natural fibre composites, 5) Hybrid biocomposites, 6) Hierarchical nano-biocomposites, 7) Long fibre extrusion and injection molding and 8) The improved processing that would encompass co-melt processing and design of light weight green composites.

Without a doubt, fossil fuel-based products are not going to be phased-out entirely, but their use will taper-down. The goal is to use natural fibre composites containing the maximum possible amount of renewable biomass-based derivatives to have a sustainable future in the composite materials industries.
Dr. Carlos Gonzalez-Esquivel has a first degree in Animal Production from the University of the State of Mexico and a Ph.D. in sustainable agriculture from Wye College London. He has worked since 1994 in the evaluation of agroecosystem sustainability using indicators. He has also conducted and collaborated in field trials using forage crops (grass, cereals and their associations with legumes), as well as horticultural crops under organic management. Most trials have been carried out on-farm using participatory approaches, looking at the productive, economic and environmental effects of conventional and alternative resource management strategies.

As an agri-business officer at the InCrops Enterprise Hub, my role is to promote alternative and non-food crops amongst farmers and small and medium enterprises. As part of the project I am now conducting experimental and demonstration trials at Easton College and other locations in the East of England.

In this work alkaline treatment at different conditions has been applied to enhance the interface between flax fibers and cement matrix. The effect of alkaline treatment parameters on tensile, flexure and compressive strength was examined and reported in this paper.

John Summerscales was educated at UWIST Cardiff (BSc (Joint Honours) Applied Sciences: Chemistry & Polymers), Thames Polytechnic (MSc: Molecular Science of Materials) and Plymouth Polytechnic (PhD: hybrid fibre-composites), with a year at the Central Patents Index between the latter. He completed a Postgraduate Diploma in Education (Adult Education) at UoP in 1998. After the doctorate, he studied thermal insulation for a hyperbaric liferaft for the Diving Diseases Research Centre, followed by five years with the Ministry of Defence (Navy).

In 1987, he joined the new Advanced Composites Manufacturing Centre (ACMC at UoP). Dr Summerscales is currently Reader in Composites Engineering at the University of Plymouth.

Natural fibres are perceived as a sustainable alternative to glass fibres for the reinforcement of polymer matrix composites. This paper reports a Quantitative Life Cycle Analysis for flax fibres (to be judged against glass fibres) using the eight environmental impact classification factors identified in ISO/TR 14047:2003.
This research pioneers 3D woven natural fibre composites using epoxy and bioresin matrix systems. A higher-specification eco-composite material, resin processed via the VARTM method with specific structural characteristics has been produced. With enhanced properties in the through-the-thickness orientation, these can be assigned for trial in a variety of prototype applications.

Collaborative research reported in this paper uses textile design expertise gained from developing 3D wovens and carbon composites for aerospace research that has been redirected into the natural fibre composites arena. 3D woven materials have primarily been developed in carbon fibre to serve a need within high specification aerospace and military applications, where tolerances and specifications are stringent. The key objective of the textile preform is to provide structural load-bearing reinforcement. New 3D woven structures have now been produced in natural fibres.

Driven by requirements in the automotive sector, the majority of natural fibre composites are manufactured using non-woven fibre mat products in flax, hemp, and hybrid mixed fibre assemblies with orientated fibre direction, or single layer woven piled laminates. These materials target appropriate yet non-load-bearing applications and have seen steady growth in the last 7 years.

However, the lack of continuous fibre integrity within the textile part is a significant factor which inhibits their development and selection for higher specification structural parts with load-bearing capabilities for a range of industries.

This research undertaken at the University of Ulster reports on the introduction of 3D woven natural fibre composites using epoxy and bioresin matrix systems. It advances both discovery and innovation by generating a new class of natural fibre composite material resin processed via the VARTM method with specific structural characteristics. With enhanced properties in the through-the-thickness (Z-Axis) orientation, these can be assigned for trial in a variety of prototype applications.

A range of 3D woven fabric architectures have been fabricated in flax and naturally derived viscose rayon yarns for discussion, analysis and testing. The initial results from mechanical test programs assessing flexural strength and impact tolerance have indicated encouraging results when compared to laminated structures.
Matthew has been working in natural fibre research at De Montfort University, Leicester for the last five years. His research interests include a number of topics relating agricultural and environmental science to the production of natural fibres. He is particularly focused on the successful development of sustainable natural fibre supply chains for high-value textiles, including agricultural crop production, fibre crop conversion technology, and end user added value. He has worked extensively on the development of flax, hemp and stinging nettles as a source of textile fibre in partnership with a number of private sector enterprises, both in the UK, the EU and globally. Future work will involve the continued improvement of the quality of fibre (fibre fineness, fibre length, etc) available from commercial bast fibre crops (flax, hemp & Sting nettle), through plant breeding, improved crop management and improved conversion technology. Also, future work will investigate how to identify and exploit the key factors that maintain fibre quality (fibre fineness, fibre length, etc) in expanding stakeholder unit networks, within the agro-fibre supply chain.

Implications considered in Matthew’s research are for both public and private sector stakeholders. His research has contributed to insights for a number of public and private sector stakeholders with an interest in sustainable agriculture, agro-industrial crops and their products. Additionally, Dr Horne’s research has contributed to the academic literature and the theoretical debates therein.

The cultivation and processing of flax crops for the production of a whole yield of a single quality of high-value ‘spinnable’ fibre has been investigated in crop and processing trials at De Montfort University, UK. Crop production has been investigated in farm trials and assessed for cost effectiveness, while fibre extraction methods have been developed and tested. This work examines the fibre quality that could be expected from a commercial flax production and the effectiveness of decontamination and fibre separation technologies.

Angela Morris has been a specialist in packaging design for 30 years. Through her successful packaging consultancy, Angela provides broad based packaging solutions and integrated design management for clients large and small, including Cadbury’s, BHS, Avon and The National Trust. With a true enthusiasm for her field, Angela is also a visiting lecturer on the Design Management MA course at the University of Northumbria.

With a particular passion for optimising and reducing excessive packaging, Angela is committed to developing innovative, environmentally friendly solutions wherever possible. In 2009 she founded The Wool Packaging Company and launched the biodegradable and sustainable alternative to polystyrene insulated packaging, woolcool®. Angela has won the prestigious Institute of Packaging ‘Starpack Award’, the Observer Food Monthly Best Innovation Award for woolcool® and is shortlisted in the 2009 Green Awards for Packaging.

The original ‘smart fibre’, wool, has been increasingly sidelined by the development of man-made fibres but the case for its resurgence is more compelling than ever. Sustainable, biodegradable and with unique insulation properties, this paper demonstrates how innovative commercial applications for wool could re-invigorate the global wool industry.
DunAgro – a new approach to hemp processing
S Amelynck and H. Koether, Van Dommele Engineering, Belgium
Van Dommele Engineering, Bissegemstraat 169, 8560 Gullegem-Wevelgem, Belgium
helmut.koether@vandommele.be • Tel: +32 56 431 562

Helmut Koether works as a sales engineer for Van Dommele Engineering located in Gullegem, Belgium. He has a master degree in Industrial Design and in Industrial Management and joined Van Dommele in 2004.

Van Dommele builds turnkey processing lines for bast fibres such as flax, hemp and kenaf. Helmut will be giving a presentation about the latest processing lines they have put in operation this year.

DunAgro is an integrated approach to hemp straw processing in which the main goal is to reduce the overall processing cost. This cost reduction is achieved by optimizing the harvest and by keeping the initial investment, the energy consumption and the labour cost as low as possible.

Jungle to people: pineapple leaf fibre leather substitute
C Hijosa, Royal College of Art, Kensington Gore, London SW7 2EU, UK
carmen.hijosa@network.rca.ac.uk

Carmen Hijosa graduated in 2002 with a BDes (honours) and an MA in textile design from the National College of Art and Design in Dublin, Ireland. She is presently a researcher/designer, preparing a PhD in the Royal College of Art and Design in London. Her project: ‘Jungle to People, Environmentally Sustainable Products and Ethical Design’, aims to develop an alternative to leather derived from natural fibres extracted from waste pineapple leaves. Carmen is a social entrepreneur and designer.

In 1977 she co-founded and was designer of ‘Chesneau Leather Goods’, a manufacturing company of luxury leather goods in Ireland. In the 1990s Carmen become a design consultant with the World Bank and the EU. From 1993 she has been working in the Philippines with various government departments developing products (textiles and fashion accessories) for the export market, using local skills and raw materials.

Carmen’s work has been exhibited and sold in Europe, USA, Japan and the Philippines. A new product based in the use of pineapple leaf fibres (PLF) is being developed by Carmen Hijosa as part of her PhD as a researcher in the Fashion and Textiles Department of the Royal College of Art and Design, London. The project called ‘Jungle to People’ aims at developing a leather substitute derived from PLF which are a by-product of the pineapple.

Sustainable nano-enhanced structural biocomposites: a new hope in green materials world
M Misra, University of Guelph, Ontario

This presentation intends at reporting very recent developments in processing, properties and applications of structural nano-enhanced composites produced from natural fibres, nano size fillers and functionalized plant/vegetable oil. The progress of these bio-based nanocomposites will facilitate a rapid transition to a bio-economy by providing a foundation of economic and environmental sustainability for natural fibre-composite industries.

Dr. Manju Misra is an Associate Professor in the School of Engineering and cross appointed in the department of Plant Agriculture at the University Of Guelph, Ontario, Canada and is pursuing research activities in the area of sustainable materials for past twenty years. Her current research is primarily focused on novel biobased composites/nanocomposite materials from agricultural and forestry resources for the sustainable bio-economy, and application of nanotechnology in materials uses.

Currently in her position, she is collaborating with DuPont, Ford Motor Company, MaxTech manufacturing, GreenCore Composites and EnerGrow, Arkema Chemical Company, Stemergy Inc., FlaxCraft Inc, and Green Field Ethanol in various nano-bio materials applications with funding from NSERC Canada.
Lindy Hensen graduated in Industrial Design Engineering, in the master Strategic Product Design, focused on innovation management. Lindy Hensen has been working at NPSP Composieten as project coordinator NaBasCo since May 2008. NaBasCo, an abbreviation for nature-based composites, is NPSP’s brand for bio-based thermosetting composites.

Lindy is responsible for the research & development and business development of these bio-composites at NPSP. Important R&D focus points are the optimization of natural fibres for use in composites and the joint development and processing of bio-based resins into high performance composites.

Work is done on the development and optimization of bio-based fibre reinforced thermosetting composites. Subjects involve:

- Value chain of biobased composite products and its possible optimizations
- From fibres to non-wovens, wovens and uni-directional
- Developments in thermosetting bio-resins
- Towards a high performance material
- Projects in which technical developments have been demonstrated

The presentation shows the current possibilities and an overview of the important topics for future developments towards fully bio-based composites.
Dennis Waldron is a Senior Research Fellow having gained a first degree in Metallurgy at Nottingham University before studying for a MSc in Corrosion Science and Engineering. He recently gained a MPhil in textile technology, studying the effects of maturation on the primary processing of flax, at De Montfort University. With almost 30 years industrial experience in the fibre industry involved with manufacture, development and research, Dennis joined the Textile Engineering And Materials (TEAM) Research Group at De Montfort University in 2002. Within this role the work has been directed into two major areas; firstly research associated with natural fibres and sustainable technologies in the textile industry and secondly support and intervention for small local textile businesses wishing to make the transition from standard commodity products into those which are considered to be technical textiles. Currently he is involved with the development of local “on-farm” processing of bast fibres including flax, hemp and stinging nettles. The role within TEAM also involves some lecturing to undergraduates on topics related to natural fibres, sustainable technologies and use of fibres in technical textile applications as well as providing support for undergraduate and post graduate research projects.

Mankind has obtained fibres from plants for numerous centuries and the current desire for natural fibres has stimulated research into some of the older fibres. The stinging nettle is one such plant where the application of modern technology is helping to revive its use.

Judith Condor-Vidal, Peruvian, associate member of the World Fair Trade Organisation (WFTO) and director of Trading for Development. TFD’s work involves opening markets for Fair Trade producers and building support for Fair Trade across Europe. Her concern is to make world trade fairer, giving pride of place to small scale producers. Judith is also trustee of the Ethical Fashion Forum.

Natural fibres are used in everyday clothing. The production of natural fibres totals around 30 millions of tons every year. A large percentage of this output is produced by small-scale producers in the South, many earning less than a dollar a day. This presentation highlights a small experience in mainstreaming. TFD works with certified Fair Trade producers. TFD partners are all members of the World Fair Trade Organisation. It attempts to share this experience and to draw attention to the benefits and challenges of this experience.

Enzymes are non-toxic and environmentally friendly biocatalysts. As biotechnology makes rapid progress regarding their application conditions, this finishing process is gaining increasing industrial consideration. This work examines the effectiveness of enzymes to scour pineapple leaf fibres (PALF). The dyeing properties of PALF-blended cotton fabric are also investigated.
Born in a village north of Madrid, on February 5th, 1954, for a while, I hated my own name, Maria Isabel, preferring my Christian saint’s day, Agatha. My parents decided for us, their seven children, to move to the city when I was 3. Since childhood I liked drawing, but the scientific part of my mind, pushed me into Mathematics when I went to university. Now, it’s good to count papers, then, it was useful to gather every hippie in Madrid, or the attics I lived in, when I became independent, at 19, young for dreaming of London, and ever singing English songs.

I turned 21 and said goodbye to coin gramophones at the west park, exchanging countries, leaving Spanish for English, college for etching at Epsom, Oxford, and Banbury schools. With another earth turn, I was back, in the northern region, Cantabria. Our two daughters were born here; being a fighter for sustainability those days was a rare avis, but I got credentials as solar projects designer and founded a small industry to make interdependence living tools: recovering fibres for renewable products made of paper and providing environmental education. I am grateful.

Energy saving and the reduction of carbon gas emissions have increasingly become an important part of our daily life. Within this context, the using of U-tube cold light bulbs becomes a new interesting alternative experience (to be compulsory in the near future). But they are odd-shaped, difficult to clean, and less shiny under conventional light shades. Fibres from plants and textiles, as well as recycled Kraft paper bags, make exciting materials for decoration. Pulps of those composites allow inkjet and laser printing and engraving; so that, it is very easy to create a different type of lamp at a low cost, having advantages in both: simplicity and green credentials.
Michael Carus studied physics at the University of Cologne. Following his studies he worked as a scientific staff member for nuclear energy and environment at the University of Tuebingen, as a scientific journalist for different professional magazines (environment and technology), at the KATALYSE-Umweltinstitut in Cologne (environment and resources), for the US company Tektronix GmbH in Cologne (IT system management) as well as for the company Flachglas Solartechnik GmbH in Cologne (solar power plants) until founding the nova-Institut GmbH with other scientists in 1994.

Since its foundation, Michael Carus, together with Dirk Schubert, is the managing director of the nova-Institut and is head of the field ‘Renewable resources and market research’ with its three departments:

- Economy & resource management
- Biomaterials
- Print, IT, congress and event management

Today, Michael Carus is considered to be one of the leading experts and market researchers in Europe for agricultural resources, bioenergy and especially for the material/industrial use of renewable resources. He is actively involved in building networks in the fields of agricultural and forestry resources, biomaterials (bioplastics, natural fibre reinforced plastics, WPC and other innovative wooden materials) and industrial biotechnology/biorefinery. Mr. Carus is a member (partly in leading functions as managing director or advisor) in many societies, associations and international organisations.

Use of natural fibres in modern industrial applications like automotive, construction, insulation, furniture, consumer goods and pulp & paper. Market data (volume, prices) from different studies between 2005 and 2009 including domestic (hemp, flax, nettie) and exotic (Jute, Kenaf, Sisal, Abaca, Coir). Natural fibres reinforced plastics (NFRP) are produced in different technologies like compressing moulding, extrusion, injection moulding. Basic facts on properties and competition.

Examples: Pictures of many different NFRP which are already produced and introduced in the market, some examples of well established products. Also insulation and construction products are shown.

Environment: Ecological benefits of the use of natural fibre products substituting fibre glass


Price developments of natural fibres compared to other natural and fossile resources.

Potential: Potential markets and applications for NFRP and other natural fibre products depending mainly on oil price, technical development and political framework.
Mr George O’Malley, CEO of BioRefinery Ireland, holds an Hons B.Sc having majored in pure mathematics. His involvement in biorefining began with the EC Fifth Framework Programme and he is generally credited as being the first in Ireland to recognise and promote the importance of biorefining as a sustainable means of providing society’s future needs for fuel, biochemicals and materials.

BioRefinery Ireland has advanced plans to establish biorefineries in Ireland and the UK focussing primarily on grass. BioRefinery Ireland has a well established network of industry and academic partners throughout Europe. Mr O’Malley is one of four industry directors of an Irish government initiative to establish a competence centre focussing on bioenergy and biorefining.

The possibility of using grass as a feedstock for biorefining is only recently being realised. For Europe and beyond it offers real possibilities for the sustainable co-production of energy, feed, chemicals and materials. In particular the fibre fraction of grass has many applications from its use as a horticultural substrate substituting for rockwool, to insulation, packaging and automotive-acoustic applications.

Grassland agronomy, management and supply chain logistics are advanced. Cultivation demands are minimised, carbon sequestration is significant and biodiversity conservation is provided for.

Will Newby graduated in 2008 with an MEng in Mechanical Engineering. He is part of the research team at Exeter Advanced Technologies research group within the School of Engineering, Mathematics and Physical Sciences at the University of Exeter. He is currently the lead researcher on the TSB funded ECOBRAKE project.

ECOBRAKE is investigating the development of friction linings from environmentally friendly materials; in particular, hemp fibres and a resin derived from Cashew Nut Shell Liquid. The technical approach used to develop the new friction materials has encompassed mechanical, thermal and rheological characterization techniques.

Commercially available hemp fibres and a Cashew Nut Shell Liquid (CNSL) resin have been used to produce friction materials for rail applications using a novel, low-energy manufacturing process. This work examines the effect of hemp fibre content on the mechanical properties and friction and wear performance of rail brake pads.

Dr.M.Sivaraja was born on May 03rd 1974 at Erode, Tamilnadu, INDIA. He completed his B.E degree in Civil Engineering from Madurai Kamaraj University, India during 1995. He was the Gold Medalist in his M.E Structural Engineering from Government College of Engineering, Salem, India during 2001. He completed his Doctoral program (Ph.D) in Civil Engineering (Concrete Composites) during 2008 from Anna University, India.

He is having 4 years of industrial experience and 10 years of teaching experience. Now he has been working as Assistant Professor in Civil Engineering, Kongu Engineering College, Erode, Tamilnadu, India. He has done many consultancy and testing works for various industries in the area of Materials, Concrete Technology, Soil and Foundation Engineering and Surveying etc., His area of interests are Natural Fibre Reinforced Composites, Disaster Resistant Structures, Structural Health Monitoring, Multifunctional Cement Based Smart Materials etc.

Conventional methods using in-situ techniques are found to be economical and more practical for low cost housing of slums which generally consists of low rise structures. Here bio composite pre-cast concrete panels for roofing and walls are developed. Bio-composites are sandwiched in between the concrete layers. The sandwich may be either in a single layer or double layers.
In the 1930’s Aero Research Limited of Duxford developed a cotton fibre phenol formaldehyde matrix composite, which was subsequently developed into the flax reinforced Gordon Aerolite. This material was used to fabricate an experimental wing spar for a Blenheim bomber and a fuselage for a Spitfire – true ‘aerospace’ applications. However, by the late 1940’s, research into natural fibre reinforced composites (NFRCs) had ceased, with the advent of glass-fibre. Over the past decade or so there has been a huge resurgence of interest in NFRCs. Early reports in the 1908s stressed the remarkable mechanical properties of fibres such as flax, but we have yet to see such impressive properties translate to the composites made from these fibres.

Composites can be manufactured that exhibit good stiffness values, but strength and in particular toughness properties are not what would be required for performance applications. In our research in the late 1990s we became aware that a major problem with natural fibres was the presence of compressive defects in the cell wall. These acted as points of weakness in the fibre, and produced stress concentrations in the matrix leading to premature failure. Lack of fibre pull-out in impact studies resulted in very poor toughness properties. The fibre-ends exhibited brittle fracture. These compression defects arose not just as a result of fibre processing, but were even found to occur within the plant when single cells were extracted with the mildest of maceration techniques. Fibre processing is also an area that requires extensive research, the techniques that are in general use are not particularly advanced technically or result in fibre damage. Natural fibres are susceptible to moisture, which may be a problem in certain applications.

Compared to glass fibres, natural fibres do not exhibit impressive aspect ratios, which combined with the above mentioned defects result in rather poor reinforcing properties. What can we as a research community do about this? A major advantage of natural fibres is the chemical reactivity of the cell wall components. We can exploit this to modify properties, using for example acetylation to bulk the fibres and remove moisture loving hydroxyl sites, but much more sophisticated chemistry can be exploited and some ideas will be presented. Can we improve our processing and combine this with annealing to remove the compressive defects?

We can’t change the aspect ratio, but we can deconstruct the fibres and work with the reinforcement within the fibres – the microfibrils. Much more attention has recently been focussed on utilising plant-derived materials to form the matrix. Maybe with the right surface chemistry we can dispense with a matrix altogether? Surely over the next few years we will begin to see some high performance composites derived entirely from renewable resources.

Callum Hill graduated with a First Class Honours Degree in Chemistry from the University of Bristol in 1977. After working as a technician at the Bristol Royal Infirmary, he then took a post as a research officer in the School of Materials Science at the University of Bath working on the degradation of PVC. He then went to Bristol Polytechnic (now University of West of England) where he researched the use of organic semiconductors as gas sensors, gaining a PhD in this area in 1985. He then spent two years at the University of Bristol working on non-aqueous colloidal systems and then moved to Bangor University where he studied the non-linear optical properties of organo-metallic compounds. In 1994, he went to work in the then School of Agricultural and Forest Sciences at Bangor University, first as a Lecturer in Wood Science and in 2001 a Senior Lecturer in Renewable Materials. He took up his present post of Professor of Materials Science at the Centre for Timber Engineering Edinburgh Napier University in 2007. Professor Hill has published over 80 peer review papers, more than 50 conference papers, as well as authoring a book on wood modification.

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We can’t change the aspect ratio, but we can deconstruct the fibres and work with the reinforcement within the fibres – the microfibrils. Much more attention has recently been focussed on utilising plant-derived materials to form the matrix. Maybe with the right surface chemistry we can dispense with a matrix altogether? Surely over the next few years we will begin to see some high performance composites derived entirely from renewable resources.
Eduardo ACHÁ, graduated in Civil Engineering at University of Federal São Carlos (1999)- Brazil, Specialist in constructions systems at University of Federal São Carlos (1999)- Brazil, Master degree in Civil Engineering (Structures area) at Pontifical Catholic University of Rio de Janeiro (2002)- Brazil, PhD Research student at Pontifical Catholic University of Rio de Janeiro in Progress and consultant in numerical analysis of high risk structures for Hydroelectric Plans.

Natural fiber like date palm fiber can be used as reinforcement material in composite. This work characterizes the Date palm fiber–polypropylene (DPF-PP) composites. Also examine the effect of surface treatment like alkalization on mechanical properties for DPF-PP Composite material.

Dr Mizi Fan spent the early part of his career as a University Lecturer in natural fibre and composite subjects before receiving his PhD from the University of Wales, UK in 1994. He then carried out research at the UK Building Research Establishment for a period of 12 years before re-entering higher education as Lecturer at University of Bath and then Senior Lecturer and Head of Research of Department of Civil Engineering at Brunel University. In 2004 he was appointed a Visiting Professor in the College of Material Science, FAF University, and for many years a Fellow of Institute of Wood Science, IOM3.

He teaches all aspects of civil engineering materials, construction and sustainability to undergraduate and postgraduate students, and his principle research interests have included fibre science and technology (nano cellulose), wood and non-wood based composites, recycling and sustainability in construction. He is author, or co-author, of over one hundred and ten technical papers and author of two text books on natural fibre composites and new products, and management, recycling and reuse of waste composites. He is currently the Technical Leader for the TSB funded NATCOM (Optimally Efficient Production of High Strength Natural Fibre Composites) research programme.

NRC3 Brunel University, UK is engaged on an extensive programme of research aiming at a better understanding of the properties of nature fibres and composites, and establishing methods of improving its strength and optimising its utilisations. Many important outcomes have been achieved and this paper is an attempt to reveal the failure mechanisms of elementary nature fibres and hence develop high strength composites for application in construction.

Ian Pritchett BSc(hons) is Chairman and Technical Director of Lime Technology Ltd., a company dedicated to pushing the use of traditional lime based building materials into the new build market, as ecological alternatives to cement based products. Ian is involved in developing low energy building materials through research projects at Bristol, Bath and Bradford Universities. These are centred around natural soils, clay, chalk and lime binders with natural aggregates and plant fibre reinforcement (e.g. unfired earth blocks and Hemcrete®).

Ian is an acknowledge expert in the field of traditional, low energy building materials and gives numerous lectures on the subject. Lime Technology have been involved in supplying lime based materials to hundreds of new building projects including the new Channel Tunnel Rail link Terminal at St Pancras Station, the new National Trust headquarters, the new Amnesty International office, the new Adnams Brewery Distribution centre, the CAT WISE project, Clayfield Housing project at Elmswell for Orwell Housing Association as well as numerous other schools and social housing schemes.

UK grown industrial hemp shiv (woody core of the stalk) is being mixed with lime based binders to make bio-composites for wall construction with excellent thermal properties and that lock up carbon dioxide. This offers a new way to reduce the carbon footprint and operational energy of buildings.
Microstructural and mechanical aspects of bagasse fibre reinforced epoxy composites at liquid nitrogen temperature
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Optimisation of interfaces in biodegradable and natural fibre composites
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Characterization of date palm fibre-polypropylene composite material
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Dr S.K. Acharya is at present working as an Associate Professor in mechanical engineering, NIT rourkela-769008, Orissa, INDIA. He has published about twenty five research papers on composite materials on various international and national journals. He has guided about 23 ME and two PhD students. His current area of research is natural fibre polymer composites for tribological applications. The present experimental investigation deals with the mechanical behaviour of bagasse fibre reinforced epoxy composite at cryogenic temperature. Fibers of 10, 15 and 20 Wt. % were reinforced with epoxy matrix to prepare the composites. This work also examines the effect of fiber treatment on mechanical properties of epoxy laminates.

Dr Alma Hodzic is a Senior Lecturer in Department of Mechanical Engineering at The University of Sheffield, UK. Dr Hodzic has taught and performed research in the areas of Advanced Composite Structures, Nanocomposites, Engineering Materials and Aircraft Design since 1997. She holds her PhD in Science of Engineering Materials from The Australian National University, and BSME in Aeronautical Engineering (Dipl. Ing.) from The University of Belgrade. Dr Hodzic manages Composite Systems Innovation Centre (CSIC) at Kroto Research Institute at Sheffield. The main focus behind multidisciplinary projects of CSIC is to improve the environment by replacing traditional technologies with sustainable composite structures. Dr Hodzic is the editor, author or co-author of over 50 peer reviewed publications and two patents. She is currently an active Fellow of Institution of Mechanical Engineers, Fellow of Institute of Materials, Minerals and Mining, Member of Royal Aeronautical Society and Intreader for Australian Research Council.

Interfaces in natural fibre composites are studied with the emphasis of increasing the interfacial shear strength and subsequent improvement of stiffness and strength for engineering applications. The improvements in properties arising from the presence of transcrystalline region, modifying agents, types of natural fibres and various bio-matrices show that biodegradable composites are able to match the properties of their thermoplastic synthetic counterparts.

Ahmad Alawar was born in Alain in United Arab Emirates, on May 31, 1973. He graduated from Sultan Qaboos University, Muscat, 1996. He was honored a scholarship from UAE University to pursue his masters and Ph.D. Studies. He received his masters degree in mechanical engineering from University of Southern California, 1999, followed by Ph.D. in Material Science from the same university.

Currently, he is filing a position of assistant professor in the faculty of mechanical engineering at United Arab Emirates University. His teaching and research interests fall into the domains of Composite Materials, Metallurgy, Creep, Natural Fiber applications and Intelligent Design and Manufacturing. His employment experience included Abu Dhabi Marine Operating Company, ADMA OPCO, Etisalat- a Telecommunication Company, and Teaching and research assistant at United Arab Emirates University.

Natural fiber like date palm fiber can be used as reinforcement material in composite. This work characterizes the Date palm fiber -polypropylene (DPF-PP) composites. Also examine the effect of surface treatment like alkalization on mechanical properties for DPF-PP Composite material.
David Jesson: Having read Materials Science and Engineering for my first degree, I was awarded a PhD for research on the reinforcement of polymers and polymer matrix composites with organically modified silica (ormosil) nano-particles. I am currently a Research Fellow at the University of Surrey and have worked on a variety of projects with materials ranging from cast iron to advanced composites.

The themes that have run through this work are the characterisation of mechanical properties and the use of statistical methods, particularly Weibull, in order to compare the properties of ostensibly non-similar sample sets. In addition to several long term projects, I am establishing a body of work looking at natural fibres for composite materials.

I am a member of the Institute of Materials, Minerals and Mining (ProfGradIMMM) and of the Institute of Physics (MInstP).

Natural fibres, particularly those which originate as waste materials from other industries, are of interest to manufacturers as an easily sourced material, from which a composite material could be produced. The current work considers the mechanical properties of one such fibre, specifically their strain rate dependency.
Eshrar Latif is currently doing his MPhil/PhD on ‘Potential for bio-based insulation in the UK’ in UEL in collaboration with the Centre for Alternative Technology. He is also involved in the project on ‘Energy efficient bio-based natural fibre insulation’ (2008-2011) with Bio-Composites Centre Bangor University, University of East London and others.

He has an MSC in ‘Planning Practice and Research’, an MSc in ‘Architecture: Advanced Environmental and Energy Studies’ and a professional BArch. He has six years’ experience in varieties of architectural projects including residential design, extensions, restaurant conversions and refurbishments. At present, he is also participating in a certificate programme on ‘A Systems Approach to Product and Service Design’ at Cornell University in New York.

Hemp based thermal insulation has the potential to reduce CO2 emissions from buildings and to be ‘carbon-negative’ in its production and manufacture. The environmental and functional performance of hemp insulation can be improved in several ways and this paper describes work on these aspects.

Majid Ali completed his bachelor’s degree in civil engineering with honours in 2004 and master’s degree with first position in 2006 with specialization in structural engineering from the University of Engineering and Technology, Taxila, Pakistan. He was awarded Crescent Gold Medal for the best performance in bachelor’s final year examinations. He joined National Engineering Services Pakistan (NESPAK), one of the leading consultant organizations of Pakistan, as a structural engineer in 2004. His duties were the structural designing of RCC buildings (institutions, schools, colleges, hospitals, and flats etc) and some infrastructure structures (water tower, underground water tanks, retaining walls etc) with the help of StaadPro, Microsoft excel, AutoCAD and Etabs/SAP. He also worked on international projects (Supported by the Government of Pakistan).

During his employment in NESPAK, he was offered a regular employment in 2005, Honorarium for the year 2005-2006, Accelerated Promotion in 2007 and Letter of Appreciation for the year 2007-2008. His interest developed on the use of natural fibres in concrete in early 2008. His first publication “Natural fibres as construction materials” was published recently in NOCMAT 2009. The young researcher aims to introduce natural fibres reinforced concrete as a constructional material for structural members in earthquake prone areas.

This paper presents the literature review, about the properties of natural fibre reinforced concrete (NFRC). The aim of this review is to compile the available data of different NFRCs evaluated in last few decades, and thus, it can be used as a reference/guideline for upcoming research for a particular NFRC.

Carmen Galán-Marín: Assistant Professor of the Department of Building Technology of the Escuela Técnica Superior de Arquitectura of the University of Seville (Spain). Entitled as architect in 1995, she has specialized in new materials and technologies applied in architecture and construction. She has formerly developed research on polyester composites and moved later to bio-composites and earth construction. Focused on the applications of new materials for prefabrication and evaluation of prototypes is currently the Director of construction research for the University of Seville team for solar decathlon competition 2010 (to design, build, and operate the most attractive and energy-efficient solar-powered house).

She has presented several papers and contributions in international conferences and made various publications in books and journals. Member since 1999 of AEMAC (Spanish Association for composite materials).

She has been visiting professor at Germany (Hanover University), the Netherlands (Faculty of Building and Architecture of Eindhoven) and Great Britain (South Bank Polytechnic of London and University of Strathclyde – Glasgow). She has undertaken various stays for studies abroad in the University of Porto (Portugal), Politecnico di Milano (Italy), the Department of Architecture and Planning, Queen’s University of Belfast (United Kingdom) and the University of Krakow.

Wool - a natural animal fibre available in abundance but no longer widely used in local textile industry has been used to improve earth construction. This work examines the feasibility of using this animal fibre in conjunction with a soil matrix to produce a composite material suitable for wet climatic conditions.
Martin is Reader in Materials in the Department of Mechanical Engineering at the University of Bath and Deputy Director of the BRE Centre for Innovative Construction Materials. He has published extensively on the structure-related properties of cellulosic materials and is well known for his work on the fatigue of laminated wood for wind turbine blades and bonded-in connection technology for timber.

His first paper on natural fibre composites was published in 1983 (http://staff.bath.ac.uk/mssmpa/) and research is focussed on high fibre volume fraction composites in thermosetting and thermoplastic matrices. Recent publications are concerned with the fatigue of sisal-epoxy composites, the design of co-cured joints for natural fibre composites and a study of interfacial bonding in sisal-PLA matrix composites. Martin is a past-president of the Institute of Wood Science and is a Fellow of IoM3.

The paper is concerned with the evaluation of jointing techniques for high volume fraction natural fibre composites based on well aligned sisal fibres in an epoxy matrix. In-line and moment-resisting joints were manufactured by hot pressing and high integrity joints were formed with applications in the automotive and construction industries.
The aim of this paper is to outline ways in which one might achieve a 25%-30% reduction in market price across the board, increase supply chain profits and increase the volume of supply to meet potential demand.

The hemp fibre industry will succeed or fail on its ability to provide a constant supply of consistent quality fibre and hurd at a competitive price. While the technical attributes of both hemp outer long bast fibre and inner short fibre (hurd or shive) are considerable, some end use manufacturers are reluctant to develop products that benefit from those attributes because there is no guarantee of sufficient or expanding supply or a competitive price.

For example, the present world price for grade 2 fibre (suitable for non-woven textiles) set by European production, is 20% higher in price than most other similar fibres. If the price of grade 2 hemp fibre was 20%-25% less than the present world price and a consistent quality and supply assured, manufacturers could focus their processing and product development on the utilisation of hemp fibres unique characteristics resulting in increased efficiency and further cost savings to the manufacturer.

For every unit of demand for fibre one must grow, harvest, transport, process, store and sell four (4) units of hurd. In simple terms four fifths (80%) of the time, labour and energy is expended on the Hurd. Therefore it is crucial that markets and products are developed to utilise the hurd, and at a level that are relative, in volume, to the consumption of the outer long fibre. The key to a successful industry is how one manages and profits from the hurd and not just the fibre.

There are many sectors in present farm-to-finished product value chain that have both inefficiency and waste. The following approach is designed to reduce those inefficiencies but maintain or increase the profit within each sector. Obviously a company with the appropriate technology will stand to benefit by maintaining/increasing profits and increased volume of production. This is where the Greatest Opportunity Exists.

Therefore, the aim of this paper is to outline ways in which one might achieve a 25%-30% reduction in market price across the board, increase supply chain profits and increase the volume of supply to meet potential demand.

Areas capable of greater efficiencies exist across the entire value chain, potential targets are:

1. 12% Lower cost of raw material by achieving a 20% higher crop yield.
2. 15% Higher proportion of fibre to hurd ratio in plant genetics.
3. 30% Lower cost of production in harvesting and handling to mill and
4. 25% Lower cost of Stage 1 processing “classification” of raw materials.

Before I go into these 4 points in detail I will give some background into both the Hurd and Fibre pricing and production.
Nancy Hati is a Scientist in the Wood and Biofibre Technologies team at Scion in Rotorua, New Zealand where she has worked for 2 and a half years. While at Scion she has worked on improving mechanical properties of wood reinforced biopolymers, modifying resin application technologies for the MDF (Medium Density Fibreboard) industry and visualisation techniques regarding resin adhesive distribution on fibres and within MDF boards.

Nancy has always had an interest in Matauranga Maori (traditional knowledge of the indigenous people of New Zealand) regarding the use of indigenous plant leaves and fibres such as Harakeke (New Zealand Flax, Phormium tenax). It was this interest that inspires her current project of researching alternative indigenous fibres. Fibres that were valued by traditional Maori for customary use in ropes, bindings, baskery and mat work and examining whether the properties that the plants were valued for are suitable for future application. Her research extends into understanding protocols and sensitivitys when working with Maori people and registering proper acknowledgement of cultural input.

Fibre-based composites are more eco-friendly and demonstrate competitive performance when compared to petroleum-based composites. This research compares an alkali and a traditional Maori method of extracting fibres to determine microstructure, lignin and mechanical properties of the fibres. Cordyline australis and Freycinetia banksii fibres produced the best results for composite manufacture.

Zaida Ortega is a Chemical Engineer of Las Palmas de Gran Canaria University (Spain). Last year she has started her PhD studies at the same university. She has been working in “Procesos de Fabricación” (Manufacturing Processes) research group for the last two years. This group has two main research areas: rapid prototyping and new materials development, and supplies also services to local companies. This group is formed by a number of Mechanical and Chemical Engineers and some Industrial Designers too. The group is involved in several research projects; one of these projects is Badana’s project, entitled “Development of an automated process to extract the fibres from the waste of banana food production for exploitation as a sustainable reinforcement in injection – and rotomoulded products”, financed by the Seventh Framework of the European Union, and that started on July 1st. However, this research group have had some experiences before starting this project, for about one year.

In this work different chemical treatments have been applied to banana tree fibre to improve the fibre-plastic matrix compatibility. Mechanical properties of the composite have been tested.
This paper outlines the use of hemp bast fibres in a variety of composite material applications including reinforced thermoplastic polymers, reinforced thermosetting polymers, and reinforced cement materials. In addition, a novel, cost effective method for decorticating industrial hemp is highlighted.

Industrial hemp (cannabis sativa) has significant potential as a reinforcing fibre in composite applications due to its good mechanical properties, light weight and environmental benefits. This paper outlines the use of hemp bast fibres in a variety of composite material systems including reinforced thermoplastic polymers, reinforced thermosetting polymers, and reinforced cement materials. In addition to characterizing the relative mechanical performance of these materials, this paper highlights a novel, cost effective method for decorticating industrial hemp feedstocks based on chopping, milling and screening methods. Characteristics of the resulting fibres processed are discussed.

Dr. John Wolodko is Program Leader of the Polymers & Composites Group at the Alberta Research Council in Edmonton, Canada. His areas of expertise include advanced materials; mechanical & structural testing; polymer processing; product design; and failure analysis. Prior to joining the Alberta Research Council, he was a Senior Research Engineer with the Centre for Engineering Research, and has worked in both academia and as a consulting engineer in the oil & gas, pipeline and construction sectors. Dr. Wolodko also holds an adjunct professor position in the Department of Chemical and Materials Engineering at the University of Alberta.
New future and perspectives for natural fibres in high level technology industries and the effects on producing poverty alleviation

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Alain Bourmaud was born at Nantes, France, on February, 4, 1969. He is a research engineer in Material Engineering Laboratory of Brittany (LIMATB) in Lorient, France. This laboratory is specialized in elaboration and characterisation of biocomposites. Specific methods have been developed in LIMATB in order to determine mechanical properties of single vegetal fibres and to evidence fibre-matrix interfaces properties of biocomposites.

Alain Bourmaud has obtained a master specialized in polymer engineering at the Jean Monet University, Saint-Etienne, France in 1993. Actually, his main research topic is the knowledge of mechanical behaviour of vegetal fibres and more especially flax fibres. These researches are carried out by using nanoindentation, tensile tests on single fibres and atomic force microscopy (AFM). Alain Bourmaud is specialized in nanoindentation on polymers and vegetal fibres. He has written or co-written around 10 papers in international reviews during the last 4 years.

For 1 year, Alain Bourmaud is studying for a PhD on the knowledge of mechanical behaviour of flax fibres.

Nanoindentation tests have been performed on flax fibers sections in order to study the influence of retting, enzymatic treatment and location of the fibers into the stem on mechanical properties. The first results evidence the interest of nanoindentation but highlight some questions linked to the specific structure of fibers.

Hemp fibre circular tubes for structural applications

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The use of natural fibres as reinforcement in polymer composites has generated much interest in recent years due to implementation of environmental legislation and improvements on natural fibre performance and process-abilities. This research investigated the use of natural hemp fibre as reinforcement for producing fibre reinforced Sheet Moulding Composites or Compounds (SMC) as an alternative to glass fibre in an industrial scale application which ranges from building construction, automotive, to aerospace. The work shows that the natural hemp fibre SMC (H-SMC) achieved equivalent level of the mechanical properties of the glass fibre SMC.

Dr Ren is a senior lecturer in the School of Engineering and Technology, University of Hertfordshire (UH). Ren’s expertise covers composite and functional nanomaterials in the application fields of energy, transportation and healthcare. His grants awarded during the past 8 years are about £500K. Ren’s first degree (1983) is in organic chemical engineering in China and worked for PetroChina Oil Research Institute and Beijing FRP R&D Institute before he came to QMUL as an academic visitor in 1993 with British Council SBSF award working fibre reinforced polymer composites for improving mechanical and fire performance. His PhD (QM, 94-97) was on fibre reinforced ceramic silicates composites.

He was RA on a number of projects sponsored by Industry, EPSRC, BAE in polymer, ceramic composite materials for fire barrier and high temperature aerospace mould systems. He worked at QM during 01-08 as a Senior Overseas Tutor & Senior Research Fellow until Jan 08. Ren’s current interests include composites (rotor blades, fire resistant materials and LLW material management); natural fibre composites; absorption of electromagnetic waves/radiation for concealed weapon detections; antimicrobial nanomaterials for fabrics and medical devices; petrochemicals savings through nanoaditives. His recent EPSRC grant was on natural fibre surface treatment for better applications in aerospace, automotive and building constructions.
Nanoindentation contribution to mechanical characterization of vegetal fibers
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Hemp fibre circular tubes for structural applications
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Wetting behaviour and surface energy of coconut (coir) fibres
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Ngoc Tran was born in Cantho City, Vietnam. He earned his Bachelors degree in Chemical Engineering from HoChiMinh City University of Technology, Vietnam; then Master degree in Materials Engineering from Katholieke Universiteit Leuven – Belgium in 2004.

Ngoc has spent 4 years working as assistant lecturer and researcher at Cantho University – Vietnam. He had worked for some research projects such as: ‘Vietnamese natural fibres for construction materials’, ‘Research and development of polymer composites based on natural fibres’…

Since 2008, he has been working as PhD researcher in the Composite Materials Group of Katholieke Universiteit Leuven. His research topic focuses on ‘Polymer Composites based on Coconut Fibres’

Wetting behaviour of coconut fibres is studied by contact angle and sorption measurements using the Wilhelmy technique. The dynamic contact angle is investigated at different immersion speeds. Besides, water sorption of the fibre is studied to determine its effect on the contact angle measurement. From the contact angle of coconut fibre with different probe liquids, the surface energy is calculated.

Alain Bourmaud was born at Nantes, France, on February, 4, 1969. He’s research engineer in Material Engineering Laboratory of Brittany (LIMATB) in Lorient, France. This laboratory is specialized in elaboration and characterisation of biocomposites. Specific methods have been developed in LIMATB in order to determine mechanical properties of single vegetal fibres and to evidence fibre-matrix interfaces properties of biocomposites.

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Bartosz Weclawski holds a master degree in structural materials and biomaterials from Gdansk University of technology. In 2007 he took part in a project at the Institut de Chimie de la Matière Condensée de Bordeaux aimed at development of more economic processing route for silicate carbide filaments reinforced titanium composites for aerospace applications. Since 2008 Bartosz started PhD research at Brunel University, aiming at improvement of natural fibres reinforced composites. At the moment he is focusing on hemp fibres reinforcing biocomposites as a prospectus durable and load bearing material. His interests are composites, biomaterials, their structural design and processing.

A comprehensive programme has been carried out to develop novel natural fibre circular tubes. A series of 3-D products have been manufactured by using the developed processing technologies and characterised to establish correlations between the processing and parameters of raw material and the performance of final composite products.
Paul Knox is professor of plant cell biology in the Centre for Plant Sciences at the University of Leeds. He has long term interests in plant physiology and biochemistry and particularly the structures and functions of plant cell walls in relation to both plant growth and development and also in relation to their importance for food and fibres. His main research strategy is the generation and use of molecular probes (including monoclonal antibodies and carbohydrate-binding modules) to detect cell wall polysaccharides in situ in plant materials including fibres using a range of microscopy procedures.

In the context of plant-derived fibres the areas of studies include understanding how the polysaccharide components of fibre cells (celluloses, hemicelluloses and pectins) impact upon final fibre properties and also the identification of polymers that bind bast fibres, such as those obtained from hemp and flax, into stem tissues. This latter research is aimed at developing improved procedures for fibre isolation.

Widely used plant fibres are plant cells with thick secondary cell walls. We are interested in the polysaccharide composition of natural plant fibres from the perspective of plant cell walls. We are developing cell biological methods to determine the structure-function relationships of fibres and their component polysaccharides in the context of their use as textiles and other materials.
Rob Elias is a commercial manager at the BioComposites Centre and has a major interest in the development of bio-derived materials that reduce global warming potential. He has an industrial and academic background in natural fibre production. His expertise includes biocomposite production, biomass extraction/chemical composition and product development. To help companies develop new biodegraded technologies Rob set up and established the BC’s Technology Transfer Centre on Anglesey. Using the pilot scale facilities at the Tech Transfer Centre companies can demonstrate their ideas by developing prototype materials.

Rob currently manages 4 TSB projects working with companies to develop new packaging materials and construction products. His current research interests include biocomposite production, biomass extraction/chemical composition and product development. To help companies develop new biodegraded technologies Rob set up and established the BC’s Technology Transfer Centre on Anglesey. Using the pilot scale facilities at the Tech Transfer Centre companies can demonstrate their ideas by developing prototype materials.

There are increasing opportunities to develop products from waste natural fibres. This paper will focus on recent R&D into the use and development of waste MDF fibres for applications in MDF, insulation materials and wood plastic composites. The work was part of a WRAP funded project completed in 2007.
Steve Eichhorn graduated in Physics from the University of Leeds in 1993 and subsequently completed a Masters degree in Paper and Forestry Industries Technology at Bangor and UMIST in 1994/5. He then went on to do a PhD degree, graduating in 1999 on the subject of the “Deformation Micromechanics of Regenerated Cellulose Fibres”. His academic appointments have been as a temporary Lecturer in the Department of Paper Science (then separate from the School of Materials) in 1997-8 and as a Visiting Research Scientist from 1998-1999. After this period he went to work under the supervision of Professor Bob Young as a postdoctoral research associate (1999-2002) and was appointed as a Lecturer in the Materials Science Centre in 2002 and is now Reader.

His research interests are at the interface between natural and biomaterials research with particular emphasis on cellulosic materials and composites. Dr Eichhorn has particular expertise in the use of Raman spectroscopy, synchrotron x-ray diffraction and molecular dynamics/mechanics modelling of polymeric materials. He is a member of the ACS Cellulose and Renewable Materials division, the Institute of Physics and the Royal Society of Chemistry. He is also the Program Chair for the Cellulose and Renewable Materials Division of the American Chemical Society.

The use of Raman spectroscopy to follow the local stress state in natural fibres (both nanosized and micron-sized) in composite materials will be presented. This technique will be shown to assist greatly in the validation of theories of adhesion, and is also a quantitative approach to assessing the local deformation mechanisms in natural fibre composites.
Salum Shamte is one of the leading authorities in the sisal industry in the world. He is from Tanzania. He is the Managing Director of Katani Limited—a private company dedicated to the development of the sisal industry.


He spent the 80’s working in London, from where he was coordinating the marketing of Tanzania’s sisal products worldwide. On his return to Tanzania in 1990, Salum Shamte and his colleagues decided to dedicate their efforts in Research and Development for sisal to determine new uses and new markets.

Katani Limited was able to construct a commercial size biogas/electricity generation plant using the sisal biomass at its Hale Estate. This is the first of its kind in the world. On the fibre front the focus has been to develop sisal for specialty pulp and paper; in padding and insulation and in composites. Salum Shamte has been at the forefront to explain the case of sisal not only for Tanzania but for the rest of the world.
Mechanical behaviour of natural sisal fibers

Flávio de Andrade Silva is a visiting researcher at the Institute of Construction Materials – TU Dresden. He received his D.Sc. degree in civil engineering from the Federal University of Rio de Janeiro (UFRJ) in 2009 for his dissertation on “Durability and Mechanical Properties of Sisal Fiber Reinforced Cement Composites”. He is a member of ACI committee 544, fiber reinforced concrete and RILEM Committee TDT, test methods and design of textile reinforced concrete and 208-HFC, high performance fiber reinforced cementitious composites. He has more than 8 years of experience in natural fibers and natural fiber reinforced composites research. His research interests also include textile reinforced concrete, high performance fiber reinforced cement composites, green concrete, environmental friendly materials and metal matrix composites. Flávio has published 30 papers in conference proceedings and 5 in international peer reviewed journals. He has a strong international experience which includes affiliations to COPPE/UFRJ in Brazil, Center for Investigation and Advanced Studies of IPN in Queretaro – Mexico (CINVESTAV), Arizona State University (ASU) and Technical University of Dresden in Germany.

The tensile and fatigue behavior of individual sisal fibers was experimentally investigated. The tests were performed on a microforce testing system and the cross-sectional area of the fiber was measured using scanning electron microscope micrographs coupled with image analysis. The fatigue behavior was examined in terms of the stress versus cycles and stress-strain hysteresis behavior of the fibers.

Effect of transcrystallinity on microbond shear strength at sisal fibre – polylactic acid interface

M Prajer & MP Ansell: Bath University, UK

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The paper examines transcrystalline growth of polylactic acid crystals on the surface of single sisal fibre bundles. The matrix morphology at the interface was investigated with hot stage microscopy. The effect of transcrystallinity on the interfacial shear strength (IFSS) was investigated to determine the micro-integrity of bio-thermoplastic matrix composites.

Marek Prajer is a PhD student in the Dept of Architecture and Civil Engineering at the University of Bath supervised by Dr. Martin Ansell. He’s got Master in Materials Engineering at the Institute of Chemical Technology in Prague.

Before starting his PhD he was working in polymer industry. His research interest lies in the field of thermoplastics and thermoplastic composites.

Mechanical behaviour of natural sisal fibers

Influence of the natural fibre coating on interfacial adhesion between the fibres and the polymeric matrix in composites

A Delille, A Bismarck, & A Mantalaris: Imperial College London, UK

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Dr Anne Delille was born on 4 May 1979 in Thionville in France. She studied chemistry and physico-chemistry at the University of Metz and Nancy from 1998 to 2007. Her research activities were in the field of conversion coating of stainless steel surface (master research project at ARCELOR Research, in France) and spectroscopical analysis of bacterial biofilm formation on ATR crystal (PhD research project).

She joined the Polymer and Composites Engineering group (PACE), leads by Pr. Alexander BISMARCK, at Imperial College London in 2008. She currently works on green composite materials by optimizing the adhesion between natural fibres and the polymeric matrix by using bacterial cellulose as reinforcing agent.

The aim of this study is to move to green renewable materials that match the physical performances of traditional ones. Different types of chemical and biochemical coatings of sisal and Lyocell fibres have been investigated to reduce the gap between the fibres and the polymeric matrix in the resulting composites.

The tensile and fatigue behavior of individual sisal fibers was experimentally investigated. The tests were performed on a microforce testing system and the cross-sectional area of the fiber was measured using scanning electron microscope micrographs coupled with image analysis. The fatigue behavior was examined in terms of the stress versus cycles and stress-strain hysteresis behavior of the fibers.
Currently, we are dependent on finite petrochemicals, which are not only going to become more expensive, but are also associated with the release of greenhouse gases. One solution is to increase our use of renewable fuels and materials. Natural and bio-based fibre producers will have to recognise the part they can play in this emerging bio economy.

The renewable carbon in natural and bio-based fibres provides a means to manage carbon in a sustainable manner. Petrochemicals were once living organisms and the carbon they contain is the product of ancient photosynthesis. Petrochemicals are formed over a geological timescale, so their large-scale use for fuels and materials means they are finite on a human timescale. The GHG released by the use of fossil fuels also contributes to climate change. However, by using renewable materials, and thus renewable carbon, we can manage carbon in a more sustainable way and reduce the net gain of GHGs in the atmosphere.

However, sustainability is not enough. The natural and bio-based fibres must have at least as good a performance and functionality as petrochemical derived fibres. It is therefore important to use both natural and bio-derived fibres in ever more challenging applications, and provide a scale of manufacture to rival petro derived products in order to maximise efficiency and economics.

In the future there will a place for natural and bio-based synthetic fibres – one need not be a threat to the other.
Jürgen Steger has an MSc in Biology from the University of Bochum studying the mechanisms of olfaction. He did his Doctoral thesis at the University of Bonn on flax and hemp fibre based technical products and their potentials for a sustainable development. He is a member of EU advisory committee Flax and Hemp (2003 – 2007), a member of COPA/COGECa consultative committee (2003 – 2007), and a member of expert working group Flax and Hemp of the German Ministry for Food and Agriculture (2003 – 2007).

Participating in several national and international RTD projects related to technical bast fibre applications, he has broad experience with bast and hard fibre processing and related production methods and wide eco balancing experience.

Between 2000 – 2007 he was Managing Director of German Natural Fibre Association (DNV), and since 2007 has been Director of SachsenLeinen GmbH. Since 2008 he has been a Board member of German Natural Fibre Association (DNV).

Bast fibres (Flax, Hemp, Jute, and Kenaf) have a long tradition in the textile sector and paper market. The same is for hard fibres (Sisal, Abaca) which are used to make high-quality paper and strong ropes/hawsers. Because of their remarkable mechanical properties, they are standard in automotive applications since many years. This is because of their lightweight potentials and low energy input for production. Both can reduce the CO2-Footprint of individual and public transport of the 21st century.

Nicholas Cronin is presenting this talk.

Jute fibre reinforced composites were prepared using resins based on cardanol, the main constituent of Cashew Nut Shell Liquid (CNSL), a renewable natural resource obtained by the cashew nut. Coupling jute fibres with cardanol-based matrices led to composites characterized by a high amount of natural components.
Yuli Somme, M.A. (Textiles) I have roots in two places: the country of my birth, Norway, and the English county of Devon where I have spent most of my life. These two places have wool deeply embedded in the history and culture, and this is something that seems to run in my ancestry and in my veins.

In the 1970’s I volunteered on organic farms in New Zealand and learnt the art of spinning and weaving.

At Coldharbour Mill in Devon in the 1980’s I worked as a researcher into the cottage weaving industry and at Exeter Art College I turned to making felt. There was no-one to teach me – just my own familiarity with wool as a guide.

Learning ancient techniques from traditional Turkish felt makers in 1999 imbued me with a deeper understanding of tacit knowledge. This I have taken forward into my educational work in schools, and also in the development of a more industrialized felt, using locally sourced wool, and R & D work with Axminster Carpets (Buckfast Spinning Company). My partnership with Anne Belgrave and the forming of our company, Bellacouche, has resulted in an interesting bridge between the hand-made and the industrial felt making process.

Two artists are playing an important part in the greening of the funeral trade by using wool to make felt burial shrouds.
Barbara Marshall CMG is a colour designer and Director of Marshall Design, a multi-disciplinary design practise that specializes in international trend forecasting. Barbara is a Chairholder of the prestigious Color Marketing Group of the USA and a Director of the Pan Pacific Fashion Colour Council. With experience in fibre and textiles from the field to the factory Barbara has clients in the textile, carpet and furnishing industries. Her current projects include developing commercial product ranges from naturally coloured wool and alpaca fibre as well as developing a training package in managing colour standards for natural fibre producers.

The challenges in designing textiles for a trend driven commercial market using only the naturally occurring colours of natural fibres can be considerable. This paper addresses some of the strategies that both growers and users of natural fibres can use to make the most of a limited colour gamut.

Mark Patten is Product Manager for Tradical® Hemcrete® at Lime Technology Ltd., a company dedicated to pushing the use of traditional lime based building materials into the new build market, as ecological alternatives to cement based products.

Lime Technology is involved in developing low energy building materials through research projects at Bristol, Bath and Bradford Universities. These are centred around natural soils, clay, chalk and lime binders with natural aggregates and plant fibre reinforcement (e.g. unfired earth blocks and Hemcrete®).

Lime Technology have been involved in supplying lime based materials to hundreds of new building projects including the new Channel Tunnel Rail link Terminal at St Pancras Station, the new National Trust headquarters, the new Amnesty International office, the new Adnams Brewery Distribution centre, the CAT WISE project, Clayfield Housing project at Elmswell for Orwell Housing Association as well as numerous other schools and social housing schemes.

At the end of 2008 the new Govt. Department of Energy and Climate Change (DECC) decided to fund the construction of a demonstration house at the BRE made from renewable materials. The brief was to use renewable materials to show that high quality and high performance could be combined with affordable price. The National Non-Food Crop Centre (NNFCC) project managed the construction. The house was built using a timber frame, Hemcrete® walls, sheepswool roof insulation, soya based paints and natural fibre rugs and furnishings. The resulting house has a low carbon footprint, low energy use and meets level 4 of the Code for Sustainable Homes.
Kirsi Immonen is a Research Scientist at VTT Technical Research Centre of Finland, where she has worked for eight years. Before VTT she worked at Finnish chemical company, Neste Chemicals, with applied research and processing R&D for different polyester based materials. She graduated as Master of Science from Lappeenranta University of Technology at Applied Chemistry Department in 1991. Her background is in polymer chemistry and for several years her research area is mainly focused on different natural fibre based composites, biocomposites and their processing. She is an author of scientific papers and patents.

Natural fibre composites are becoming more popular as concerns over sustainability increase. Their mechanical properties are not yet comparable to those of synthetic composites for numerous reasons including porosity and poor chemical bonding at the fibre-matrix interface. Filler materials are commonly used in composite materials to reduce costs with minimal reduction in mechanical properties. Lignin is a natural material and also a waste product from many industries including paper manufacture.

Fritz Vollrath received his PhD from the Zoology, Department at the University of Freiburg in Germany. After time at the Smithsonian Tropical Research Institution in Panama and the Zoology Departments at the Universities of Oxford UK, Basel CH and Aarhus DK he is now back at the Department of Zoology at Oxford where he works primarily on spiders’ webs and silk structure-function-property relationships. fritz.vollrath@zoology.oxford.ac.uk

Silk has been used as a textile for thousands of years and yet it is only recently that we are beginning to fully understand its structure.

Ben Wood has been working as a Research Engineer with WMG at Warwick University for the last three years. Past projects include the development of Eco One, an environmentally-friendly racing car which received international media attention. His current research focus is the development of technologies for sustainable motor sport, including high performance biodiesel and biocomposites.

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Characterisation of biocomposites manufactured from natural fibres, sustainable resins and lignin as a filler

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Nanoscale toughness of spider silk

D Porter & F Vollrath: University of Oxford, UK

PLA and PP composites with cellulosic fibres from wood industry and peat

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Dr. Karnik Tarverdi has extensive experience and expertise in developing and using sustainable composites for packaging including recycled composites and the use of nano materials to enhance properties of polymer based materials.

Dr. Tarverdi is involved in many UK Government and European Union funded projects and has been in the forefront of developing and exploitation of continuous extrusion blending technology for the manufacture of composites, he has many patents and published even more papers in compound and machine development for the manufacture and assessment of sustainable composites.

He lectures to MSc. Students on Advanced Materials Processing, including nano composites, at the School of Engineering and Design, Brunel University.

A novel co-rotating intermeshing extrusion compounding process is described for the preparation of biopolymer composites containing natural fibres as low cost and sustainable reinforcing agents.
Failure mechanism of foam cored natural fiber sandwich structures in three point bending

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ABSTRACT:
The results of the experimental analysis carried out on sandwich structures with rigid polyurethane foam (PU) core and different skin materials have been reported. From 3 point bending test facing bending stress (FBS), Core shear stress (CSS) have been evaluated for the sandwich structures. These tests have been conducted on 4 different compositions of the core materials and 3 varieties of skin materials. Comparisons of results have been between the sandwich structures. A macroscopic and microscopic analysis of the fractured surfaces has been made to identify the nature of failure under bending loads. It has been demonstrated that the debonding strength of the core-face and core plays an important role in enhancing the flexural property and controlling of the failure mechanisms. It has been observed that with increasing the debonding strength of the core-face interface, the failure mode changes from debonding of the core-face interface to the failure of the face.

Geotextiles

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ABSTRACT:
Geotextiles is one of the main parts of technical textiles. In this poster, we are highlighting about geotextiles. Experiences of geotextiles have demonstrated that it has extensive application potential in various geotechnical engineering works. They are also capable of providing instant solution under distress situations. Besides the projects detailed in this poster several other experimental projects of diverse nature, employing geotextiles made from both natural & synthetic fibers, have been either successfully executed or are under progress. The laboratory evolution methods for geotextiles used in various civil engineering applications are expected to be designed in such a way that reasonably good correlation between the laboratory test results and the actual field performance is obtained. The test data also helps the design engineers to select a correct type of geotextiles in relation to their application areas. The selection of the geotextiles for a particular design is based on matching the geotextiles ability to perform each of basic functions. Their relative importance in that design application. In 1973 three basic functions of geotextiles were identified namely separation, filtration, and reinforcement shortly afterwards the drainage function is added in the basic function.

Non-woven geotextile fabrics are produced from 100% virgin polymers, needle-punched or spun-bonded to provide maximum permeability and optimum strength. The high permeability, excellent drainage capacity and controlled filtration properties of non-woven geotextile products ideally suit them for drainage and soil filtration applications. Nonwovens geotextiles are extensively used in civil engineering to supply a combination of separation, filtration & reinforcement. Keeping this in view geotextiles have been to be used in various projects either on trial bases or as an effective alternative economical solution. A case history of different projects executed with geotextiles have been brought out. Their popular applications are in river embankments, canals, roads, railways, airports, earthen dam, slopes, ports, harbors docks, drain etc. River bed, canal lining, harbors docks & ports construction, road construction, rural road edge drains, and applications in dams are mentioned. The poster reviews the current scenario covering geotextiles & also focuses attention on the potential future applications.

Synthesis and characterization of CeO2 and Al2O3 obtained by using egg shell membrane as template

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SUMMARY:
Egg shell membranes were used as template for producing biomimetic CeO2 and Al2O3 materials. Characterization of novel materials showed that structure (specific surface, porosity and crystallite size) depends of the temperature of the thermal treatment.

ABSTRACT:
Egg shell membranes were extracted from the fresh chicken eggs. Membranes were washed with distilled water and immersed in 1M solutions of Ce(NO3)3 x 6 H2O and AlCl3 x 6 H2O for seven days. Samples were dried and heated in inert atmosphere (600 °C) for 2h. To study the crystallization process, samples were heated, in air, at different temperatures (600, 800 and 1200 °C). Samples were characterized by nitrogen adsorption measurements, X-ray diffraction, scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDS).

Nitrogen adsorption measurements have shown that samples have developed mesoporosity and that specific surface and porosity decrease with increasing the temperature of thermal treatment. XRD of samples infiltrated by Ce(NO3)3 x 6 H2O reveal that very good crystalline CeO2 is obtained at low temperature (600 °C). But, samples infiltrated by AlCl3 x 6 H2O were still amorphous at low temperatures (600 and 800 °C). At 1200°C samples have shown very good crystalized Al2O3 phase. SEM images reveal fibrous structure of obtained samples at low temperatures (600 and 800°C). At higher temperatures, the microstructures were loosed fiber structure but, the porous structure was retained.

Tensile strength of cotton and coir fibers – an experimental investigation

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SUMMARY:
The natural fibers are a part of the human civilization and they are most important engineering materials for agricultural formers from a long time. Even though formers do not know the principles of science and engineering synthesize the fibers and fabricate the required thing. In this experimentation we have taken the coir, i.e. coconut fibers (exactly the way in which local formers will take) and we have conducted the tensile tests in our college laboratory. And also we have conducted the tensile test on the cotton fibers and we have compared the data with the literature and data available. The coir fibers can replace the conventional fibers like glass.

ABSTRACT:
The conventional fibers. Glass, carbon, boron and Kevlar are being used as reinforcing materials in fibre reinforced plastics (FRP). However, these materials are a challenge to human civilization , by using these materials we are degrading the environment and a great threat to the future generations . Disposability of plastics and the polymer composite are not possible easily and threat to our life’s hence. Natural fibers from plants such as jute, bamboo, coir, sisal and pineapple can be used with natural binding resins . They have very high strength and can be used for many load-bearing applications. These fibres have the advantages of renewable resource and biodegradability. For the present study, two types of commercially available fibers coir and cotton were used to conduct the tensile tests on the spring compression tester in our lab , the testing conditions were at the room temperature , because the formers will fabricate the things at room temperature only. We found that the coir can replace glass fibers and cotton fibers can be used for moderate applications.
Applications of natural hemp and flax fibres
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SUMMARY:
The aim of this project is to bring together a multidisciplinary team of specialists to investigate and further the use of natural renewable resources, such as the hemp and flax, in a wide variety of sectors which include medical, construction, textile, automotive and food industries.

ABSTRACT:
Renewably-resourced natural materials are currently under intense investigation in order to diminish reliance on petroleum based synthetics and non-sustainably farmed natural products. Cellulose rich hemp and flax bast fibres are particularly suitable, sustainable resources for natural biopolymer production and can result in significant reduction of carbon footprint. The bast fibres are cheap, resistant to microorganisms, of high tensile strength and low density and can be blended with synthetic or biodegradable polymer binders to form high strength biocomposites. The whole plant can be utilised for a range of applications in medical, construction, textile, automotive, cosmetic, and food industries. The University of Brighton has brought together a team of researchers with expertise in a diverse but interconnecting range of disciplines and approaches to sustainable materials to establish methods of investigation which are best used in a holistic iterative approach. In order to assess the benefits attained from the entire chain of the bast fibres, a holistic approach using traditional and novel methods which extend from agriculture to the related processes, end-products and waste disposal is adopted. The project comprises of six work packages which include assessment of the ecological impact of growing bast fibres, waste/residue management and life cycle analysis, applications of biocomposites in product design, applications of bast fibres in construction, biomaterial applications and assessment of hemp and flax in the food industry.

Effect of drying and rewetting cycles of cellulosic fibres on Resistance of Cementitious Composites
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SUMMARY:
This work analyzes the potential beneficial effects of subjecting cellulosic fibres to drying and rewetting cycles –hornification process– on the resistance of cured cement mortar composites. Two types of cellulosic fibres have been used for comparison: chemical pulp from softwood and cotton linters.

ABSTRACT:
Besides ecological and sustainability considerations, natural fibres are cheaper and bring to cement or mortar cement matrixes resistance among other benefits. Nevertheless, the use of these cellulosic fibres in vegetable fibre reinforced cement composites (VFRC) is hampered by their low durability and poor adhesion, which in recent years has led to the replacement of these fibres by synthetic ones. The lack of durability of VFRC is mainly caused by the absence of calcium hydroxide on the matrix, which degrades the fibres, and by changes in the environmental moisture, which induce dimensional changes in the vegetable fibres.

It is well known that drying and rewetting cycles principally cause shrinkage of the natural fibres due to the formation of hydrogen bonds in cellulose. This irreversible effect is known as “hornification” and is quantified as the percentage reduction in water retention values (WRV). The reduction in the WRV of the hornificated fibres could have beneficial effects on VFRC. On one hand, the hornificated fibres will have higher dimensional stability, and thus higher fibre-matrix adherence is expected. On the other hand, as a consequence of the lower WRV of these hornificated fibres, a reduction in the formation of incrustations of calcium hydroxide on the surface and lumen of the fibres and consequently a reduction in the degradation of the cellulose in the cementitious matrix are expected.

In this study two types of cellulosic fibres - chemical pulp from softwood and cotton linters- previously subjected to hornification process have been used to prepare cement mortar composites with different composition. The resistance of these composites was tested after 28 days of cure treatment and after four wet-dry cycles. Results indicated that the previous treatment of fibres (hornification process) has beneficial effects on the resistance of the resulting cementitious composites.

Migration of calcium hydroxide particles from the matrix to the cellulosic fibres in cement mortar based composites
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SUMMARY:
This work analyzes the migration of calcium hydroxide particles from cementitious matrix to cellulosic fibres in cement mortar based composites. This effect has been analyzed using two types of cellulosic fibres with different origin: chemical pulp from softwood and cotton linters.

ABSTRACT:
Besides ecological and sustainability considerations, natural fibres are cheaper and bring to cement or mortar cement matrixes resistance among other benefits. Nevertheless, the use of these cellulosic fibres in vegetable fibre reinforced cement composites (VFRC) is hampered by their low durability and poor adhesion, which in recent years has led to the replacement of these fibres by synthetic ones. The lack of durability of VFRC is mainly caused by the presence of calcium hydroxide on the matrix. In this study two types of cellulosic fibres - chemical pulp from softwood and cotton linters- have been mixed with a matrix with high content on cement. The corresponding composites were subjected to four wet-dry cycles and the eventual changes on chemical composition of the fibres and of the matrix were studied. Optical micrographs (Fig.1 Optical micrograph of the softwood fibre filled with calcium hydroxide particles) and X-ray diffraagrams indicated the presence of calcium hydroxide particles in the lumen of the fibres. This migration of the calcium hydroxide particles from the matrix to the inner of the fibre was also confirmed with thermogravimetric analysis.

Characteristic and performance of elementary hemp fibres
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SUMMARY:
A comprehensive experimental study has been carried out to ascertain the properties of elementary hemp fibres. Characteristics, failure modes and strength of elementary hemp fibres have carefully been determined by using microscopic techniques and their correlations established. Many important outcomes have been achieved and presented in this paper.

ABSTRACT:
There have been many investigations of the strength of hemp fibres, however, it is not possible to use or appropriate to compare data reliably from different investigations reported in the literatures. Measuring natural fibres proves to be a great challenge. Micro-structural defects, fibre abstraction (e. g. single fibre) and processing technology are yet to be studied. This
The wetting properties and topography of bamboo fibres (Guadua Angustifolia)

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SUMMARY:
Several controversies concerning the correctness to determine natural fibre surface energy components from quasi-equilibrium contact angle measurements exist at present; therefore, it is not clear if the results derived from wetting experiments can provide reasonable accuracy. This study points out that the large fluctuations in wetting between various bamboo fibres may be due more to the topography of the fibre than to any other type of phenomena.

ABSTRACT:
Many of the phenomenological aspects of wetting processes have been recognized and modeled for synthetic materials, from which surface energy components can be derived. Nevertheless, in the case of natural fibres, there are several difficulties to obtain meaningful data from wetting measurements, caused by their complex nature: liquid sorption, diffusion of extractives, different cross section along the fibre length, chemical heterogeneity, etc. As a result, the wetting behavior of natural fibres is far from the behavior which should ensure the meaningful interpretation of wetting as quasi-equilibrium phenomena.

In this study, the wetting behavior of untreated and autoclave treated bamboo fibres is characterized by use of the Wilhelmy technique; surface topography is examined by AFM, surface chemical components are identified using XPS and sorption is measured by microbalance. Additionally, wetting experiments on PET fibres are conducted in order to compare the wetting behavior of a synthetic fibre with a natural fibre.

The results indicate that the large fluctuations during wetting between various bamboo fibres of the same batch may be due more to the topography of the fibres than to any other type of non-equilibrium phenomena, and it is possible to obtain experimental wetting data on natural fibres with reasonable accuracy, allowing meaningful information on interfacial interactions to be deduced.
ABSTRACT: The study of natural fibers arose due to the need of providing an alternative to the destruction of trees, the use of certain plants provide diverse options to produce paper and at the same time reduce impact to the environment as well as an opportunity of doing extensive research for Art. The re-discovery of paper as a main element in a piece of Art has as objective to identify the possibilities that natural fibers offer in a piece of Art as a support to Photography, Sculpture and Happenings. Also, to identify the contribution of nature give us to create a masterpiece, the beauty of natural fibers and the endless variety of textures, color and transparencies to create a piece of Art. It feels attraction for this material for all that can provide as a way for creativity. The Universidad Técnica Particular de Loja (UTPL) through the Department of Art and Design has "natural fibers" as an objective of research with the purpose of relating Art with Ecuadorian flora. The investigation raises basic processes of elaboration the paper of natural fibers such as the extraction of the fiber, the cooking of the fiber, the preparation of the flesh, molding and drying of the paper as well as an analysis of the behavior of the fibers. For the process of drying the paper natural pigments have been used from native plants such as Avocado, Nogal, Cochilina and some more from the area where the ‘Shuara’ live in the Amazonic province of Zamora Chinchipe, in the process is used traditional tools from Ecuador. It has also been experimented the extraction of different native fibers such as Musa pandanifolia, Agave salinana, Furcaria andina, Andropogon citratos and Guadua angustifolia. Also, we present the results of the elaboration of paper made from natural fibers of no-filament plants which are recoverable in region from 2001. Arkharmerino × Moghani crossbreeds of sheep started in region from 2001. Arkharmerino x Moghani (Amo) crossbreed sheep were produced and maintained at the Khalat Poshan Research Station located in Tabriz, Iran. Before shearing wool samples were taken from the rib region of 125 AmO crossbreed sheep. Each sample was measured for average fiber diameter, fiber diameter variability, staple length, proportion of medullated fiber, proportion of kemp, and comfort factor.

ABSTRACT: Vegetable fibers have several aspects, such as low production costs, biodegradability and great mechanical properties, which make them very attractive in the field of composites reinforcement [1]. The aim of this study is to introduce into a L-poly-(lactic-acid) (PLLA) – hemp bicomposite a new compatibilizer, inspired from mussels’ adhesive capacity [2], to improve the fibers’-matrix bonding. As a first step, we carried out atomic force microscopy (AFM) and surface energy measurements in order to evidence the creation of a polydopamine thin film on the PLLA substrate. Secondly, tensile tests were performed. The first results show a significant increase of the Young modulus and the strength at breaking-point when using polydopamine. Observations made through scanning electronic microscopy (SEM) confirmed an improvement of the fibers-matrix coupling in the presence of poly- (dopamine).

Modification of hemp/clay interface by organosilanes grafting

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SUMMARY: Several fibre treatments have been used to improve fibre/matrix interface in natural fibre composites using raw mineral materials as the matrix. This work examines the effect of fibre treatments on mechanical properties and moisture absorption for hemp reinforced clay containing composites.

ABSTRACT: In order to develop environment-friendly materials, natural bast fibers have been successfully used as reinforcement for composites materials. These renewable and biodegradable fibers have a low density and a low cost. Therefore, they are interesting for various applications, such as in building materials. Nevertheless, the presence of fibers in the fiber/binder composites induces a delay in the setting time of the hydraulic binder and may lead to a modification of the hydration of the silicate phases. Moreover, the alkaline and basic environment modifies the chemical composition of fibers. Our researches consist in optimizing the physico-chemical exchanges at the fiber/clay interface, in concentrated suspensions of cellulose hemp fibers, clay minerals and hydraulic lime. Our aim is to increase the cohesion between the mineral matrix and the cellulose fibers through chemical treatment. We used grafting of organic molecules presenting functional groups able to form chemical bonds between fibers and clay platelet surfaces. In fact, the strengthening of fiber/clay interface may protect fibers against the alkaline attacks and the fiber hydration, which in...
turn may improve the mechanical and physical properties of the final product. Grafting was performed by silane coupling agents including reactive functions (carbonyl, amine, acrylate) on raw fibers and clay platelets suspensions. Si-O-C chemical bonds and Si-O-Si inorganic network between the hydroxy groups of hemp fibers (or of clay platelet surfaces) and silanes have been characterized by different techniques (infrared spectroscopy, differential thermogravimetric analysis, contact angle and asta-potential measurements). Results show that the grafted quantity (on hemp or clay surface) depends on the initial concentration and the chemical structure of the organosilanes. Measurements of the impact of the chemical treatment on the mechanical properties of the final composite are currently being developed.

**ABSTRACT:**

The conventional production of natural fibres from e.g. hemp or flax is based on field drying and retting of fibre straw. At the usual harvest time in September, weather conditions are often problematical for the processing of harvested hemp. A weather-independent post harvest technique is under investigation at the Leibniz Institute for Agricultural Engineering (ATB). The harvest of hemp by means of a chopper followed by an aerorack storage is favourable for the farmer because the weather risk can be avoided. Additional steps are the same as for ensiling of fodder. As a further advantage of this novel processing technology, the whole plant material will be processed to final products like insulation materials and fibre boards or semi products for injection moulding. A pilot plant with a processing capacity of 1 t per hour wet preserved fibre material has been built up at the ATB and is tested at present.

Pilot plant for the processing of wet preserved hemp

The technology of the pilot plant enables the processing of different fibre plants from agriculture (e.g. hemp, flax, kenaf) and forestry. The realized process is a modified dry/half dry process from wood industry adapted to the processing of hemp silage at reduced energy consumption (Fig. 1).

**RESULTS:**

The pilot plant has been put into operation in March 2007 and is tested at present (Fig. 2). First samples such as high and medium density fibre boards have been produced from material mixtures of hemp and wood. According to the current results, the mechanical properties of these samples are comparable with the properties of commercial products made of wood fibres. Silage-like odours of the raw material can be disadvantageous for several end products. First trials have shown that the novel processing technology is appropriate to reduce the content of odorous components. Butyric acids and other odorous acids are released to the exhaust air by means of the thermal treatment of the raw material in the defibrating and drying stage of the process. Therefore, end products do not have any unfavourable silage-like odours. Experiences from construction and testing of a novel fibre processing plant have shown that wet preserved hemp can be processed to high quality fibre boards. The typical weather risk of the hemp harvest can be largely eliminated for the farmer. Also other fibre plants from agriculture and forestry or mixtures of different raw materials can be processed in the pilot plant at reasonable costs. The novel technology is appropriate to establish decentralized processing plants at farm level. Main advantages of such plants for hemp processing will be the alternative income for the farmer, the environmentally sound production of fibre boards and the enrichment in crop rotation.

**Textile innovation and sustainable development: fabrics of the future**

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**ABSTRACT:**

This practice led project explores ways of using sustainable textile fibres, through creative experiments with natural fibres and closed-loop synthetics, to produce sustainable textile products. It will explore the impact of newly developed natural fibres and expand current understanding of the discursive and aesthetic contexts of sustainable textile products. This practice-led project explores innovative ways of using newly developed natural fibres, closed-loop synthetics and Biomimetics to identify and advance their use and in sustainable textile products. The introduction of sustainable textile fibres produced from the bio-polymer process on protein based sources like milk and soya beans, has resulted in new fibres which present new opportunities to explore their potential application within fashion and interiors. Closed-loop production techniques, challenge designers and presents opportunities to explore innovative approaches in creating new appeal for the products they design. This extends to consumer expectation and perception of products which now have an extended, multi-functional role in everyday life.

The environmental impact of the application of newly developed textiles products has lasting consequences. Recent eco-aware design literature indicates that designers could use nature as a means to identify alternative approaches to sustainability of textile design. Biomimetics, uses nature as a design philosophy in response to identified need. Biological research has revealed a firm foundation on which to base theoretical and practical development of high performance textile products. Textile designers’ newly identified responsibility towards the extended life-cycle of the products they design, has been discrete, underdeveloped. Now the tentative articulation of their critical awareness is crucial to the further advancement of design thinking. This practice-based research project aspires to contribute to the current knowledge of textile designers’ approach to design.

**Natural aligned fibres and textiles for use in structural composite applications**

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**ABSTRACT:**

NATEX project is focused on the development of aligned textiles from natural fibres that are suitable for use as high-strength reinforcing fabrics to produce structural composite materials. This includes the incorporation of orientated woven natural fibres in both bio-derived thermoplastics and thermoset resins, to produce high-tech products from renewable resources.

**NATEX project will allow increasing the mechanical properties of bio-composites and introducing them in applications with high mechanical requirements in different sectors, such as transport, energy, agricultural machinery and shipbuilding. Considering the importance of the NATEX final application sectors, the versatility of use of the fabrics in conventional processes, and the current limitations on the use of natural fibres in composites, it is expected that the project results contribute to demonstrate that the replacement of the currently used traditional textiles and non-textiles by natural textiles in the composites sector is feasible that these natural reinforcements have good properties and competitive costs.

The main innovations in NATEX project are:

- Modification of the fibre surface to obtain the desired interface properties when combined with the polymer matrix.
- New spinning process to reduce the yarns’ twisting during the textile manufacturing process, increasing the fibre volume fraction and the wetting of the fibres. This is going to increase the mechanical properties of the yarns.
- To develop new weaving techniques in order to improve impregnation and to obtain innovative 3D textiles.
- To develop new commingling and film stacking for thermoplastic composites, for improving the permeability of the composite and to obtain well mingled yarns.
An innovative concept of fibre plant processing with cost efficient cleaning of natural fibres

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SUMMARY: A new technology for bast fibre plant decortication and processing was developed at the ATB and tested in a pilot plant. The line included all steps from straw bale opening to cleaning and refining of end products. Especially the technological principles of decortication (based on hammer mill) and of fibre cleaning (by comb shaker) were essentially enhanced and improved.

ABSTRACT: Based on the discussion on declining and price fluctuations for fossil resources an increasing demand on renewable raw materials like natural fibres has to be recognized. Improvements at all stages of the value added chain from cultivation to industrial utilization are needed to supply cost and quality competitive fibre materials.

A new technology for bast fibre plant decortication and processing was developed at the Leibniz Institute of Agricultural Engineering Potsdam Bornim and tested in a pilot plant 2001 to 2006. The line included all steps from straw bale opening to cleaning and refining of end products. Especially the technological principles of decortication (based on hammer mill) and of fibre cleaning (by comb shaker) were essentially enhanced and improved.

By reviewing the state-of-the-art of technologies for bast fibre processing it became clear that the requirements of modern industrial fibre applications with traditional technologies and machines for decortication as well as cleaning of fibres and shives could not be fulfilled. Beside the development of an innovative decortication technology (by means of impact stress) especially the step of fibre cleaning was investigated based on comprehensive experiments. As high throughput rates of min. 3 t h-1 with a high reliability have to be realized with modern processing lines the capacity of the cleaning lines has to be increased. Comb shakers - low-cost machines from traditional long fibre cleaning – are proved to have the highest potential to fulfill the requirements of modern short fibre cleaning.

Based on a mass flow and screening model a prototype of an improved and reliable comb shaker was designed and manufactured. A input mass flow of up to 1.6 t h-1 fibre/shive mixture can be realized by remaining shive content of less than 5% m-1. As a result of this work, the number of process steps necessary for short fibre production has been essentially reduced. Process lines using the novel decortication system in combination with modified comb shakers need only two cleaning steps for the production of high quality fibres from hemp. Thus, investment and operational costs for new process lines can be reduced.

Chemisorption of protein reactive indoor air pollutants by wool

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Tel: 0161-3063784, 1 DWI-an der RWTH Aachen e.V., Aachen, D; 2 renopan AG, Bad Homb, D; 3 eco-Umweltinstitut, Cologne, D

SUMMARY: Sheep's wool was used to improve indoor air quality. Wool as a protein fiber shows physi- and chemisorption especially of formaldehyde, which results in permanent binding of the pollutant.

ABSTRACT: In industrialized countries people spend up to 90% of their time indoors. Airborne, harmful substances such as kindergardens by incorporation of wool continue to show drastically lowered formaldehyde concentrations.
The Department of Energy and Climate Change (DECC) was created in October 2008, to bring together:

- energy policy (previously with BIS - the Department for Business, Innovation & Skills), and
- climate change mitigation policy (previously with Defra - the Department for Environment, Food and Rural Affairs).

We face unprecedented challenges to our environment, our economy, and the future security of our energy supplies – and the decisions we make now will affect the planet and our way of life for generations to come. DECC exists to tackle these challenges.

Our three overall objectives are to:

- ensure our energy is secure, affordable and efficient
- bring about the transition to a low-carbon Britain
- achieve an international agreement on climate change at Copenhagen in December 2009

Natural fibres and the wide range of materials and products derived from them can play a key part in developing a low-carbon economy in the UK, as set out in the UK Low Carbon Transition Plan and Low Carbon Industrial Strategy, published on 15 July 2009.

They can deliver significant GHG reductions, provide important new business and employment opportunities, particularly in rural areas, and contribute to a range of other sustainability objectives.

DECC sponsor the National Non-Food Crops Centre (NNFCC), the UK’s National Centre for renewable materials and technologies. The NNFCC provide independent advice and information to industry, Government and the general public on renewable materials, including natural fibres. Dr John Williams, head of polymers and materials at the NNFCC will be speaking at the event.

One of the key roles for fibres in the low-carbon economy will be in the use of biocomposites to produce strong but lightweight materials, particularly for vehicles. DECC’s Bioenergy & Materials team are working with industry and academia to promote the development and use of these materials.

Lord Hunt

Lord Hunt is Minister of State for the Department of Energy and Climate Change (DECC), and Deputy Leader of the House of Lords. He leads for DECC on ensuring the UK has a secure, low-carbon and affordable energy supply. He previously served as a Minister in the Department of Environment, Food and Rural Affairs, so has an understanding of some of the other issues relating to natural fibres, including sustainability and agriculture.

Materials Knowledge Transfer Network

The Materials Knowledge Transfer Network (KTN) facilitates advanced materials and engineering developments that underpin innovation in key application sectors by:

- Raising awareness of materials development, manufacturing processes, design concepts and assembly technologies
- Encouraging and creating knowledge and information about advances in materials and process technologies

The Materials KTN brings together umbrella materials-related knowledge networks covering a wide range of materials, such as natural materials, polymers, composites, ceramics, technical textiles and metals. It also covers materials-related technologies, such as rapid manufacturing, powder processing, surface engineering and smart materials and structures. The KTN has wide coverage of product design, sustainable materials for transport applications and for packaging. Current membership is about 9000 individuals from over 4600 organisations.

For further information please visit www.materilasktn.net

InCrops – Creating an innovation cluster in the East of England

The InCrops Enterprise Hub is a not for profit company set up and based at the University of East Anglia. The InCrops project has 5 years of funding (2008-2013) from EEDA and the European Union (ERDF) to develop an enterprise hub linking the region’s top plant science research with businesses looking to develop new products from biorenewables for the marketplace.

By 2013, the scheme aims to have helped SMEs to create 140 new jobs and to support entrepreneurs to start 80 new businesses, whilst bringing in £3M of new public and private sector funding to the region. The Enterprise Hub operates a virtual network across the whole of the East of England with staff located at seven sites with a distributed operating structure.

Our aims are to:

- Stimulate the commercialisation of new biorenewable and low carbon products from alternative and non-food crops; build on the East of England’s world-class research capability in plant and crop science; facilitate supply chain development, market integration and product innovation; and support the business and commercial sector and stimulate sustainable economic growth.

The InCrops Enterprise Hub provides specialist business support to companies, SMEs, micro-businesses and entrepreneurs based in the East of England; develops applied and collaborative industry-led projects with academic partners, develops new products and processes for the exploitation of alternative and non-food crops and promotes natural and renewable technologies into the low carbon economy.

We support a spectrum of market sectors including green chemicals and biopolymers, natural fibres, composites and nanomaterials, the built environment, personal care, transportation and low carbon vehicles, bioenergy, biomass heat and power, biopharming and high-value chemicals. We have in-house experts in those sectors and are linked to the expertise of our partners. Additionally, InCrops has an expertise in Life Cycle Analysis.

The London Sisal Association

Sisal is a Sustainable Environmentally Friendly Green Natural Vegetable Fibre

The objectives of the Association are:

- The promotion of trade in Sisal fibre and the Sisal products of sisal growing countries.
- The collection and dissemination of statistical and other information relating to the trade.
- The promoting, supporting, or opposing of legislative or other measures affecting the aforesaid interests.
- The maintenance and operation of standard forms of contract.
- The doing of all such other things as may be beneficial to the trade, or incidental to the attainment of the above objectives.

The Association provides an efficient and dependable marketing service to producers and consumers of Sisal and promotes the best interests of the Sisal trade as a whole for the mutual benefit of all concerned.

2009 is here – The United Nations International Year of Natural Fibre!!! “DISCOVER SISAL”, Discover this wonderful crop. Discover all the very useful products mankind can derive from this natural renewable resource!!! Discover how this plant changes the lives of millions of people around the world. Visit www.londonsisalassociation.org

NNFCC

Your partner in the low carbon economy

The NNFCC is the UK’s national centre for renewable materials. We help players in biorenewables visualise how they fit into the big picture, not just today but in the future. Using our unbiased objective expertise, we forge links between government, industry and research to get natural and bio-based fibre products to market.

We work in:

- Construction - Co-ordinator of The Renewable House Project
- Biocomposites
- Renewable polymers
- Biobased content certification
Contact our Polymers and Materials Sector Manager,
Dr John Williams
j.williams@nnfcc.co.uk
+44(0)1904 435182

The Renewable House at the
BRE Innovation Park
Join our new Composites
Thematic Working Group
Become part of the network
that brings together the whole
supply chain to overcome
barriers to the uptake of natural
fibres.
Launching at Natural Fibres '09
on 15 December.

Novel crops from ADAS: Background
The agronomy, use and economic viability of novel crops is
addressed from within the ADAS Centre for Sustainable Crop
Management (SCM), providing first-class research and consultancy
in the area of sustainable crop production. SCM is involved in utilising
crop physiology, biochemistry, genetics and crop protection expertise
to bring about improvements and solutions for businesses that
produce and utilise crop and plant-derived raw materials. We are able to make an impact throughout the supply
chain from farmers & growers through to processors, manufacturers,
retailers and distribution companies as well as provide legislation,
regulatory and crop assurance advice and expertise. The Centre

What does ADAS offer?
We provide expertise in the following disciplines:
• Crop Biochemistry & Physiology (glasshouse and
  field-grown crops)
• Crop Production Systems; e.g. maximising levels of specific
  ingredients and/or standardising of raw materials
• Lab facilities inc. GC-MS, HPLC for analysis of plant materials
• Crop assurance, traceability
• Co-ordination & management of multi-partner research
  projects

For more information, visit www.adas.co.uk

Modern Built Environment Knowledge Transfer Network
The Modern Built Environment Knowledge Transfer Network (MBE KTN) is funded by the Technology
Strategy Board to increase the exploitation of innovation in the built environment for demonstrated business benefit.
The MBE KTN works with its members to:
• identify industry challenges;
• showcase potential innovations;
• catalyse new collaborations;
• facilitate access to funding opportunities; and
• assist members connect with each other.
The KTN is currently focusing on four key themes to establish where innovation can add real value to the built environment.
• Energy & Carbon Efficiency
• Process Efficiency
• Climate Change Adaptation
• Life Extension and Retrofit
Visit www.mbektn.co.uk for more information and to engage with the MBE KTN community.

BRE
BRE has been Building a better world for
almost 90 years through cutting edge
research, consultancy and testing services.

Our unrivalled knowledge in regard to sustainability and innovation
is now used across the construction industry and in the corporate
world creating better buildings, communities and businesses. BRE is
part of the BRE Group of companies owned by the BRE Trust, a
registered charity. The profits made by BRE go to the BRE Trust
and are used to conduct key research projects that advance our
knowledge of the built environment.

As the construction industry rises to the challenge of building in
a more sustainable way, the use of natural fibres has taken on a
renewed significance in the sector. BRE is currently active in this area
in several ways:
• We are a partner on the InCrops (Innovation in Crops) Enterprise
  Hub, a new science and knowledge transfer initiative supporting
• Earlier this year we launched the Renewable House on the BRE
  Innovation Park. Built by the NNFCC, this highly sustainable
  house which uses the hemp plant as its primary wall material
  achieved Level 4 of the Code for Sustainable Homes.
• A low energy pre-fabricated straw bale demonstration house
  has recently been built on University of Bath campus as part of
  a research project which is being led by the BRE Centre for
  Innovative Construction Materials (a partnership between BRE and
  University of Bath).

For more information, please visit www.bre.co.uk

For more information, visit www.mbektn.co.uk
● **Launch of the Composites Thematic Working Group**

**15 December**

Join the Composites Thematic Working Group and bring biocomposites to the mainstream.

- The NNFCC’s Thematic Working Groups (TWGs) bring together the whole supply chain to actively address opportunities and barriers to the uptake of renewable products.
- We work directly with the UK Government Departments DECC (Department of Energy and Climate Change) and Defra (Department for Environment, Food and Rural Affairs)
- We facilitate the Renewable Materials LINK programme
- Our TWGs represent the fundamental science base, agriculture, manufacturers, processors, end users and government. They act as a recognised focal point to facilitate technology, identify barriers to further market development and represent a harmonised industry voice proposing strategies to overcome these hurdles.
- By joining the Composites TWG at this early stage you will be able to help set the agenda for the group and define its aims and key activities.

To find out more about the Composites Thematic Working Group, please join Dr John Williams on 15th December at 8pm the Institute of Materials, Minerals and Mining, 1 Carlton House Terrace, London. Refreshments will follow this launch.

Dr John Williams  
j.williams@nnfcc.co.uk  
+44(0)1904 435182  
www.nnfcc.co.uk

● **Lean, Mean and Green:** The World’s First Environmentally Friendly Racing Car

**Public Lecture**

**15 December**

Dr Kerry Kirwan, University of Warwick, UK

The new WorldFirst racecar is a clever piece of lateral thinking. It is the first Formula 3 racing car designed and made from sustainable and renewable materials, putting the world first by effectively managing the planet's resources. Dr Kirwan will actively demonstrate in a lively public lecture how this joined up approach of apparently disparate arts, sciences and engineering can result in something ground breaking like the World First F3 racing car - a much more environmentally friendly vehicle than most road cars, let alone racing vehicles. Being green does not mean being boring or stepping back in time!

The lecture will be followed by the launch of the new NNFCC Thematic Working Group on Composites materials, presented by John Williams of NNFCC at 8pm. Refreshments will follow.

Booking essential, contact dawn.bonfield@iom3.org

● **Visit to Innovation Park BRE, Watford**

**16 December**

The park features a number of demonstration properties showcasing modern methods of construction, near zero carbon homes, and over 200 innovative and emerging technologies.

Of particular interest to delegates of Natural Fibres ’09 are the Renewable Hemp House and the Natural House. Those interested in attending this visit should confirm their interest when booking their place at the conference. Places will be allocated on a first come, first serve basis. Coaches will leave London at 09.30 and return by 14.30. Refreshments are also provided.