



# Biowerkstoff-Report

Report on Bio-based Plastics and Composites



## Our Events at HANNOVER MESSE:

20<sup>th</sup>–21<sup>st</sup> April 2010

- Congress on Bio-based Plastics and Composites
- Innovation Award

Picture: Tecnaro

**Visit the  
International  
Congress on  
Bio-based Plastics  
and Composites**  
20<sup>th</sup>–21<sup>st</sup> April 2010  
Convention Center, Saal 2  
Page 21 to 42

## Innovation Award

**Bio-based Material of the  
Year 2010 | 20<sup>th</sup> April**

The Nominated

- GreenGran B.V. | GreenGran
  - Henkel AG | ECOmfort
  - Propper GmbH & Co. KG |  
Proganic
- Page 21

## Report on Industrial Hemp

22 Extra Pages

Page 43



# Biowerkstoff-Report

Sehr geehrte Leserin, sehr geehrte Leser,

Die neue, siebte Ausgabe des Biowerkstoff-Reports steht im Zeichen des Biowerkstoff-Kongresses, der am 20. und 21. April 2010 erstmalig in Hannover, im Rahmen der HANNOVER MESSE stattfinden wird, welche einen eigenen Ausstellungsbereich zu Biowerkstoffen in Halle 6 (Industrial Supply) präsentiert.

Zum ersten Mal erscheint der Biowerkstoff-Report in diesem internationalen Kontext in (primär) englischer Sprache. Waren bislang etwa 10 bis 20 % der Beiträge auf Englisch, so sind es in dieser Ausgabe über 85 % aller Texte. Neu ist auch der Sonderteil „Report on European Industrial Hemp“, der zukünftig einmal im Jahr erscheinen soll.

Innovative Biowerkstoffe (=Bio-Based Plastics and Composites) können und werden bereits heute in großem Stil von der Industrie eingesetzt, vor allem in der Automobil-, Verpackungs- und Bauindustrie. Schätzungen gehen von rund 500.000 Tonnen pro Jahr und einem zweistelligen Wachstum in der Europäischen Union aus. Dennoch ist das Wissen um die technischen, ökonomischen und ökologischen Möglichkeiten bislang auf relativ wenige Produzenten und Anwender beschränkt. Die meisten Unternehmen, die Interesse an „grünen Werkstoffe“ haben, tun sich schwer, geeignete Werkstoffe und Anbieter zu finden. Der „Dritte Biowerkstoff-Kongress“ stellt deshalb eine Leistungs-Show der Branche dar. Führende Produzenten zeigen, was bereits heute und in naher Zukunft möglich ist, und machen Mut, innovative Wege zu beschreiten. Abgerundet wird dies von Vertretern aus der Politik, die vorstellen, welche hohe Bedeutung für Klimaschutz und Ressourcensicherheit sie Biowerkstoffen beimessen und wie die zukünftigen Rahmenbedingungen in der Europäischen Union aussehen werden.

Eine nachhaltige Bioökonomie braucht bei Werkstoffen eine „Rohstoffwende“, eine Überwindung ihrer heutigen Erdölabhängigkeit und eine Hinwendung zu bio-basierten Produkten auf Basis von Agrar- und Forstrohstoffen. Was die Solar- und Windenergie für die Energieversorgung sind, sind Biowerkstoffe für den Werkstoffbereich!

Die vorliegende Ausgabe versucht einen umfassenden Überblick zum Thema Biowerkstoffe zu geben und neue Trends aufzuzeigen. Viel Spaß beim Erforschen!

Mit freundlichen Grüßen



Michael Carus  
GF der nova-Institut GmbH



Lena Scholz  
Biowerkstoffe nova-Institut GmbH

P.S.: Von der letzten Ausgabe des Biowerkstoff-Reports wurden 6.000 Exemplare und weitere 3.000 Exemplare als PDF verteilt bzw. runtergeladen – insgesamt gingen fast 10.000 Exemplare an Industrie, Forschung und Politik. Alle sechs bisherigen Ausgaben (siehe Seite 67) sind weiterhin im nova-Shop unter erhältlich.

Schicken Sie uns Ihre Texte und Bilder zu neuen Entwicklungen und Produkten – wir veröffentlichen sie gerne (lena.scholz@nova-institut.de)! Nutzen Sie den Biowerkstoff-Report für Ihr Marketing. Dominik Vogt informiert Sie gerne über die Anzeigenpreise (dominik.vogt@nova-institut.de).



Michael Carus  
Geschäftsführer  
nova-Institut GmbH



Lena Scholz  
Biowerkstoffe  
nova-Institut GmbH

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## Biowerkstoff-Report beziehen

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# Report on Bio-based Plastics and Composites

Dear Readers,

This new seventh issue of the Biowerkstoff Report heralds the Biowerkstoff Congress, which takes place for the first time in Hannover at the HANNOVER MESSE venue on May 20<sup>th</sup> – 21<sup>st</sup> 2010. The HANNOVER MESSE will present a separate exhibition on Bio-Based Plastics and Composites in hall 6/B40 (Industrial Supply).

This is the first time the Biowerkstoff Report has been issued in this international context and is written mainly in English. In contrast to previous editions, in which 10 % – 20 % of the articles were written in English, this issue contains more than 85 % of the texts in English. The special issue, the “Report on European Industrial Hemp”, is also new, and an annual edition is planned.

Innovative bio-based materials – Bio-Based Plastics and Composites – can be, and are used already to a great extent by industry, especially by the automotive, packaging and building industries. Estimates give a figure of about 500,000 tonnes a year and a two-digit growth in the European Union. However, the knowledge of the technical, economic and ecological capabilities, is restricted to only relatively few producers and users.

Most of the companies who are interested in “green materials” find it difficult to source suitable materials and suppliers. Thus, the “3<sup>rd</sup> Biowerkstoff-Kongress – International Congress on Bio-based Plastics and Composites” constitutes a major event in this sector. Leading producers will show current and imminent opportunities and encourage new initiatives. The Congress will be rounded-off by political representatives, who will illustrate the great importance they attribute to bio-based plastics and composites for climate protection and to maintain resources. They will also discuss what future conditions within the European Union framework might look like.

A sustainable bio-economy needs a revolutionary change in the use of raw materials, it needs to overcome today’s dependency on fossil fuels and to bring about a shift towards bio-based products based on agricultural and forest resources. Within the energy supply sector, it’s solar and wind power, within the materials sector, it’s Bio-based Plastics and Composites.

This publication of the Biowerkstoff Report aims to give a comprehensive outline of Bio-based Plastics and Composites and to show new trends. We hope you will enjoy reading the report and exploring its new ideas!

Kind regards

**Michael Carus**  
Managing director  
of the nova-Institut GmbH

**Lena Scholz**  
Responsible for Bio-based Plastics and Composites  
at the nova-Institut GmbH

P.S: 6,000 copies of the last issue of the Biowerkstoff Report were distributed and a further 3,000 copies as pdf-files were downloaded. 10,000 copies in all were distributed to industry, research and policy makers within the political sector. All previous six issues (see page 63) continue to be available at the nova-Shop under [www.nova-shop.info](http://www.nova-shop.info).

Send us your texts and pictures on new developments and products – we look forward to publishing them ([lena.scholz@nova-institut.de](mailto:lena.scholz@nova-institut.de))! Take the opportunity to use the Biowerkstoff Report as a marketing instrument. Mr. Dominik Vogt will be pleased to inform you about our advertising prices ([dominik.vogt@nova-institut.de](mailto:dominik.vogt@nova-institut.de)).

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# EUROPEAN BIOPLASTICS WELCOMES FRENCH FRAMEWORK AGREEMENT ON COMPOSTABLE WASTE BAGS

European Bioplastics, the association of the bioplastics industry in Europe, welcomes the recently signed framework agreement supporting compostable bio-based plastic waste bags in France. The new agreement intends to develop the availability of compostable bio-based plastic waste bags in mass retailing in order to promote the selective collection of compostable waste.

European Bioplastics regards this new initiative as a significant contribution to environmentally sound waste management. "The use of certified compostable bioplastic waste bags supports the organic recovery of biodegradable waste", says Hasso von Pogrell, Managing Director of European Bioplastics. "The French agreement can therefore be seen as a role model for other European Countries.", he adds.

The covenant was signed by the French Ministry of Ecology and Sustainable Development, the French Mayors Association (AMF), the Federation of Commerce and Distribution in France (FCD), the French Bioplastics Association (Club Bio-plastiques), the Association of Plastics Manufacturers (Plastics Europe) and the French Plastic and Flexible Packaging Association (ELIPSO). It ties-in with both the Agricultural Orientation law of 5 January 2006 aimed at enhancing the production of compostable products from renewable resources, and with the directions set in the Grenelle 1 law, seeking to support organic recovery by composting. European Bioplastics supports

the certification of compostability of plastics according to standards on biodegradability or compostability, such as ISO 17088, EN 13432 or other similar standards. It owns the seedling logo which is awarded only to those products complying to these rigorous standards.

European Bioplastics is the European association representing the interests of the industry along the complete bioplastics' value chain. Its members produce, refine and distribute bioplastics, plastics that are either biobased, compostable, or both. Today, around 75 companies are members of European Bioplastics.

More information and pictures are available at [www.european-bioplastics.org](http://www.european-bioplastics.org) ●

*Press release: European Bioplastics, Berlin, 17. Dezember 2009, E-mail: [press@european-bioplastics.org](mailto:press@european-bioplastics.org)*

On the one hand, interest in biopolymers is growing steadily mainly due to the prevailing sustainability debate. On the other hand, the lack of reliable material data presents a bottle neck for the commercial use of biopolymers.

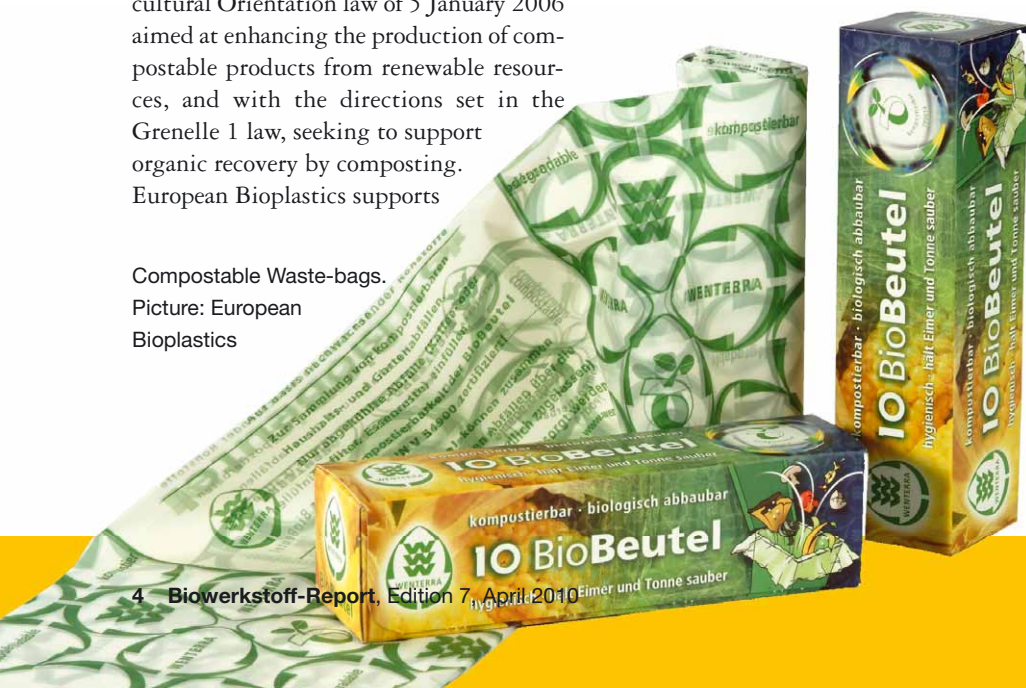
In order to overcome this lack of information, the University of Applied Sciences and Arts Hanover, Department of Bioprocess Engineering in cooperation with M-base Engineering+Software GmbH has developed a new biopolymer database (see fig. 1 and 2) that provides crucial technical information (sponsored by BMELV, FNR e.V.). The benchmark is the well known CAMPUS® database, which has become the international standard information system for conventional engineering polymers.

The biopolymer database includes more than 100 biopolymer manufacturers and more than 500 material grades. Today, the data from material suppliers are neither comprehensive nor comparable because they are reported according to many different test standards. Therefore, it is increasingly difficult for a processor to find the right material for the intended application or to make a fair comparison between different grades. It is the goal to test all commercially available biopolymers under uniform and comparable conditions at the University of Applied Science and Arts. The first results of the database are available since November 2009. The database is available via internet in German and English. The access is free of charge under [www.materialdatacenter.com](http://www.materialdatacenter.com).

With the biopolymer database the customers, converters, and end users will find themselves connected to the bioplastic manufacturers. They will be in a position to easily find and compare technical informa-

Compostable Waste-bags.

Picture: European Bioplastics



# A NEW BIOPOLYMER DATABASE

Fig. 1: Comparability of the data

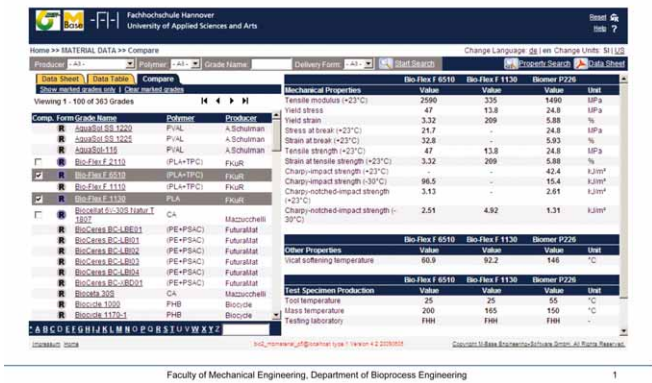
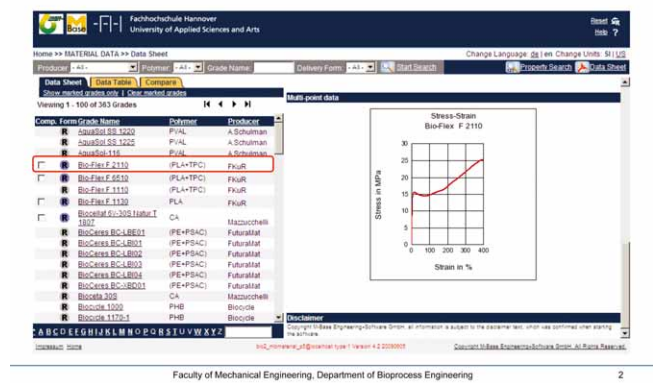


Fig.2: Graphics



Material Data Center. Pictures: FH Hannover

tion. Step by step, the users can choose between thermoplastic resins or films. The biopolymer database allows extensive search options for both options, and will then provide information on manufacturers incl. contact addresses, polymer grades, trade names, mechanical, thermal or rheological properties, barrier properties, information about certifications (compostability, contact with food, etc.), biobased/renewable material content, and many other details.

In addition, the database also offers the opportunity to compare properties of differ-

ent biopolymers. One other available feature is the possibility to search relevant literature that is linked to the database.

As final output, all data are printable as datasheets. Besides the new standardized comprehensive measured data, the datasheets provided by manufacturers will also be available.

Another innovative contribution to the bioplastics field is the new book on “Engineering Biopolymers” (see fig.3). The book provides a broad basis of information from a plastics processing point of view. It includes comprehensive descriptions for all commercially available biopolymers. The new book on engineering biopolymers is available in German now. An English version is in preparation, it will be published in June 2010. ( <http://www.hanser.de/buch.asp?isbn=978-3-446-41683-3>).

The unique book represents an important and comprehensive source of material technical information and a knowledge

base for researchers, developers, technicians, engineers, marketing, management and other decision makers in all areas of applications such as raw material suppliers, manufacturers of plastics and additives, converters and film producers, machine manufacturers, packaging suppliers, automotive industry, fiber/nonwoven/textile industry, and universities.

With the new knowledge database (biopolymer database) and the new biopolymer book the situation can be improved dramatically, due to quick and easy access to critical information. The database and the biopolymere book provide valuable information to improve the market penetration of biopolymers. ●

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Fig. 3



# JEDES KILOGRAMM ZÄHLT

Johnson Controls zeigt neue Wege zum Leichtbau bei Innenraum-Komponenten



Fibrowood. Bilder: Johnson Controls

## INNENRÄUME MIT LEICHTBAUPOTENZIAL

Neben Leichtbausitzen engagiert sich Johnson Controls auch beim Leichtbau von Instrumententafeln und Türverkleidungen. Als Ansatzpunkte für die leichte Gestaltung von Instrumententafeln dienen Modifikationen in der Oberflächengestaltung, bei der Airbagintegration sowie an der Bauteilstruktur selbst. Je nach Kombination der einzelnen Möglichkeiten können die Instrumententafeln bis zu einem Drittel leichter gestaltet werden als konventionell gefertigte Referenzbauteile. So verhilft EcoSpace, eine reduzierte Tragstruktur für Cockpits, die auch im aktuellen Konzeptfahrzeug re3 zu sehen ist, nicht nur zu einem deutlichen Raumgewinn auf der Beifahrerseite. Dank Hybridbauweise aus Kunststoff und Stahl spart die EcoSpace-Cockpitstruktur im Vergleich zu konventionellen Querträgern bis zu 26 Prozent an Masse. Der freie Platz eröffnet neue Gestaltungsperspektiven an der Beifahrerseite. Alternativ kann EcoSpace auch dazu genutzt werden, die Instrumententafel kleiner zu gestalten und so zusätzlich Gewicht einzusparen.

## WENIGER GEWICHT DURCH NATURFASERWERKSTOFFE

Je nach Bauteilgeometrie kommen neben anderen Naturfaseralternativen hauptsächlich zwei unterschiedliche Materialkonzepte als Trägermaterial für Türverkleidungen oder Instrumententafeln zum Einsatz: Fibrowood, eine Holzfaserplatte mit Acrylharzbinder, oder EcoCor, eine formbare Matte aus Polypropylen und Naturfasern, die in einem einstufigen Formgebungs- und Kaschierprozess verarbeitet werden kann. Beide Werkstoffe för-

dern den Einsatz erneuerbarer Ressourcen, zeigen ein gutes Crash-Verhalten und ein hohes Leichtbaupotenzial: Da das Flächengewicht der Naturfasermaterialien deutlich geringer ist als bei normalen Thermoplasten, ergeben sich allein durch den Austausch der Werkstoffe bis zu 25 Prozent Gewichtseinsparung. Noch deutlicher lassen sich die Leichtbaupotenziale von Fibrowood nutzen, wenn die Bauteile konstruktiv dünnwandiger ausgelegt werden oder wenn Funktionselemente direkt in die Bauteile eingepresst werden, um so das Gewicht des sonst erforderlichen Klebstoffs zu sparen. Nach Einschätzung von Han Hendriks sind mit derlei Angeboten für den konstruktiven und werkstofflichen Leichtbau noch etliche weitere Einsatzmöglichkeiten denkbar: „Unsere hohe System- und Integrationskompetenz versetzt uns in die Lage, gemeinsam mit unseren Kunden zielgerichtet die Bauteiloptimierung weiter voranzutreiben“, verrät er einen künftigen Entwicklungsschwerpunkt.

## SICHTBARE NATURMATERIALIEN ALS A-OBERFLÄCHE

In eine andere Richtung zielt eine Konzeptentwicklung mit sichtbaren Naturfasermaterialien im Fahrzeuginnenraum, das sogenannte „Exposed Natural Material“. In diesem Rahmen ist es Johnson Controls erstmals gelungen, durch den Einsatz einer neuen Oberflächentechnologie in Serie befindliche Werkstoffe auf Naturfaserbasis so zu gestalten, dass ihre Oberflächenanmutung den hohen Anforderungen an einen automobilen Innenraum gerecht wird. Da das durch eine transparente Folie geschützte Trägerteil ohne zusätzliche Kaschierung genutzt wird, lassen sich bis zu 30 Prozent Gewicht einsparen. Gleichzeitig trägt das innovative Konzept zu einer



authentischen und natürlichen Ästhetik des Innenraums bei. Auch dies ist im Konzeptfahrzeug re3 zu sehen, das sowohl Türverkleidungen als auch Teile der Instrumententafel aus dem neuen Material enthält. Für Han Hendriks, Vice President Global Product Centers Cockpit Systems bei Johnson Controls, wäre die Neuentwicklung der „Exposed Natural“ Materials ohne die profunde Fertigungskompetenz für Naturfasermatten nicht möglich gewesen: „Unsere langjährige Erfahrung im Bereich Naturfasern und unsere eigene Produktionslinie ermöglichen uns, Materialien und Prozesse so zu modifizieren, dass wir neue Anwendungen erschließen können.“

●  
*Pressemitteilung: Johnson Controls, Burscheid, 15. September 2009, E-Mail: [astrid.schafmeister@jci.com](mailto:astrid.schafmeister@jci.com)*

*Fotos sind unter [www.johnsoncontrols.de/presse](http://www.johnsoncontrols.de/presse) digital verfügbar.*

## BIOCONCEPT-CAR – WITH BIOMATERIALS ON THE PASSING LANE



BioConcept Car 2, the Mégane Trophy. Picture: Four Motors

The Ford Mustang GT RTD features the world's most powerful biodiesel engine and bodywork made of flax-fibre reinforced linseed-acrylate, i.e. a high performance composite made of natural fibres embedded in a resin from the same plant (flax and linseed).

At the end of October 2009 the 'BioConcept-Car' project by Four Motors, Reutlingen, Germany, received the COMPOSITES Pioneer Award 2009 for the groundbreaking achievements in using natural fibres in automotive applications. The award was given to team leader and former DTM driver Thomas von Löwis of Menar (photo) within the framework of the COMPOSITES EUROPE 2009 exhibition. The trophy itself also lived up to its name, as its basic body is made entirely from renewable materials. Industrial designer Rolf Bender, who has already designed a large number of awards, created a monolithic shape made from the biopolymer PLA and bamboo grass. Its special feature: the two PLA sheets are welded, not glued, to the layer in between.

During Composites Europe 2009 in Stuttgart, Germany, the Ford Mustang was presented, as well as the new generation BioConcept-Car, a green Renault Mégane Trophy. Both racing models show that even with biofuels and materials from renewable resources, trophies in long term races, such as the BFGoodrich long-distance championship and the 24-hour races on the Nürburgring, can be successfully achieved. Advantages of the bio-composites are their lower weight compared to glass-fibre composites, they do not splinter in crashes and, most importantly, they are better for the environment.

The globally unique project with the Mustang featuring doors, fenders, engine hood, bumpers, spoilers and trunk lid made

completely from bio-composites is now being further developed with a Renault Mégane Trophy 09. Its multi-part glass fibre reinforced body will be replaced step-by-step by natural fibre reinforced linseed-acrylate. This is happening in close cooperation with the German government's FNR (Agency for Renewable Resources) and the German Aerospace Center (DLR). "One important goal after the 2007 Mustang was to reduce weight and increase stability," says Thomas (Tom) von Löwis. "The new unpainted door of the Ford (that can be seen in the picture) is already 40 % lighter than the previous one. This was achieved by reducing the number of fibre layers in some areas while maintaining a rigid structure in the areas of the hinges or the windows." The weight of the engine hood was reduced by 45 %, and so on. "And there is still room for further improvement," says Tom. All of the experts from the FNR and DLR, as well as the racing team, are confident that with the Mégane even load-bearing parts can be realised. "This will really take us a huge step further," Tom points out.

The project is based on a concept with a scope far beyond motor sports. With the application of bio-materials and bio-fuels Thomas von Löwis and racing driver Smudo (by the way, he's a well-known Hip-Hop Star in Germany too) want to show and prove the capabilities of renewable resources. Further goals in the BioConcept Car 2 project are for example a solar panel roof to support the on-board electronics. "This will not lead to reduced lap times - that is the job of our drivers - but it will help to go longer distances on just one tankful," says Tom von Löwis. And he begins to dream ... but it is a dream with the potential to come true: "One day, I hope we

can drive a racing car around the Nürburgring powered by an electric motor, the batteries charged by a block power station - solar panels during daylight and a biodiesel generator at night. E-mobility is definitely coming," he says.

But this BioConcept Car project does not want to be restricted to motor racing. On the contrary, the supporting partners FNR and others are very interested in transferring the project's findings to serial applications, starting for example with rear view mirror housings or tank lids. "Potential partners from industry that are interested in participating and transferring these results into 'real' products are more than welcome," says Simone Falk of Four Motors. The first talks with seat manufacturers, for example, have already started. [www.fourmotors.com](http://www.fourmotors.com) ●

*Author: Michael Thielen, first published in bioplastics magazine, reprinted with generous permission of the editor, E-mail: [mt@bioplasticsmagazine.com](mailto:mt@bioplasticsmagazine.com)*

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Markus Jessberger (Director COMPOSITES EUROPE), Amanda Jacob (Editor in Chief 'Reinforced Plastics') and Thomas von Löwis, Crew Chief 'Four Motors'. Picture: bioplastics MAGAZINE

# THAILAND MÖCHTE BIODERIVATSTOFF-, „HUB“ ASIENS WERDEN

Workshop zur Bioderivatstoff-Politik in Bangkok erörterte geeignete politische Instrumente.

Kaum ein anderes Land bietet so günstige Bedingungen für die Produktion von bio-basierten Kunststoffen wie Thailand. Das Land verfügt mit Cassava (Tapioka), Zuckerrohr, Reis, Bambus und Kautschuk über eine umfassende Rohstoffbasis. Vor allem Cassava-Stärke gilt als perfekter Rohstoff: Je nach Jahr werden zwischen 20 und 27 Mio. t Cassava produziert, von denen mehrere Millionen Tonnen pro Jahr als Stärke exportiert werden. Eine Nutzung im eigenen Land würde die Wertschöpfung allerdings erheblich steigern. Cassava ist zudem der preiswerteste Stärkelieferant in Thailand, und die Preise waren in den letzten Jahren im Gegensatz zu anderen Agrarrohstoffen nur geringen Schwankungen ausgesetzt.

Neben der Rohstoffbasis verfügt Thailand über eine starke Kunststoffindustrie sowie F&E-Einrichtungen auf Weltniveau. Die produzierten Bioderivatstoffe sollen die wachsende Nachfrage im organischen Abfallsektor decken, dauerhafte Anwendungen erobern und auch exportiert werden. Verschiedene Ministerien wollen die Entwicklung und Produktion von bio-basierten Kunststoffen in Thailand fördern, bzw. günstige Rahmenbedingungen für die Industrie schaffen. Das Kabinett hat 2008 eine „National Bioplastic Roadmap“ verabschiedet. Bereits heute sind acht internationale Unternehmen in diesem Bereich tätig, darunter die niederländische PURAC mit der größten Milchsäureproduktion der Welt und BASF mit biologisch abbaubaren (aber noch nicht bio-basierten) Kunststoffen. Firmen wie NatureWorks aus den USA und Uhde Inventa-Fischer aus Deutschland haben auch schon ein großes Interesse an dem Produktionsstandort Thailand gezeigt.

Um die Frage nach den geeigneten politischen Instrumenten zur Förderung bio-

basierter Kunststoffe ging es am 18. November 2009 in Bangkok. Die Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn/Bangkok, und die thailändische National Innovation Agency (NIA), Bangkok, hatten Experten aus Industrie, Verbänden, Forschung und Politik zu einem Workshop eingeladen. Zuvor hatte das nova-Institut, Hürth, in Zusammenarbeit mit Fraunhofer UMSICHT, Oberhausen, und der Bauhaus-Universität Weimar/Knoten Weimar für die GTZ eine Studie zu den weltweit bereits eingesetzten sowie neuen politischen Instrumenten zur Förderung von Bioderivatstoffen und Innovationen in der Abfallpolitik durchgeführt. Die Zwischenergebnisse wurden in Bangkok präsentiert und zur Diskussion gestellt. Dabei ging es um Instrumente der Steuerpolitik, Verbote und Gebote, Vorgaben beim öffentlichen Einkauf, direkte finanzielle Unterstützung sowie um Markteinführungsprogramme, F&E- und Informationsprojekte bis hin zur Gleichstellung der energetischen und stofflichen Nutzung. Gerade beim letzten Punkt zeigten sich die Experten aus Thailand sehr aufgeschlossen. Thailand hat in den letzten Jahren, ähnlich wie Deutschland, eine Reihe von Maßnahmen zur finanziellen Unterstützung von Bioenergie implementiert, darunter EEG-ähnliche Einspeisegesetze für Biomassestrom und geringere Abgaben für Bioderivatstoffe. Neue Instrumente sollen entsprechend die Wettbewerbsfähigkeit von bio-basierten Kunststoffen verbessern.

Die Ergebnisse der deutschen Wissenschaftler sind vor allem als Input für eine Strategie-Studie des „Petroleum and Petrochemical College“ an der Chulalongkorn Universität in Bangkok gedacht, die in den nächsten Monaten konkrete Vorschläge für

politische Instrumente ausarbeiten wird. Aus Sicht der Agrar-, Umwelt- und Innovationspolitik stehen vor allem bio-basierte Kunststoffe aus einheimischen Rohstoffen im Mittelpunkt des Interesses, um neue Arbeitsplätze und erhöhte Wertschöpfung im ländlichen Raum sowie neue Produktions- und Exportmöglichkeiten für die Kunststoffindustrie zu schaffen und ferner eine nachhaltige Bioökonomie zu fördern. Die Abfallpolitik hat dagegen vor allem biologisch abbaubare Einkaufs- und Komposttüten im Visier, welche dazu beitragen sollen, die Probleme bei der Behandlung organischen Mülls (14,4 Mio. t) sowie die Umweltverschmutzung durch Plastiktüten in der Umwelt zu verringern. Auf dem Workshop schlugen Berater der Regierung vor, ein „National Committee for Bioplastics“ einzurichten, analog zu dem bereits existierenden für Bioenergie. Die Rahmenbedingungen seien so zu gestalten, dass Investitionen – gerne auch aus dem Ausland – in den Bioderivatstoffsektor attraktiv sind.

Insgesamt entwickelt sich hier ein spannender Prozess. Sollte es in den nächsten Monaten in Thailand tatsächlich gelingen, die „National Bioplastic Roadmap“ mit Leben zu füllen und geeignete politische Instrumente zu etablieren, dürfte Thailand tatsächlich gute Chancen haben, zum „Bioplastic Hub“ Asiens zu werden. ●

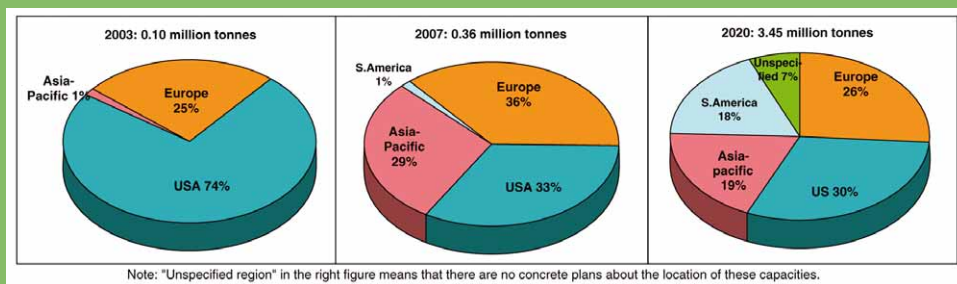
*Pressemitteilung: nova-Institut, Hürth, 25. November 2009,*

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# PRESENT AND FUTURE DEVELOPMENT IN PLASTICS FROM BIOMASS



Breakdown of worldwide capacity of bio-based plastics by region.

Product overview and market projection of emerging bio-based plastics.

Biobased plastics have experienced fast growth in the past decade thanks to the public concerns over the environment, climate change and the depletion of fossil fuels. This perspective provides an overview of the current global market of biobased plastics, their material properties, technical substitution potential and future market (for 2020). In addition, the technology and market development of three biobased plastics, namely polylactide (PLA), biobased polyethylene (PE) and biobased epoxy resin, are discussed in detail. The emerging biobased plastics market is still small compared to traditional biobased polymers and biomaterials. The global capacity of the emerging biobased plastics was only 0.36 million tonnes in 2007. However, the market grew strongly between 2003 and 2007 (approx. 40 % per year). The technical substitution potential of biobased plastics replacing petrochemical plastics is estimated at 90 %, demonstrating the enormous potential of biobased plastics. Global capacity of biobased plastics is expected to reach 3.45 million metric tonnes in 2020. Starch plastics, PLA, biobased PE, polyhydroxyalkanoates (PHA) and biobased epoxy resin are expected to be the major types of biobased plastics in the future.

Polymers abound in nature. Wood, leaves, fruit, seeds and animal furs all contain natural polymers. Biobased polymers have been used for food, furniture and clothing for thousands of years. Every year about  $17 \times 10^{10}$  metric tonnes biomass are produced by nature, of which only 3.5 % are utilized by mankind.<sup>[1]</sup> Apart from wood used for conventional applications, for example energy, paper, furniture and construction, only a minor part of the total biomass is currently used for materials, for example clothing and chemicals. The subject of this

perspective is biobased plastics. We define biobased plastics as man-made or man-processed organic macromolecules derived from biological resources and used for plastic and fiber applications (without paper and board). Biobased plastics have a history of more than a century – much longer than petrochemical plastics. The first artificial thermoplastic – celluloid – was invented in the 1860s.<sup>[3]</sup> Since then, numerous inventions have been patented for new compounds and materials made from biological resources, such as ethylene produced by the dehydration of biobased ethanol in the 1940s.<sup>[4]</sup> However, many inventions made in the 1930s and 1940s remained in the laboratories and were never commercially exploited, due to the development of cheap, synthetic polymers from crude oil in the 1950s. The petrochemical industry has since taken off and plastics have become a daily necessity. In Western Europe in 2007, 43 % of all plastics are used for packaging, 21 % are used in building and construction, 8 % for automobiles, 5 % for electrical and electronic appliances, and the remaining 23 % are used for various other applications.<sup>[5]</sup>

The vast majority of the polymers used are polyolefins, i.e., polyethylene (PE) and polypropylene (PP) which together represent 54 %, followed by polyvinyl chloride (PVC, 14 %), which dominates in building and construction, and polyethylene terephthalate (PET, 8 %).<sup>[5]</sup> Biobased plastics have experienced a renaissance in the last few decades. Many new polymers from biobased feedstocks were developed, for example polylactic acid (PLA) from sugars. One of the earlier drivers was to provide the market with biodegradable plastics in order to solve the problem of increasing amounts of waste and limited landfill capacity.

Today, public concerns about the environment, climate change and limited fossil fuel resources have become more important drivers. This perspective provides an overview of the market, material properties, applications, the technical substitution potential of emerging biobased plastics between 2003 and 2007, and the projections of the future market until 2020. An extensive description of such polymers can be found in Shen et al.<sup>[2]</sup> In this perspective, three biobased plastics, namely PLA, biobased PE and biobased epoxy resins, are highlighted for their recent developments.

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Press release: 7. December 2009 Wiley InterScience ([www.interscience.wiley.com](http://www.interscience.wiley.com)); DOI: 10.1002/bbb.189; *Biofuels, Bioprod. Bioref.* 4:25–40 (2010)

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The complete Study: Product overview and market projection of emerging bio-based plastics can be downloaded on the website of European Bioplastics e.V. : [http://www.european-bioplastics.org/media/files/docs/en-pub/PROBIP2009\\_Final\\_June\\_2009.pdf](http://www.european-bioplastics.org/media/files/docs/en-pub/PROBIP2009_Final_June_2009.pdf)

# GREENGRAN NATURAL FIBRE REINFORCED (BIO)PLASTICS: FIGHTING THE WAR ON WHITE POLLUTION



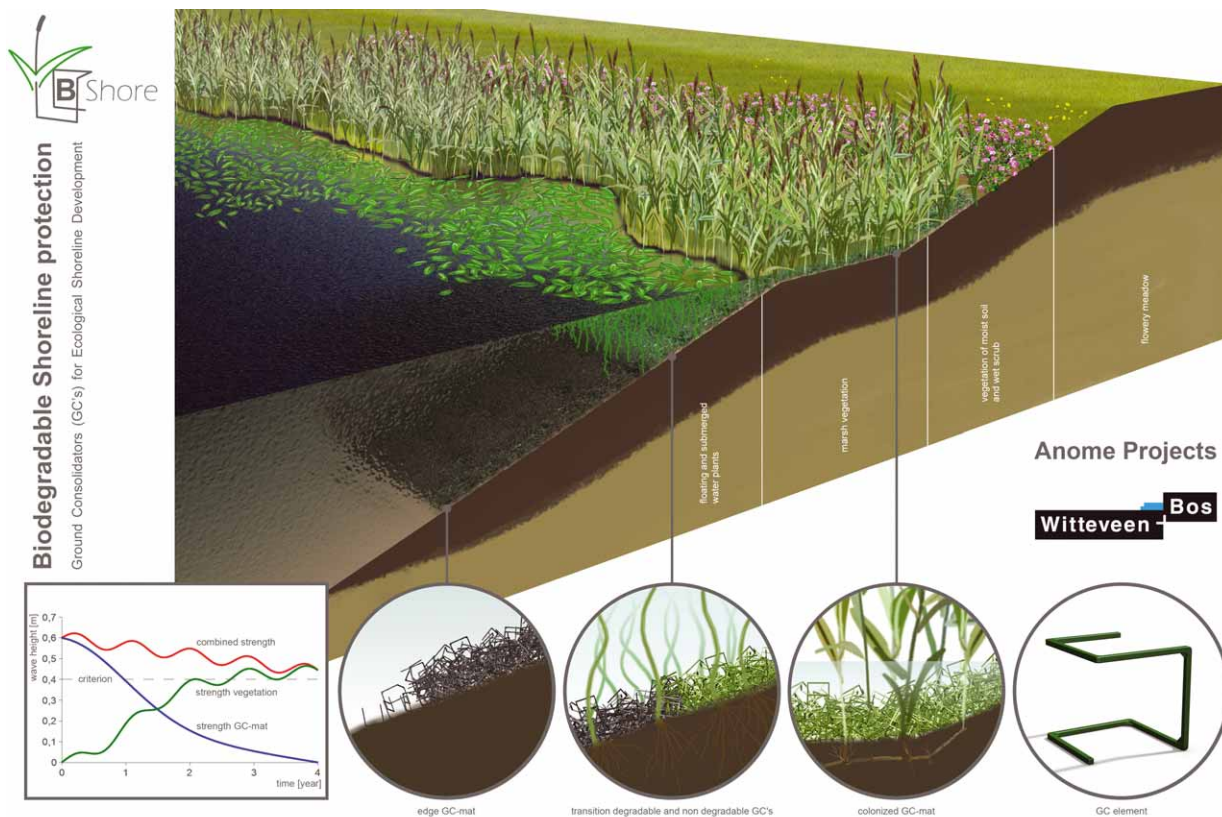
Waterworks. Picture: GreenGran

Widely used in many industries, plastics have become the source of white pollution. While the world is struggling to deal with this problem, GreenGran has been ardently advocating a new technology that replaces glass fibres with natural materials. Natural fibre reinforced polymers, with qualities that rival engineering plastics, is paving a new path to a better environment.

In the 90s, European countries began to focus on recovering, reusing and recycling automobile materials and spare parts, especially on glass-fibre reinforced plastic parts which are widely used but difficult to recycle. With financial support from the UN and EU, the Wageningen University of the

Netherlands commenced research on the development of natural fibre reinforced polymers. The result was the invention of the technology to produce natural fibre reinforced plastic granules which became a registered patent in the late 90s. A few years later GreenGran was founded as a spin-out company, aiming at production, marketing and sales of natural fibre reinforced (bio)plastic granules for injection moulding applications.

Using sustainable and renewable natural plant fibres (such as flax, jute, hemp and kenaf) and through industrial production techniques that mix them into plastics, GreenGran's granules are made from the



B-Shore. Picture: Anome B.V.



Winner Excellence Awards 2009.  
Picture: GreenGran

combination of these natural fibres with polypropylene, thus reducing the use of petroleum products. Five times stiffer and 2.5 times stronger than polypropylene, it will not cause wear and tear to the screw and the mould like glass fibres do, and unlike glass fibres, it does not pose safety and health risks. Its recoverable component comes from these natural plants and can occupy over half of its weight, up to 80 percent. All these features make it suitable for the production of durable products.

To list out the many advantages of our granules: good insulation, dimensional stability at high temperatures, high thermal deformation temperature, flame retardant, impermeability, possessing a stiffness and strength similar to traditional glass fibre filled polypropylene, can withstand long machine resistance time, low water absorption rate, high resistance to UV radiation and demonstrates normal flow behaviour, making it the best substitute for glass-reinforced plastic.

For a material to be genuinely environmentally friendly, its entire production process should be a closed system. The waste released by each production process should be usable in the next process, forming a cradle-to-cradle production cycle. In addition, as the raw materials of GreenGran's natural plastic come from plants and petrochemicals, the whole product can be collected and reused.

Lab figures showed that GreenGran natural fibre reinforced polymers products can be reused as many as seven times. Even when the product has reached the end of its life cycle, it can be collected and made into energy pellets for electricity generation, during which only water and carbon dioxide will be released when combusted.

To promote its granules, last year Green-

Gran moved from innovation to commercialization. It shared its technology and partnered with Bio-Natural Technology Co., Ltd. to form GreenGran BN (HK) Limited in Hong Kong, from where its industrial production was established. The granules are currently produced for a range of applications in automobiles, construction materials, packaging, toys and electronic products.

Custom made orders are also available to cater for clients' products. The type and amount of natural fibres can be adjusted to manufacture products of different features and appearances. These include UL94 FR V0, V1 & V2 grades.

Apart from conventional industrial usages, GreenGran is initiating researches to apply its bio-based materials in innovative applications. Among them is a partnership with Anome; in co-operation with Dutch Waterworks (ITC), Havenbedrijf Rotterdam and Boskalis, 35,000 protective blocks made from GreenGran granules were placed on riverbanks and dams to prevent riverbank erosion. Experiments have shown great results. As GreenGran materials can be made of biodegradable plastics too, they will decompose in a specified time period during which no harmful substances will be released, making it ideal for different areas of application.

Coral reefs around the world are dying in massive numbers due to various reasons. The traditional method of reviving the coral colony is by sinking a ship that acts as a new home for corals. But the ship's paint and other substances will pollute the sea. Better, GreenGran natural fibre reinforced polymers will disappear and be replaced by coral reefs. This meets the purpose of coral reefs rebuilding.

We care a lot – care for the environment,

care for our clients' economic return, care for your products/market combinations and care for a sustainable supply chain. GreenGran is solution- and service driven, aiming at working with you to co-create the transition from the oil-based economy to the bio-based economy. ●

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Charge unit. Picture: GreenGran

## BIOPLASTICS FOR DEMANDING MULTI-LAYER FILM SYSTEMS



Approximately one third of worldwide plastics production is used for the production of film, making film extrusion one of the most important processing procedures for plastics. The requirements placed on plastic films, especially those used predominantly in food and hygienic packaging, have been continuously increasing during the last few years and have now reached a level that can only be achieved by using a number of different processes.

For many applications only multilayer systems have proven to be sufficient to meet the specific criteria of the packaging task. Only by using a multiple layer matrix is it possible to guarantee all of the desired features, such as protection against sunlight and oxygen, preservation of flavour and aroma, effective barrier properties, and also sealability and printability.

Previously many existing biofilms have been produced as monolayer films and until recently it was assumed that bioplastics could not be used for multilayer systems as a result of their limited processibility. In cooperation with the Fraunhofer UM-SICHT Institute, FKUR Kunststoff GmbH has developed a wide range of biodegradable plastics predominantly from renewable raw materials which enable straightforward processing on conventional extrusion lines without any kind of additional additives.

As a result of the requirement to optimise the use of bio raw materials FKUR has developed different bio-compounds branded as Bio-Flex®, all of which can be con-

verted into blown film. An obvious advantage of the Bio-Flex range is the excellent compatibility of the different types. This is at the same time a precondition for an outstandingly adherent multilayer system that combines the different advantages required in a semi-finished film product. The entire multilayer system made from Bio-Flex is, of course, biodegradable.

The following practical examples will clarify the expansion of the range of applications for bioplastics by means of skilled utilisation in multilayer systems. For both examples the high content of natural resources (provided by Bio-Flex® A 4100 CL) as well as the excellent sealability (provided by Bio-Flex® F 2110) were the decisive factors for choosing a multilayer system.

McCain uses a three layer combination made from Bio-Flex F 2110 / Bio-Flex A 4100 CL / Bio-Flex F 2110 for packaging of their “Bio-Ernte” product line. This multilayer allows for the production of a very flexible and extensible film with a great stiffness also at low temperatures.

A three layer system made from Bio-Flex F 2110 / Bio-Flex A 4100 CL / Bio-Flex F 2110 was used by Umbra Olii for wrapping their “Ecolive” laundry soap, which is made from 100 % natural olive. The film allows for a very appealing glossy surface along with a great toughness and chemically resistance as well as good barrier properties for a bioplastic.

Bioplastics are technically mature and do not represent an obstacle in the conversion process! The processing of multilayer films using bioplastics from FKUR offers new application possibilities! ●

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Pictures: FKUR.



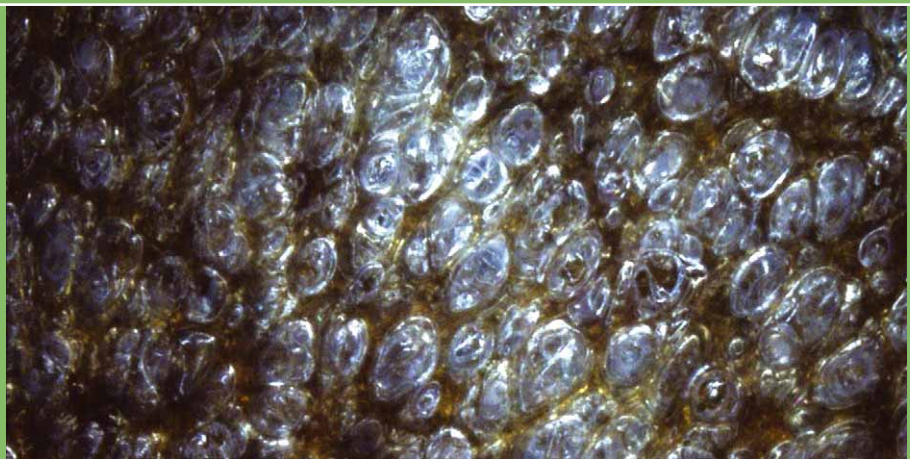
## CELLULOSE ACETATE FOAMS

Foam sheet extrusion of thermoplastics (e.g. expanded polystyrene foam (XPS)) is a well-established foam technology. Two basic categories of blowing agents are used for foam production (table 1). The blowing agent is the primary factor controlling the foam density as well as its cellular microstructure and morphology, so determining the end-use properties of foams<sup>[1]</sup>.

A wide range of conventional polymers is available for foam extrusion processes (e.g. PE, PP, PS, PET, PVC)<sup>[1;2]</sup>. Foams based on biopolymers (starch or PLA) are subject of recent developments and are already available on the market, especially as food trays or particle foams<sup>[3]</sup>. At present the use PLA for the production and application of foam trays for hot contents is limited due to its low heat resistance. Furthermore, the thermoforming process of PLA-based foam sheets is critical with regard to the high crystallinity and brittle-

Fig. 1: Cellulose Acetate based foam sheets and thermoformed tray.





ness of unmodified PLA. Therefore Fraunhofer UMSICHT, FKuR GmbH and Inde Plastik GmbH, a leading manufacturer of XPS-based food trays, are developing thermoformable cellulose acetate foam sheets for hot food applications. Foam tests with BIOGRADE C 7500 CL and different chemical blowing agents (CBAs) produced foam sheets with good thermoforming behaviour (Fig. 1).

By adding an azodicarbonamide as a CBA to the extrusion process it was possible to reduce the density of BIOGRADE C 7500 CL from 1.244 g/cm<sup>3</sup> to 0.454 g/cm<sup>3</sup>. The cellulose acetate foams exhibit a coarse morphology with inhomogeneous distribution of the cells (Fig. 2). Furthermore these bubbles are surrounded by compact BIOGRADE C 7500 CL as a matrix. The relatively low reduction in density and the coarse foam morphology with only a few, but large cells is typical for foams produced with CBAs.

In comparison to an XPS produced with PBAs, the cellulose acetate foams are stiff and have a high tensile modulus due to the relatively high amount of compact matrix material around the bubbles determining the mechanical properties (Fig. 3).

The rigidity in combination with a high heat resistance (Vicat A of BIOGRADE C 7500 CL is 111°C<sup>[4]</sup>) and thermoformability of these cellulose acetate foams make them attractive to rigid foam applications (e.g. trays for hot contents). Furthermore, the excellent injection mouldability together with the foaming performance of BIOGRADE C 7500 CL are ideal for the manufacturing of foam injection moulded compact parts with a (rigid) foam core. Recent developments by Fraunhofer UMSICHT and Inde Plastik GmbH are focusing on cellulose acetate foams produ-

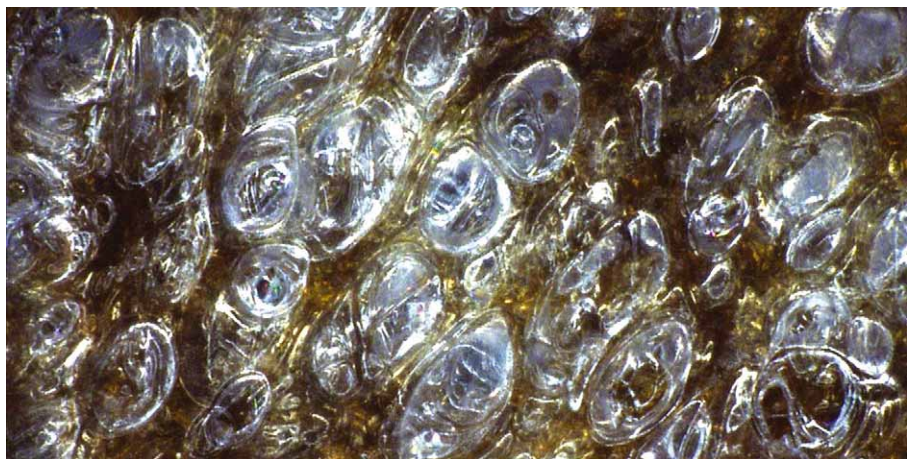


Fig. 2: Morphology of cellulose acetate foam [digital microscope; magnification: 25-times and 50-times.

ced with PBAs. The aims of the investigation are foams with lower densities, homogeneous cells and finer foam morphologies like XPS foams. For fine, low-density foams produced with PBAs, the polymer properties have to fulfil specific requirements<sup>[1]</sup>:

**Rheological properties:**

- specific melt viscosity and melt stability for a good gas dispersion and distribution as well as stable foam morphology without collapse.

**Thermal properties:**

- wide processing window without thermal degradation to achieve a specific melt rheology
- crystallization behaviour of the polymer competing with the nucleation and growth of the bubbles
- heat distortion temperature and heat conductivity for a rapid increase in polymer viscosity to avoid foam collapse

Physical blowing agents (PBA)	Chemical blowing agents (CBA)
<ul style="list-style-type: none"> <li>• gases (e.g. N<sub>2</sub>, CO<sub>2</sub>, C<sub>3</sub>H<sub>8</sub> or C<sub>4</sub>H<sub>10</sub>) or low boiling point-fluids (e.g. ethanol or propanol)</li> <li>• separate feeding via gas injection into the polymer melt (homogenization zone)</li> <li>• lower foam densities and higher foam ratios with more homogeneous foam morphology than for CBA</li> <li>• thin-walled foam sheets, films or profiles</li> </ul>	<ul style="list-style-type: none"> <li>• thermally unstable chemicals (e.g. bicarbonates, azodicarbonamide, hydrazine derivatives or citric acids) which decompose or react under temperature and produce gases (e.g. N<sub>2</sub>, CO, CO<sub>2</sub>)</li> <li>• feeding as masterbatches together with the polymer (no critical modification of existing machinery is required in comparison to PBA)</li> <li>• only thick-walled products with low density reduction</li> </ul>

Tab. 1: Short characterization of physical and chemical blowing agents (according to <sup>[1]</sup> and <sup>[2]</sup>).

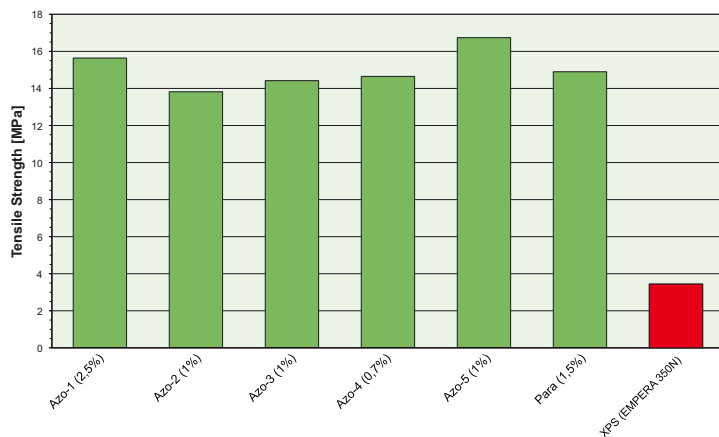


Fig. 3: Tensile Strength of different cellulose acetate foams in comparison to an XPS (red).

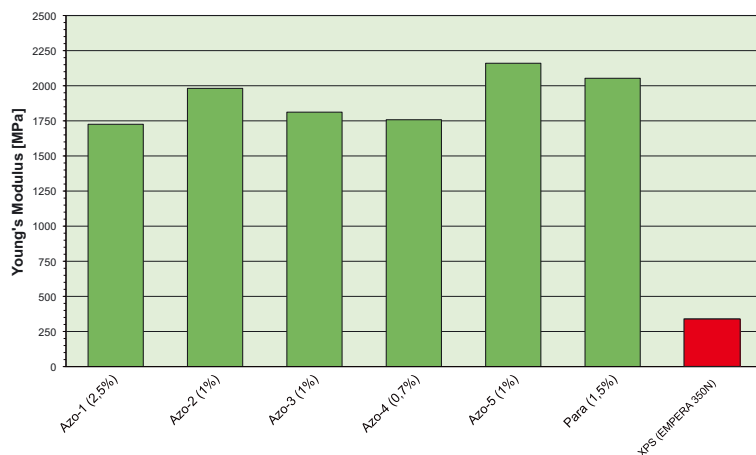


Fig. 4: E-modulus of different cellulose acetate foams in comparison to an XPS (red).

**Physical properties:**

- high gas solubility in the polymer melt but poor gas solubility in the finished foam
- boiling point, molecular weight or vapour pressure of the physical blowing agent
- physical polymer properties like molecular chain structure or degree of crystallinity

To achieve these required properties, cellulose acetate has to be modified. At present external (physical) plasticization is the most common method of cellulose acetate modification. Blending is very difficult due to its Hansen solubility parameter as well as the strong hydrogen bonds influencing the miscibility of cellulose acetate [5].

Therefore, Fraunhofer UMSICHT is studying the reactive modification (e.g. internal (chemical) plasticization) of cellulose acetate to achieve long-term stable properties needed for physical foaming. ●

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Bootsansicht. Bild: Hiendl



Decksleiste. Bild: Hiendl

Drachenboote gibt es bereits seit über 2000 Jahren. In den letzten 20 Jahren hat sich das Drachenboot von einem traditionellen asiatischen Festivalboot zu einem modernen Wettkampfboot entwickelt. Die BuK GmbH hat 1995 mit seiner modernen vermessbaren Drachenbootkonstruktion den Grundstein für diese rasante Entwicklung gelegt. Drachenbootsport ist mittlerweile eine international anerkannte Sportart. Neben den sportlichen Aspekten hat es sich der Internationale Drachenbootverband zur Aufgabe gemacht, eine Brücke zwischen dem traditionellen asiatischen Ursprung dieses Bootes und den modernen Ansprüchen einer modernen Sportart zu schlagen. Aus diesem Grund wurde eine strenge Spezifikation geschaffen. Neben den modernen Werkstoffen (GUP) sollen auch traditionelle Materialien in diesem Boot verarbeitet werden. So ist es ausdrücklich nicht erwünscht, die Decksleisten und Sitzbänke aus reinen Kunststoffen herzustellen.

Die bisher verwendeten Decksleisten wurden aus Mahagoni produziert. Eine 12,5 m lange Decksleiste musste bisher mindestens einmal mittig geschäftet wer-

# BIOWERKSTOFF HIENDL NFC® WIRD JETZT AUCH FÜR DECKSLEISTEN IM DRACHENBOOTBAU EINGESETZT

Beispielhafte Zusammenarbeit zwischen dem Kunststoffverarbeiter Hiendl und dem Drachenbootbauer BuK.



Drachenboot im Wettkampf. Bilder: Hiendl



den, um die gewünschte Länge zu erhalten. Aufwendige Fräsarbeiten und eine anschließende Oberflächenbearbeitung bis zu einer mehrschichtigen Lasur ließen dieses Bauteil zu dem aufwendigsten Einzelteil am Drachenboot werden.

Mit Hiendl NFC® hat die BuK GmbH nun einen Werkstoff gefunden, der einerseits dem traditionellen Anspruch genügt. Diese moderne Decksleiste besteht zu 70 % aus Holz und besitzt auch auf Grund der gewählten Farbgebung und der materialeigenen Struktur einen Holzcharakter. Andererseits ist sie mit allen modernen Eigenschaften ausgestattet, die eine optimale Verarbeitung und auch einen langen pflegearmen Einsatz unter härtesten Bedingungen garantieren.

Die Decksleiste wird aus Hiendl NFC®, einem Naturfaser-Verbundwerkstoff aus der eigenen Forschung und Entwicklung der H. Hiendl GmbH & Co. KG in Bogen/Bayern, gefertigt. Das Material besteht zu 70 % aus Holzfasern und zu 30 % aus Polypropylen. Mit einem Gewicht von 0,66 kg/m und den konstruktiv eingebauten Hohlräumen ist das Naturfaser verstärkte Kunststoffprofil leichter als das

bisher verwendete Holzprofil. Im Vergleich mit den natürlichen Ausgangsstoffen, insbesondere Holz, überzeugen die Hiendl NFC® Werkstoffe durch ihre überlegene Formbarkeit. Sie weisen verfahrensbedingt bereits gebrauchsfertige Oberflächen auf, d. h. Lackieren oder Beschichten kann entfallen. Profile aus Hiendl NFC® können durchgängig farbig extrudiert werden. Das Decksleistenprofil stellt zudem eine besondere Anforderung an die Fertigung, die der Biowerkstoff im Gegensatz zu konventionellen Kunststoffen hervorragend erfüllt. Die extrem unterschiedlichen Wandstärken im Profil können mit reinen unverstärkten Polymeren nicht erreicht werden. Der Kunststoff schrumpft an den dickeren Stellen und erzeugt dadurch Einfallstellen und unebene Oberflächen. Der Verstärkungsstoff verhindert das Einfallen und die Oberflächen bleiben eben und schön.

Die Vorteile der neuartigen Decksleiste liegen auf der Hand. Die Leiste kann in der gewünschten Überlänge, im gewünschten Querschnitt und in der gewünschten Farbgebung und Oberflächengüte im Extrusionsverfahren hergestellt werden. Schäftungen, Fräsungen und eine Oberflächen-

nachbearbeitung entfallen dadurch. Zudem sind die Leisten aus dem neuartigen Biowerkstoff stabiler und gleichzeitig leichter als herkömmliche Holzleisten. Sie sind weniger anfällig für Paddelschläge und Feuchtigkeit. Dieser Fakt reduziert den bisher notwendigen jährlichen Pflegeaufwand nach praktischem Einsatz faktisch auf Null.

Mit Hiendl NFC® ist der BuK GmbH ein Werkstoff an die Hand gegeben, der auf beeindruckende Weise nicht einfach nur durch besondere moderne Eigenschaften überzeugt, sondern ebenso auch die speziellen traditionellen und praktischen Erfordernisse einer exotischen Sportart erfüllt. Besser kann man Tradition und Moderne nicht miteinander verbinden. ●

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# MIT BIOWERKSTOFFEN ZU NEUEN PRODUKTEN

Kunststoffe lassen sich auf vielfältige Weise für verschiedene Anwendungen maßschneidern. Neben verschiedenen Additiven und mineralischen Füllstoffen werden hierzu Fasern aus Glas, Kohlenstoff, synthetischen Polymeren wie z. B. Aramid und natürlichen Ursprungs eingesetzt. Die sog. Faserverbundwerkstoffe sollen möglichst die jeweils positiven Eigenschaften von polymerer Matrix und Faser vereinen.



Granulierung von Arbofill®. Bild: Tecnaro



Badezimmer-Artikel aus Arbofill® Buche der Tecnaro GmbH. Bild: COZA



Attraktiv und umweltfreundlich: Der Absatz des „Eco-Pump“ von Sergio Rossi (Gucci Group) ist aus Arboform® gefertigt. Dieser patentierte Biocomposite-Werkstoff der Firma Tecnaro bindet die Naturfasern in eine Matrix aus Lignin ein und ist daher komplett aus nachwachsenden Rohstoffen. Dieses „Flüssigholz“ lässt sich thermoplastisch formen und zum Beispiel per Spritzgießen verarbeiten. Unterstützt wurde das „Eco-Pump“-Projekt von der Fraunhofer Gesellschaft und von Stephan Paccagnella von der Firma Aesop. Bild: Fabian Diehr

Holz, Flachs, Hanf, Sisal, Kokos, Kenaf, etc. sind intrinsische Faserverbundwerkstoffe mit einer Matrix aus Lignin und Hemicellulosen. Die entsprechenden Fasern können mit einer Kunststoffmatrix synergetisch kombiniert werden. Hierzu werden sie in der Regel vereinzelt, gemahlen oder geschnitten und ggf. zur partiellen Entfernung von Lignin und Hemicellulosen weiter aufbereitet. Anschließend werden die Fasern mit Polymeren, Additiven und Haftvermittlern vermischt. Zum Teil werden diese Rohstoffe beim Verarbeiter in ein- oder zweistufigen Prozessen zusammengeführt und daraus Halbzeuge oder Fertigwaren hergestellt. Für die sog. Direktverarbeitung oder eine Kaskadenschaltung spricht die Möglichkeit „aus einer Wärme“ arbeiten zu können. Nachteilig ist jedoch Notwendigkeit zum know-how-Aufbau und Investition in Dosier-, Compoundier- und Verarbeitungstechnologie sowie die Bildung von Flaschenhälsen und Kompromissen, insbesondere bei breitem oder flexiblen Produktspektrum. Es gibt daher Compoundeure, die sich auf diese Art von Biowerkstoffen spezialisiert und in

entsprechend leistungsfähige Anlagentechnik investiert haben, mit denen sich wirtschaftliche Vorteile ausschöpfen lassen. Von ihnen kann man fertige Granulate beziehen, mit denen sich insbesondere Extrusionsprofile und Spritzgussteile fertigen lassen.

Mit Naturfasern lässt sich der Anteil nachwachsender Rohstoffe im Werkstoffbereich erhöhen und damit die klimarelevante CO<sub>2</sub>-Bilanz verbessern. Ihre relativ geringe Dichte kann zu kostengünstigem Leichtbau beitragen und durch Gewichtsreduktion beispielsweise im Fahrzeugbau diesen Effekt noch verstärken.

Mengenmäßig liegen Holzfaserverbundwerkstoffe vorn. International wird mit „WPC“ die Abkürzung des englischen Begriffs Wood Plastic Composites für diese Biowerkstoffklasse verwendet. Großen Mengen werden zu Terrassenprofilen extrudiert.

Als Matrixmaterial werden erdölbasierte Duro- und Thermoplaste wie beispielsweise Epoxid- oder Phenolharze, Polypropylen PP, Polyethylen PE, Polyvinylchlorid PVC, etc. zunehmend aber auch auf Basis





Waldschilder aus Arboform®.  
Bild: Jochen Rümmelein

Zu 100 % biobasiert und biologisch abbaubar sind Werkstoffe aus der Arboform®-Familie der Tecnaro GmbH. Dabei eignet sich dieser durchaus auch für langlebige Produkte, da die Abbauprozesse erst bei Kontakt mit Bakterien im Erdreich oder in Kompostanlagen wirksam werden. Bis dahin bleiben die Werkstoffe langzeitstabil, wie es der Einsatz für Waldschilder in den Bayrischen Staatsforsten seit mehreren Jahren beweist.

nachwachsender Rohstoffe bestehende Polymere wie PLA oder Lignine eingesetzt.

Die Herstellung von thermoplastischen Faserverbundwerkstoffen mit Lignin als Matrixmaterial ist durch gemeinsame Patente der Fraunhofer-Gesellschaft und der Fa. Tecnaro weltweit geschützt.

Die Tecnaro GmbH wurde 1998 als Spin-off-Unternehmen des Fraunhofer ICT gegründet und bietet ein breites thermoplastisches Biowerkstoffspektrum an. Das Unternehmen entwickelt, produziert und vertreibt Biopolymere und Biocomposites auf Basis nachwachsender Rohstoffe und unterstützt bei der Auswahl und ggf. Anpassung für spezifische Anwendungen. Hinsichtlich Innovationsgrad und Nachhaltigkeit ihrer Produkte wurde Tecnaro mehrfach ausgezeichnet: Deutscher Industriepreis 2009 in der Kategorie Zulieferer, Werkbund label 2008, VR Innovationspreis 2007, Euromold Award in Gold, etc. Zum Portfolio zählen das lignin-basierte „Flüssigholz“ ARBOFORM®, das hochwertige naturfaserverstärkte Polymercom-

pound ARBOFILL® sowie das Biopolymercompound ARBOBLEND®.

## ANWENDUNGEN

Anwendungen in verschiedenen Branchen wie beispielsweise Haushaltswaren, Büro-Utensilien, Schreibgeräte, etc. zeigen das Einsatzpotenzial auf. Zur Anwendung von Arbofill® im Haushaltsbereich trugen u. a. die Spülmaschineneignung, die FDA-Zulassung und die natürliche Anmutung bei. Die Fa. COZA aus Brasilien schuf mit der Bios-Linie eine Serie mit mehr als 50 verschiedenen Haushaltsartikeln.

Weitere Informationen: [www.tecnaro.de](http://www.tecnaro.de) ●

*Autoren: Dr. Lars Ziegler, Jürgen Pfitzer, Helmut Nägele, Tecnaro GmbH, Ilsfeld-Anenstein, E-Mail: [info@tecnaro.de](mailto:info@tecnaro.de)*



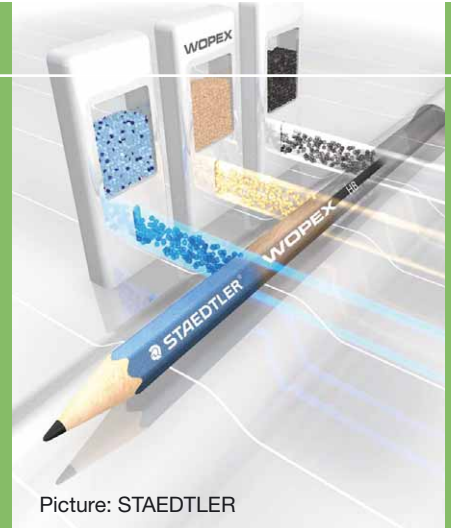
GREENLINE – die Bio-Kunststoff-Linie von Rotho - Umweltbewusstes Ablagesystem fürs Büro aus Arbofill® Buche der Tecnaro GmbH. Bild: Rotho



Tischdekorations-Artikel aus Arbofill® Buche der Tecnaro GmbH. Bild: COZA

## MARKET GROWTH WPC

The demand for wood plastic composites (WPC) is increasing despite the present economic crisis. The Third German WPC Congress in Cologne took place on the 2nd and 3rd of December 2009. With 300 participants from 26 countries and 30 exhibitors, it continues to establish itself as the leading European congress for the WPC industry. During this latest event, STAEDTLER was awarded the WPC Innovation Award 2009 for its WOPEX pencil.



Picture: STAEDTLER

Producers, mechanical engineers and additive producers came together in Cologne to exchange information and discuss the latest market developments and technical trends. Besides developments in the German-speaking areas, the focus of the congress this year was on China. A Chinese delegation introduced the Chinese WPC industry in its own individual session.

Today more than 1.5 million tons of WPC are produced worldwide, especially in North-America (about 1 million tons), China (200,000 tons) and Japan (100,000 tons). Germany is the European leader with more than 70,000 tons and is, in addition, the leader in machine engineering. In Germany the main areas for the application of WPC are in the automotive industry for car interiors and also in deckings. Deckings are floor coverings, used mainly in outdoor areas, such as terraces and public places. These deckings are increasingly becoming an alternative to tropical timber, and sales volume shows a yearly double digit growth. Representatives from industry and research presented many new applications. These innovations, for example concrete formwork boards, container floors and facing panels, will achieve substantial growth in the next few years.

The application of WPC in China is even more extensive. The Chinese production includes products such as windows, doors, thermal insulating systems, park benches, garden sheds and sun screens for tower buildings, all made from WPC. Raw materials are wood flour as well as other cellulosic agricultural byproducts. The growth in China is at a level of 30 % per year. Chinese WPC production is predicted to increase by up to 5 million tons per year between now and 2015.

A special highlight of the congress was the WPC Innovation Award for new developments

within the WPC sector. 15 companies, which had introduced new WPC products in 2009, applied for the WPC Innovation Award 2009 which was sponsored by Reifenhäuser GmbH & Co. KG, Troisdorf, Germany. A jury of sponsors, congress partners and Nova-Institut staff nominated three companies. These companies introduced their products in short presentations. Afterwards the winner was elected by the conference audience.

### WPC INNOVATION AWARD 2009:

**The first pencil made from WOPEX – the reinvention of the pencil from the stable of STAEDTLER Mars GmbH & Co. KG, Nürnberg, Germany.**

The conference audience was most impressed with WOPEX and chose this as the winning product. The new WOPEX pencil certainly has a lot to offer. The pencil shaft is made from a wood plastic composite (WOPEX WPC) with a wood content of 70 %. The material consists of fine wood fibre from PEFC-certified German saw mill residue. The pencil lead is made up of appropriate graphites with the addition of very brittle plastics and stearates (soaps) instead of the conventional mixture fired from clay and graphite. The surface consists of a polymer composite from thermoplastic elastomers (TPEs) and polyofines to give it a smooth texture, making it pleasant to handle. All materials are fused at temperatures of 130–180 °C. Afterwards they are fed to a co-extrusion head that was specially developed by the company. The single melt flows are directed towards each other in the co-extrusion head, which gives the right volume and the correct positioning.

The production process is not only interesting from the technical point of view but also has a number of advantages. Compa-

red to the production of conventional pencils, the production process is much shorter. In addition, the use of wood as a raw material is much more efficient (for conventional pencils the wood waste is up to 80 %) and less energy is required. There are also many benefits for customers: the look and feel is of a high-quality, the writing flow of the pen has a waxy glide which leaves almost no particle residue on the page. Furthermore, it lasts almost twice as long as comparable wood-cased pencils.

**Second-prize winner: the assembly profile system from Hiendl GmbH & Co. KG, Bogen, Germany.**

As an alternative to standard metal profiles H. Hiendl GmbH & Co. KG offers a variety of assembly profile systems that are made from the composite material Hiendl NFC® with a wood content of 70 %. In comparison to conventional metal systems, the profiles of Hiendl can be continuously extruded in colour. Because of the high-quality composite material and the greater thickness of the material in comparison to metal profiles, the Hiendl profiles are as robust as conventional solutions. They are compatible with conventional systems and are lower-priced than aluminum profiles.

**Third-prize winner: the WPC thermal insulated siding from Qingdao HuaSheng Hi-tech Development Co.Ltd., China**

This Chinese company offers WPC facing elements with integrated XPS-insulation. They can be extruded in multiple colours and are already used extensively in house facings. ●

*Press release: nova-Institut, Huertb, 3. December 2009, E-mail: [contact@nova-institut.de](mailto:contact@nova-institut.de);  
Author: Michael Carus, nova-Institut GmbH, Huertb*

# THE INGEO™ JOURNEY

Ingeo™ is a unique bio-based material, made from plants instead of oil. It was introduced globally in 2003 on a commercially viable scale by NatureWorks LLC, a company dedicated to more sustainable and environmental product and business development. NatureWorks' mission is to drive real environmental progress through its global market development and communication of the many and varied Ingeo™ branded products made today from either Ingeo™ natural plastic or fiber.

Since the journey began, Ingeo™ products have progressed from idea to reality, spearheading a broad assortment of creative innovations from Ingeo™ natural plastics for food & beverage packaging to service-ware, consumer electronics and durable goods, as well as Ingeo™ fiber for clothing, homeware and personal care products.

Ingeo™ performs well in both its plastic and fiber forms. It offers a significant reduction in green house gas emissions, which contribute towards global warming and climate change. It also cuts our dependence on oil as a resource material, and offers the potential for significant waste reduction.

## RAW MATERIAL FACTS

The material is not made from oil. It currently uses plant sugars from field corn as the source material for manufacture. Today, these plant sugars are derived from field corn that is already grown for many industrial and functional end-uses. Ingeo™ uses less than 1/20th of 1 % (0,05 %) of the annual global corn crop today, and as such contributes little to no impact on international or local food chains.

Ingeo™ doesn't require corn, it only needs a sugar source, whatever is most readily available depending on geography. In the future the polymer will be made from cellulosic raw materials, agricultural wastes and non-food plants.

## PRODUCT FACTS PACKAGING

The material has excellent gloss, transparency and clarity. It provides good flavor and aroma barrier properties. Besides it has good form and stiffness properties and in combination with lower density makes for lighter packages compared to PET. Packa-



ging products which are currently made of Ingeo™ are: trays, punnets, drinking cups, bottles, flow packs, foam, extrusion coated cups, cards, shrink film and injection moulded applications like cosmetic packaging.

## PRODUCT FACTS FIBERS

Ingeo™ fiber is versatile, available in both filament and staple spun forms. It can make a wide variety of textile styles from dress to sportswear, furnishings to drapes and soft nonwoven baby wipes to tough landscape textiles. It can outperform traditional synthetics for UV light resistance, hypoallergenic properties, outstanding moisture management, stain resistance, low odor retention, easy care/quick dry, breathability, comfort and insulation properties.



Pictures: Ingeo

## DISPOSAL OPTIONS

Ingeo™ offers more end-of-life options than any traditional plastic in the market: clean incineration, mechanical recycling, industrial composting, anaerobic digestion and feedstock recovery. Feedstock recovery has become a reality, with a world scale Belgian lactic acid producer Galactic, with its LOOPLA® recycling process. Galactic has built a 1500 ton lactic acid plant, based on PLA feedstocks which neatly closes another part of the Ingeo™ circle of production. Galactic is collaborating with NatureWorks to collect both post industrial and post consumer waste to feed their process.

For more information about NatureWorks and its brands, please visit our website: [www.natureworksllc.com](http://www.natureworksllc.com).

Feel free to contact us in case you need more information or in case you would like to talk to one of our representatives. NatureWorks LLC is represented by a European headoffice in the Netherlands. Our telephone number is: +31 35 6 94 5056. ●

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E-mail: [ady\\_jager@natureworkspla.com](mailto:ady_jager@natureworkspla.com)*

# FAÇADE PROFILE STRUCTURA

Striking surface structure – soft metallic colours

It is not just the velvety surface of the new WERZALIT structura façade profile. The soft colour tones – brown, anthracite or metallic – are also responsible for lending a building its appealing character. Striking accents can be set with the surface texture of these profiles, and the façade profiles can even be used with either side facing out! One side is slender and traditional while the other is broadly textured and modern. In this way, the developers of WERZALIT offer twice the benefits along with extensive design freedom. The new structura façade profile arrives on the market in the first quarter of 2010.

The material produced from the award-winning wood-polymer-composite (60 % wood fibre) S2 has all the attributes of a trend-setting, weather-resistant and functional building feature. The wood harvested from regional, PEFC-certified forests also ensures a positive eco-balance while making the product sustainable as well. It is only logical that this material should also be used for façade design. For just this purpose, WERZALIT has developed a well-conceived façade system that offers many advantages. For instance, the unusual profile width of 240 mm and the large centre-to-centre distance of 625 mm reduce the amount of installation work compared with similar, competing products. The coverage width of the profile is 232 mm.

These large, advantageous fastening distances are made possible by the sturdy and high-quality installation clips. And the profile itself is inherently very stable thanks to the inclusion of cavities in its design.

The structura façade profile is resistant to insects and fungi, water-repellent, low-maintenance and easy to clean. Another quality feature of the advanced material is



Picture: WERZALIT

its resistance to breakage and impacts, even under heavy hail. As a curtain façade, the profiles protect the building from the influences of the weather while allowing moisture arising during construction or occupancy to escape.

In addition to its technical properties and the diversity of its design, the structura façade profile offers an interesting alternative to wood façades thanks to its high material quality. The purchase and maintenance costs are low compared with other durable and robust façade materials. The value retention, easy installation and recyclability of the material – a combination of wood and plastic – make these façade profiles a sustainable, economical and aesthetically

pleasing solution for all architects and developers. ●

*Author: Dr. Matthias Schulte, WERZALIT GmbH & Co. KG, Oberstenfeld, E-mail: m.schulte@werzalit.de*

# International Congress on Bio-based Plastics and Composites

## 3. Biowerkstoff-Kongress 2010

April 20<sup>th</sup> – 21<sup>st</sup> 2010, HANNOVER MESSE, Germany, Convention Center, Saal 2



### Election and Presentation of the Innovation Award – Bio-based Material of the Year 2010!

The ceremonious presentation takes place in the evening of the first congress day. During the whole fair time the “top 3“ of the submitted applications will be presented at a common exhibition space on HANNOVER MESSE. Detailed information can be found at [www.biowerkstoff-kongress.de](http://www.biowerkstoff-kongress.de).

### CONTENT

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Henkel AG | ECOMfort



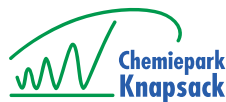
GreenGran B.V. | GreenGran



Propper GmbH & Co. KG | Proganic

Further information:  
[www.biomaterials-congress.de](http://www.biomaterials-congress.de)

Sponsor



[www.infraserv-knapsack.de](http://www.infraserv-knapsack.de)

Sponsor Innovation Award



[www.coperion.com](http://www.coperion.com)

Premium Partner



[www.hannovermesse.de](http://www.hannovermesse.de)



[www.nachwachsende-rohstoffe.de](http://www.nachwachsende-rohstoffe.de)



[www.bioplasticsmagazine.com](http://www.bioplasticsmagazine.com)



[www.heise.de/tr/](http://www.heise.de/tr/)

Organiser



[www.nova-institut.de](http://www.nova-institut.de)

# Programme

Simultaneous translation  
German ↔ English!

[www.biomaterials-congress.de](http://www.biomaterials-congress.de)



## Day One: April 20<sup>th</sup>

### SESSION 1:

#### LEAD MARKET BIO-BASED PLASTICS AND COMPOSITES – CURRENT TRENDS AND POLITICAL FRAMEWORK

- 09:30 h **Bio-Based Plastics and Composites: Current trends, drivers and future developments**  
*Michael Carus*, nova-Institut GmbH (DE)
- 10:00 h **The European Commission's Lead Market Initiative (LMI) for Bio-based Products**  
*Peter Schintlmeister*, Federal Ministry of Economy, Family and Youth (AT)
- 10:30 h **Policy on Bio-based Products**  
*John Williams*, Polymers & Materials Manager, National Non Food Crops Centre (UK)
- 11:00 h **Coffee Break**
- 11:30 h **A new Biopolymer Database**  
*Prof. Hans-Josef Endres*, FH Hannover (DE)
- 12:00 h **Measuring the Biobased Content of Bioplastics and Composites via ASTM D6866**  
*Alexander Shroff*, Beta Analytic Inc. (USA)
- 12:30 h **Certification – Industrial Task Force Bio-Based Content**  
*Jöran Reske*, european bioplastics (D)
- 13:00 –  
14:00 h **Lunch Break**

### SESSION 2:

#### BIO-BASED PLASTICS – PRODUCTION AND APPLICATIONS, PART 1

- 14:00 h **Latest Development with INGEO-PLA (Polylactide)**  
*Ady Jager*, NatureWorks B.V. (NL/USA)
- 14:30 h **Bio-based Films for Packaging**  
*Joachim Janz*, Innovia Films (DE/UK)

- 15:00 h **New Bio-based Compounds for Packaging and other Applications**  
*Dr. Christian Bonten*, FKUR Kunststoff GmbH (DE)

- 15:30 h **Coffee Break**

### SESSION 3:

#### WOOD PLASTIC COMPOSITES (WPC)

- 16:00 h **Innovative Timber Products**  
*Dr. Peter Sauerwein*, Verband der Deutschen Holzwerkstoffindustrie e.V. (DE)
- 16:30 h **Current WPC applications for the construction, furniture and automotive industry**  
*Dr. Matthias Schulte*, Werzalit GmbH & Co. KG (DE)
- 17:00 h **Diverse Examples of new Applications for WPC**  
*Helmut Hiendl*, h. hiendl kunststofftechnik GmbH & Co. KG (DE)
- 17:30 –  
18:15 h **Innovation Award**

**Compounding of Renewable Materials**  
*Miriam Walddörfer*, Coperion GmbH (DE)  
*Uta Kühnen*, Coperion GmbH (DE)

#### “Bio-based Material of the Year 2010”

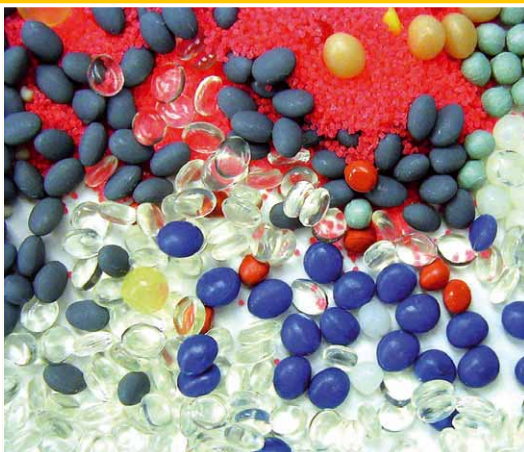
Short presentation of the three nominated companies for the Innovation Award – Election of the awardee by the participants

- GreenGran B.V. | GreenGran
- Henkel AG | ECOMfort
- Propper GmbH & Co. KG | Proganic

- 18:15 h **Dinner Buffet**

- 19:30 h **Presentation of the Innovation Award**  
by *Peter von Hoffmann*, General Manager, Coperion GmbH (DE)

- ca. 21:00 h **End of the evening reception**



## Day Two: April 21<sup>th</sup>

### SESSION 4: NATURAL FIBRE REINFORCED PLASTICS (NFRP)

- 09:30 h **Hemp Fibres for Industrial Applications**  
*John Hobson, Hemp Technology Ltd (UK)*
- 10:00 h **Use of Natural Fibres in the interior of cars: Status and Future**  
*Dr. Werner Klusmeier, Johnson Controls Interior (JCI) (DE/USA)*
- 10:30 h **Ford Motor Company's Sustainable Materials**  
*Maira Magnani, Ford Forschungszentrum Aachen (DE/USA)*
- 11:00 h **Coffee Break**
- 11:30 h **Innovative Natural Fibre Reinforced Bio-Composite Granules for Cradle-to-Cradle Solutions – China in our hands?**  
*Martin Snijder, GreenGran B.V. (NL)*
- 12:00 h **Cork Composites**  
*Alexandre Pereira, Grupo Amorim (PT)*
- 12:30 h **Going Green: Bio-based Composites and Blends (Arboform<sup>®</sup>, Arboblend<sup>®</sup> and Arbofill<sup>®</sup>)**  
*Dr. Lars Ziegler, Tecnar GmbH (DE)*
- 13:00 –
- 14:00 h **Lunch Break**

### SESSION 5: BIO-BASED PLASTICS – PRODUCTION AND APPLICATIONS, PART 2

- 14:00 h **Performance Polymers renewable sourced: Polymers, Processing and Applications**  
*Thomas Werner, Du Pont de Nemours GmbH (DE/USA)*
- 14:30 h **D-lactide and L-lactide for PLA**  
*Dr. Vincent de Jong, PURAC Biochem B.V. (NL)*
- 15:00 h **Furan Chemicals and their applications in new materials**  
*Dr. Ir. Hans Hoydonckx, TransFurans Chemicals bvba (BE)*
- 15:30 h **Braskem and Novozymes join forces on Green Polypropylene**  
*Thomas Grotkjær, Novozymes A/S (DK)*
- 16:00 h **Coffee Break**
- 16:30 –
- 17:30 h **Panel Discussion**

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#### Partner



#### Media Partner



# Statements Speakers

Day One: April 20<sup>th</sup>

## SESSION 1: LEAD MARKET BIO-BASED PLASTICS AND COMPOSITES – CURRENT TRENDS AND POLITICAL FRAMEWORK

09:30 h

Michael Carus,  
nova-Institut GmbH



Michael Carus

### Bio-Based Plastics and Composites: Current trends, drivers and future developments

Bio-based plastics and composites are in increasingly high demand by industry and consumers, with most sectors showing double-digit growth rates even during the global economic crisis.

The lecture will start with a review of markets, applications and future trends of bio-based plastics in packaging and permanent applications, of wood plastic composites and natural fibre reinforced plastics. Bio-based products today can be found mainly in the packaging, construction and furniture industry, as well as in the automotive industry and increasingly throughout the plastics industry in numerous industrial and consumer products.

The following chart, based on unverified documentation, shows the minimum quantities of different bio-based materials used in the European Union in 2009.

New Biomaterials – Technique	Quantities – Region
Biodegradable bioplastics (mostly packaging)	> 80,000 t
Bioplastics in permanent applications	> 60,000 t
NF compression moulding in the automotive industry	> 40,000 t
Wood fibre compression moulding in the automotive industry	> 50,000 t
Cotton fibre compression moulding (lorries)	> 100,000 t
WPC injection moulding and extrusion (construction, furniture, automobiles)	> 120,000 t
NF injection moulding and extrusion	> 5,000 t
<b>Total biobased products</b>	<b>&gt; 450,000 t</b>

Source: nova-Institut 2009

Source: nova 2009

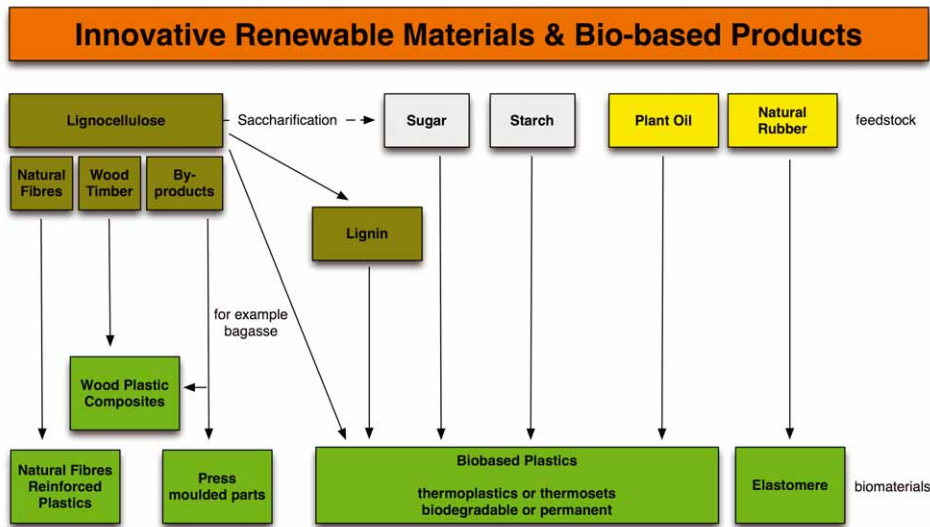
Why are bio-based materials supported by politics (EU: Lead Market Initiative) and viewed favourably by industry and consumers?

- Green materials – environmental advantages - less environmental impact: lower energy input, lower green house gas emissions, less littering problems, no harmful plasticizer, and a positive marketing image
- Offer a range of interesting new material properties – biodegradability, specific barrier properties, possibility of lightweight construction, special haptics
- Feedstock diversification – lower dependence on mineral oil and on oil prices
- Saving finite resources – by using renewable feedstock
- Rural development & agriculture/forestry – more added value and employment along the value chain
- Innovation – challenge for industry and policy: new materials, new properties, new applications and solutions, and new impact

The end of the lecture will deal with the increasing competition between the energy uses and the material



uses of raw materials from agriculture and forestry. In the 1990s energy use was, to a massive degree, unilaterally funded to make use of overproduction and to stabilise prices. Today, given the limited resources, it has become increasingly important to tackle the issue that energy at the expense of material use, is locally depleting the supply of raw materials and raising their prices. New political concepts will be discussed on how to restore the balance between energy and material use.



Peter Schintlmeister

## The European Commission's Lead Market Initiative (LMI) for Bio-based Products

The European Commission's Lead Market Initiative (LMI) is an innovative policy approach to enhance the diffusion of internationally successful innovations. The Initiative was started in 2006 and selected six markets, one of them being Bio-based Products. The Bio-based Products Lead Market covers a broad range of intermediate products, product components, and ready-made products, e.g. bio-plastics, bio-lubricants, bio-fibres for textiles, composite materials for construction and automotive, chemical building blocks, enzymes, and amino acids.

An Advisory Group for the bio-based products was set up in late 2008, composed of representatives from national governments, industry and academia. It is the first time that a cross-disciplinary expert group has been set up at European level to discuss on renewable raw materials as well as Bio-based Products.

Key topics of the LMI across all areas are challenges in a) Legislation, b) Standardization, Certification and Labelling and c) Public Procurement, the work in the specific area of Bio-based Products concentrating on the analysis of the impact of legislation and policies, encouraging Green Public Procurement for Bio-based Products and elaborating new standards as well as a common understanding of Life Cycle Analysis (LCA) and challenges in labelling and consumer information.

The presentation will comprise the recent report with recommendations of the Ad-hoc Advisory Group for the Lead Market Initiative for Bio-based Products as well as further developments.



10:00 h  
Peter Schintlmeister,  
Federal Ministry of  
Economy, Family and  
Youth (AT)

10:30 h

John Williams,  
Polymers & Materials  
Manager, National Non  
Food Crops Centre (UK)



John Williams

### Policy on Bio-based Products

11:30 h

Prof. Hans-Josef Endres,  
FH Hannover (DE)



Prof. Dr.-Ing. Hans-Josef Endres

### Biopolymer database – Evaluating Availability, Quantity, Quality and Comparability of Biopolymer Materials

- Actual situation of the availability, quantity, quality and comparability of biopolymer-data
- The biopolymer database in order to overcome the lack of information
- Overview of biopolymers and their properties

#### Our development

On the one hand, interest in biopolymers is growing steadily mainly due to the prevailing sustainability debate. On the other hand, the lack of reliable material data presents a bottle neck for the commercial use of biopolymers.

In order to overcome this lack of information, the University of Applied Science and Arts Hanover, Department of Bioprocess Engineering in cooperation with M-base Engineering GmbH has developed a new biopolymer database that provides crucial technical information\*. The benchmark is the well known CAMPUS® database, which has become the international standard information system for conventional engineering polymers.

The biopolymer database includes more than 100 biopolymer manufacturers and more than 500 material grades. Today, the data from material suppliers are neither comprehensive nor comparable because they are reported according to many different test standards. Therefore, it is increasingly difficult for a processor to find the right material for the intended application or to make a fair comparison between different grades. So it is the main issue to test all commercially available biopolymers under uniform and comparable conditions at the University of Applied Science and Arts. The first results of the database are available since November 2009. The database is available via internet in German and English and the access is free of charge.

\* sponsored by BMELV, FNR e.V.

12:00 h

Alexander Shroff,  
Beta Analytic Inc. (USA)



Alexander Shroff

### Measuring the Biobased Content of Bioplastics and Composites via ASTM D6866

ASTM D6866 is a standard test method developed by the “American Society for Testing and Materials” to determine the biobased content of solid, liquid, and gaseous samples through radiocarbon analysis. Test results are reported as the mean fraction of the “biobased content” of a product that came from biomass or renewable sources. Due to its inherent flexibility to analyze many types of samples, ASTM D6866 is recognized to be a very good analytical method for different kinds of biobased materials.

This ASTM standard was developed in the United States at the request of the U.S. Department of Agriculture for its BioPreferred Program, which satisfies legislation requiring federal agencies to give preferred procurement to manufacturers using the greatest amount of biomass in their products (per the Farm Security and Rural Investment Act of 2002). ASTM D6866 is used as a tool to verify biobased content claims of BioPreferred applicants.

The USDA is also developing a voluntary labeling scheme as part of the BioPreferred Program, under which products can use a USDA-approved label disclosing the biobased content of the product and its packaging material. The voluntary labeling program is still in draft phase but is expected to be final by September 2010.

There are also eco-labeling programs that recommend and sometimes require ASTM D6866 testing. Vincotte of Belgium uses ASTM D6866 testing for its OK Biobased program. Canada's EcoLogo requires ASTM

D6866 testing for its CCD-170 standard developed specifically for instant hand antiseptic products. Sustainable Biomaterials Collaborative has released a list of purchasing specifications called BioSpecs, which requires ASTM D6866 testing to verify the biobased content of compostable food service ware. The ICC Evaluation Service also published an evaluation guideline requiring ASTM D6866 testing to determine biobased material content of building materials.

ASTM D6866 is a widely used method in the bioplastics industry. Braskem, a leading Brazilian petrochemical company, is one of the many bioplastics companies that use ASTM D6866 to certify a product's biomass percentage.

ASTM D6866 only quantifies the biobased content of a material. Results do not have any implication on the material's biodegradability.

Jöran Reske

### Certification – Industrial Task Force Bio-Based Content

Renewable Resources play an ever increasing role in the environmental and resource discussion. With a view on the reduction of environmental burdens of industrial production, it seems especially attractive to use renewable resources for the production of goods first. After recycling these products, as often as possible, their energy content can finally be used by incineration or anaerobic digestion. Establishing such use cascades seems more promising than the direct use of biogenic resources for energy or (transport) fuels.

The content of biogenic resources, or in other words: the 'bio-based content' of such products represents an important parameter in the environmental balance, as well as in the marketing of the respective products to industrial customers or end consumers.

Currently there are different concepts for the determination (i.e. the measurement) of the bio-based content under development. All of them are based on the measurement of the content of the carbon isotope  $^{14}\text{C}$ , an isotope abundant only in recent resources. This measurement is a very suitable indicator of biomass, but unfortunately compared to the determination of biomass content based on weight, in many cases the results will not be equivalent. Therefore there is an intense discussion among industry and other experts about the most transparent, the fairest and the most feasible way of determining the bio-based content of a given product.

This contribution describes the existing systems for bio-based content determination in the U.S. and in Japan. The different approaches in the European discussion are discussed and their relation to the EU Lead Markets Initiative. Finally, an industrial Task Force covering these questions and developing a solution from the view of several industrial stakeholder associations is introduced and the current state of work will be presented.

## SESSION 2: BIO-BASED PLASTICS – PRODUCTION AND APPLICATIONS, PART 1

Ady Jager

### Latest developments with Ingeo™ Polylactide (PLA)

Bioplastics are no longer a niche application. Over the last years the global market has expanded at a rate of 25–30 % per year. Even in this difficult economic times the strategic and environment value drivers remained strong.

NatureWorks LLC is the first company to offer a family of commercially available low carbon footprint biopolymers derived from 100 percent annually renewable resources with performance and economics that compete with oil-based plastics and fibers. The production of these biopolymers uses less fossil fuel and emits fewer green-house gases than conventional polymers. NatureWorks produces and markets its biopolymers under the Ingeo™ brand name. The company is owned by Cargill.

Ingeo biopolymer is used to make everything, from packaging and consumer goods to fibers. This presenta-



12:30 h  
Jöran Reske,  
european bioplastics (D)



14:00 h  
Ady Jager,  
Nature Works B.V.  
(NL/USA)

14:30 h

Joachim Janz,  
Innovia Films (DE/UK)**Joachim Janz**

### NatureFlex™ – Bio-based Films for Packaging

Facing the fact that oil as our traditional resource (during the last 40 years) for packaging films is getting shorter more governments, organisations and companies aim to have alternative resources available. Saying that oil has been used in large scales and a great variety of products so that natural resources today have high hurdles to overcome entering the market at a moment where the public doesn't feel the shortage of oil, yet. However as pressure continues natural resources make their way such as NatureFlex™-films, which are based on cellulose and show their sustainable credentials in various aspects. NatureFlex-Films are biodegradable and compostable (EN 13432), even home compostable certified, they are certified carbon neutral and show as a premium product in the market very promising gas and moisture barriers to reach required shelf life. Once being developed as a response on Sainsbury's request for sustainable packaging it is now the packaging film to be chosen for sustainable packaging with high requirements as references such as Nestlé, Thornton's, Twinings, Birkel and Arla Group do underline. Applications like Chocolate, Sweets, Tea & Coffee, Pasta or Cereals are typically linked with NatureFlex as it combines the fitting twist-, barrier and machinability properties.

15:00 h

Dr. Christian Bonten,  
FKuR Kunststoff GmbH  
(DE)**Dr. Christian Bonten**

### Compounding Biopolymers – Key to enhanced properties!

Generally, bio raw plastics (starch, PLA, PHA, PBS and others) are not ready-made, but are customized for the correspondent application by compounding. This treatment of bio raw plastics requires special knowledge in the field of additives and a smooth compounding process.

The growth of the FKUR product range is significantly based on bioplastics for packaging of short lifetime products (food packaging, waste bags, back sheets for diapers and others). Here, especially the biodegradability and the alternative disposal route for the consumer are of benefit.

The need for bioplastics for durable goods is constantly growing and will in the medium term outrange the need for short lifetime products. Since the relevance of biodegradability takes a back seat in this context and sometimes is even not desired, the research and development of FKUR increasingly focuses on the exclusive application of natural resources.

Themed with "Plastics – made by nature!" the FKUR Kunststoff GmbH was incorporated in 2003. In cooperation with Fraunhofer UMSICHT, FKUR has developed a wide range of biodegradable plastics primarily made of natural resources.

■ BIO-FLEX® – PLA based plastics for blown film extrusion ■ BIOGRADE® – Cellulose based plastics for injection moulding ■ FIBROLON® – Natural fibre reinforced bioplastics

Special feature of FKUR bioplastics is the good processibility compared to other bioplastics. Whether high throughput in extrusion or good demoulding in injection moulding, the focus in material development has always been the processibility without losing the bio character of the materials. Many applications out of the packaging and the non-packaging sector will be shown.

## SESSION 3: WOOD PLASTIC COMPOSITES (WPC)

Dr. Peter Sauerwein

### Innovative Wood-Based Products

Decking profiles made from Wood-Polymer Composites (WPC) are free of splits and splinters, very dimensionally stable, durable against wood-destroying fungi and insects, anti-slide and need very little care and maintenance. The innovative product consists to more than 50 % of wood particles which are bonded together by a thermoplastic resin matrix. Furthermore, the material can be recycled without any problems. Since the beginning of 2008, the quality properties of WPC decking profiles are specified by the Quality Seal of the Quality Association for Wood-Based Products (Qualitätsgemeinschaft Holzwerkstoffe e. V., QGH). The properties of WPC-profiles are not covered by any standard as yet. The Technical Specification CEN/TS 15534 consists of 4 parts, but does not specify any technical values/classes until now. Up to now, every manufacturer has determined these values on his own. The Quality Seal creates standard criteria for the first time. Commerce and consumers thus may acquire an approved, technically safe product of a defined quality without any health hazards. For the QGH-Seal the natural fibres added must be made up of wood originating at 100 % from certified sustainably managed forest, certified by FSC or PEFC. In order to ensure the quality of the polymer mixture, only freshly made resin or industrial production residues may be used. In different tests the durability against load and climate for WPC terrace decks is checked in the continuous factory production control as well by the third party supervision carried out by independent testing authorities once a year. Around 80 percent of the volume of WPC terrace decks sold in Germany are subject to the requirements of the Seal. This corresponds to the market share of the producers who are members of the German Wood-Based Panels Federation (Verband der Deutschen Holzwerkstoffindustrie e. V., VHI)..

Dr. Matthias Schulte

### Current WPC applications for the construction, furniture and automotive industry

Helmut Hiendl

### Diverse Examples of Various New Applications for WPC

With regard to Wood Polymer Composites all the positive properties of the reinforcement materials and polymers are used synergistically. The mechanical strength and stiffness of the compounds are a multiple of the base materials.

This can be used in a variety of applications:

- In the area of the electronic measurement technology, where dielectric properties are particularly important
- With the construction of sport boats, where weight saving and easy processability is crucial
- With writing utensils, where the use of domestic and yet exotic appearing fibre source, namely hop fibre, attracts interest
- In the area of structural engineering and In the area of assembling systems where aluminium profiles play a major roll up to now
- Furthermore, the possibilities for the elastomer modification of WPC products will be presented.



16:00 h

Dr. Peter Sauerwein,  
Verband der Deutschen  
Holzwerkstoffindustrie e.V.  
(DE)



16:30 h

Dr. Matthias Schulte,  
Werzalit GmbH  
& Co. KG (DE)



17:00 h

Helmut Hiendl,  
h. hiendl kunststofftech-  
nik GmbH & Co. KG (DE)

17:30 h

Miriam Walddörfer,  
Coperion GmbH (DE)



Uta Kühnen,  
Coperion GmbH (DE)



Miriam Walddörfer, Uta Kühnen

### Compounding of Renewable Materials

Materials from renewable sources and biodegradable materials are of an increasing public interest. But so far most of the polymers and composites have a petrochemical basis. The speech will show possibilities how to process bio materials with a co-rotating closely intermeshing twin screw extruder.

First the main components of a twin screw extruder are explained as well as the modular design and the dimensions which are necessary for the technical characterisation of the extruder.

Like nearly all novel products also bio materials require special processing features. Therefore the machine and process technology were adapted and constantly developed with the proceeding product developments.

The following classification can be done for the materials and the processes: The polymer has a renewable basis or is biodegradable ■ Loose fill packaging material based on starch ■ Thermoplastic starch ■ Biodegradable polymer compounds ■ Polylactid acid ■ The filling or reinforcing material is renewable ■ Wood polymer composites ■ Other composites using natural fibres for reinforcing ■ Both the polymer and the filler / reinforcing material are renewable

The necessary compounding techniques will be explained using examples. Special requirements for the machine technology like the hot face cutting for water sensitive biodegradable materials or the special degassing technique like the twin screw side degassing (ZS-EG) for the compounding of wood polymer composites will be shown.

### Short presentation of the three nominated companies for the Innovation Award – Election of the awardee by the participants

- GreenGran B.V. | GreenGran
- Henkel AG | ECOMfort
- Propper GmbH & Co. KG | Proganic

19:30 h

### Presentation of the Innovation Award

by Peter von Hoffmann, General Manager, Coperion GmbH (DE)

ca. 21:00 h

### End of the evening reception

## Day Two: April 21<sup>th</sup>

### SESSION 4: NATURAL FIBRES REINFORCED PLASTICS (NFRP)

John Hobson

### Hemp Fibres for Industrial Applications

Hemp Technology Ltd are growing and processing Hemp in the UK.

The Company started under the name Hemcore in 1993 and along with other European Hemp businesses have developed the markets for this home grown natural fibre.

The 2 main fractions of Hemp, fibre and core material, are supplied into a diverse range of Industries that include Automotive, Construction, Insulation, Paper, Horticulture and Equine.

Records on the use of Hemp go back thousands of years when it was used for paper, ropes and sail making. Hemp Technology has been instrumental in bringing this once ancient fibre back to modern day Industry.

09:30 h

John Hobson,  
Hemp Technology Ltd  
(UK)



Hemp has excellent environmental credentials, it is a plant that grows well in our climate, a European grown fibre for the European market. It is a beneficial plant to Agriculture and as our processing businesses are in the countryside it is an important crop for the rural economy.

The European Hemp Industry is growing fast. Hemp is now recognised by Government and Commercial Industry that as well as its good performance in the formation of products it can seriously help in our efforts to limit Carbon emissions. John Hobson of Hemp Technology will give an overview of the UK and European Hemp Industry.

**Dr. Werner Klusmeier**

### Use of natural fibers in car interiors – now and in the future

Natural fibers have been used in cars since the beginning of automobile production, and not only in interiors, but for exterior products, too. Today's natural fiber products are mainly used for carriers for door and seat back panels, dashboards and in pads for seats. Only coconut fibers are used for seats, while mainly wood, hemp, flax, sisal and kenaf fibers combined with synthetic fibers are used for carrier materials.

The two main production processes for creating natural fiber products are duroplastic or thermoplastic. The duroplastic process involves impregnating the fibers with a duroplastic resin such as an epoxy or acrylic resin and heating the tools for pressing the mats into shape from 150 °C to 220 °C. For the thermoplastic process it is important that the natural fiber mat consists not only of natural fibers but also thermoplastic fibers such as polypropylene (PP). During the production process, the mat is first heated up to melt the thermoplastic fibers before being pressed into shape in a cold tool.

Both processes can vary, depending on the type of duroplastic resin and the type of natural and synthetic fiber.

Carrier parts based on natural fibers for interiors are becoming increasingly important, primarily due to their weight advantage over injection molding products, a better CO<sub>2</sub> balance, the increase in price of oil-based products and the ongoing improvements in plant processes.

Usually, visible carrier products for vehicle interiors are laminated with surface materials such as vinyl, textile or leather using vacuum and stamping lamination processes. In the future, products with a natural fiber look (exposed natural materials) will be available in addition to covered natural fiber carriers, especially in electric vehicles. Various types are currently in development to fulfill the requirements of visible interior parts.

**Maira Magnani**

### Ford Motor Company's Sustainable Materials

**Martin Snijder**

### Innovative Natural Fibre Reinforced Bio-Composite Granules for Cradle-to-Cradle Solutions – China in our hands?



10:00 h  
Dr. Werner Klusmeier,  
Johnson Controls  
Interior (JCI)

10:30 h  
Maira Magnani,  
Ford Forschungszentrum  
Aachen (DE/USA)



11:30 h  
Martin Snijder,  
GreenGran B.V. (NL)

12:00 h

Alexandre Pereira,  
Grupo Amorim (PT)

Alexandre Pereira

### Riding the green wave – innovative structural biobased panels

Today nobody questions anymore that green material, energy efficient systems and environmental friendly practices are now part of our global mind set and will shape the society behavior in the future. Green is in our nature. We have a true story to tell and must not be shy to repeat it again and again. But “being Green” to Amorim Cork Composites also means permanent innovation, technical performance, fitness for use and competitiveness. That is why, focused on our company strategy, we have launched last year an innovation plan that is already showing promising results. Of course, all these new materials and solutions follows our “green” design philosophy either by introducing new eco-friendly biomass based resins, post consumer/post industrial raw materials or new or optimized manufacturing processes, just as an example. FIBRICORK – BIO BASED PANELS In 2009 Amorim Cork Composites jointed efforts with Technilin (UK) to develop a new panel concept. Both company’s core businesses are related with natural raw materials production and the manufacturing of green products used in many different industries. The new product which is called FIBRICORK is a green, lightweight and fire resistant panel with good mechanical properties. The panels are made using FIBRELIN flax mats made by Technilin which are impregnated with a new thermoset bio based resin as skins, and different CORECORK cores from Amorim. The new panels were designed aiming the automotive and building industries as primary targets. During the development process the project had to address questions like how to maximize the usage of natural, sustainable raw materials and had to review the entire manufacturing processes and logistics in order to achieve the lowest eco footprint. The panels can be produced in several thicknesses and can be worked with common wood industry tools and technology. FIBRICORK can be sawed, cut, glued, drilled or machined with CNC machines. Facings can be glued in the panels during the panel manufacturing itself or can be bonded in a later operation.

12:30 h

Dr. Lars Ziegler,  
Tecnaro GmbH (DE)

Dr. Lars Ziegler, Helmut Nägele, Jürgen Pfitzer

### Going Green: with Arboform<sup>®</sup>, Arboblend<sup>®</sup> and Arbofill<sup>®</sup>

TECNARO GmbH, founded in 1998 as a spin-off company of Fraunhofer ICT, develops, produces and markets composite materials based on renewable resources. The product portfolio includes three material families: “Liquid Wood” ARBOFORM<sup>®</sup> (lat.: arbor – the tree), Wood Plastic Composites ARBOFILL<sup>®</sup> and Biopolymer Compound ARBOBLEND<sup>®</sup>. ARBOFORM<sup>®</sup> and ARBOBLEND<sup>®</sup> consist of biopolymers like the wood constituent lignin or of lignin derivatives and/or other biopolymers as a binder for natural fibres. These materials are 100 % biodegradable.

Lignin is a byproduct of the pulp and paper making industry and about 50 to 60 million tones are produced in various pulping processes worldwide every year. Instead of being directly incinerated for thermal energy generation Tecnaro uses lignin for its sustainable materials.

Meanwhile, several applications of these bio-based composite materials like e. g. loudspeakers, toys, watches, urns, shoes (heels) and technical parts for automotive and other industries are already in the market.

Tecnaro won several awards for innovation, sustainability and in the category supplier: German Industry Award 2009 (Deutscher Industriepreis), Werkbund label 2008, VR Innovation Award 2007, Golden Euro-mold Award, etc. and contributed within several national and European Projects like BioComp (Technical Coordinator), Ecobinders, Biostruct, Bioagrotex, etc.

Together with Fraunhofer several patents have been approved to protect the innovative materials and technologies.



**SESSION 5: BIO-BASED PLASTICS – PRODUCTION AND APPLICATIONS, PART 2**

Thomas Werner

**Performance Polymers renewable sourced:  
Polymers, Processing and Applications**

Renewably sourced materials from DuPont can help reduce dependence on petroleum and reduce the net production of greenhouse gases. Through DuPont innovation, DuPont™ Zytel® RS renewably sourced nylon, DuPont™ Sorona® EP thermoplastic polymer and DuPont™ Hytrel® RS thermoplastic elastomer contain between 20 % and 100 % renewably sourced material (by weight) without compromising traditional performance. The first commercial use of renewably-sourced DuPont material has demonstrated its capacity to withstand demanding application.

Dr. Vincent de Jong

**D-lactide and L-lactide for PLA**

Dr. Ir. Hans Hoydonckx

**Application of biomass based furfuryl thermoset resins in novel materials**

This presentation presents an overview of the development of new furfuryl resins in composite applications. Renewable resin systems derived from hemicellulosic sugars in agricultural waste.

Furfuryl resins are developed for the use in composite production technologies like BMC, resin infusion, hand lay up, pre-preg and hot compression moulding. With these biomass based resins fiber reinforced composites can fulfill typical requirements in different application fields. The high intrinsic resistance to fire of the furan polymer matrix renders these composite materials applicable for fire proof purposes in public transport, construction, etc.

The applicability of these novel resin systems will be illustrated with various products like natural fibre reinforced composites and modified wood.

Thomas Grotkjær

**Braskem and Novozymes join forces on Green Polypropylene****Panel Discussion**

14:00 h

Thomas Werner,  
Du Pont de Nemours  
GmbH (DE/USA)

14:30 h

Dr. Vincent de Jong,  
PURAC Biochem BV  
(NL)



15:00 h

Dr. Ir. Hans Hoydonckx,  
TransFurans Chemicals  
bvba (BE)

15:30 h

Thomas Grotkjaer,  
Novozymes A/S (DK)



16:30 – 17:30 h

## Sponsor

### InfraServ GmbH & Co. Knapsack KG

#### The Chemical Industrial Park Knapsack – “integration of industrial biotechnology into existing value-chains”

The idea of producing chemical building blocks with the help of industrial biotechnology is becoming more and more appealing to a majority of players in the chemical industry in Europe. The dynamic European market is the ideal basis for the commercialization of your bio-based chemicals. This is due to the large amount of available renewable feedstock and customers as well as a fast growing number of potential bioplastics applications. The Chemical Industrial Park Knapsack near Cologne in Germany is offering companies a scale-up platform and access to know-how for example for bioplastics production and integration into existing value-chains.

- **Growing demand** – increasing number of potential applications and customers. No large scale bioplastics production in Europe yet – first mover.
- **High quality infrastructure** – easy access for bulk logistics and adequate utilities present (power, steam, waste water, security).
- **Ample resources** – large amounts of raw materials need to be in close proximity.
- **Knowledge and R&D** – relevant chemical, biotechnology and process technology research facilities and qualified workforce.
- **Synergies** – with existing oil based plastics industry and engineering know-how in polymerization processes.
- **Good services and plots** – suitable “plug&play” plots of land for chemical production with all adequate services.

#### Europe's leading industrial region

The Chemical Industrial Park Knapsack is located in the federal state of North Rhine-Westphalia, the most important chemical and power location in Germany. Just under 30 % of all foreign investments

#### Well connected,

Direct highway access (Knapsack), without having to deal with a cross town link, is just four kilometers away. 3 international airports are available within 20 to 60 minutes. The chemical park's own public container terminal acts as a satellite terminal for the regional mega-terminal Cologne-Eifelort (Köln-Eifelort) as well as for a second major terminal located 20 km away in the Harbor Köln-Niehl. This harbor has connections to all of North Sea's overseas ports.

#### Well-established services

InfraServ Knapsack as the owner and site operator offers a plug & play concept for investors. The companies choose the services that suit their business model from a wide range offered by InfraServ Knapsack. Major benefits are the site overheads are shared thus become more cost-effective and the benefits from integrated know-how structures.

#### Our profile

As operator of the chemical park, InfraServ Knapsack offer circa 10 international companies operating in the chemical industry (production of organic and inorganic chemicals, crop protection products, fine and special chemicals, plastics) optimum opportunities to operate their production plants. However, InfraServ Knapsack does not only serve customers in the chemical park, but they offer a full range of services from just one source to customers outside the park as well. Services include plant planning and construction as well as the maintenance and certification of industrial plants. InfraServ Knapsack can draw on their decades of practical experience in this sector.

#### Contact:

*InfraServ GmbH & Co. Knapsack KG Owner and operator of the Chemical Park*

*Mr. Pierre Kramer*

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Chemiepark Knapsack. Picture: InfraServ

#### The European bioplastics boom – how to benefit?

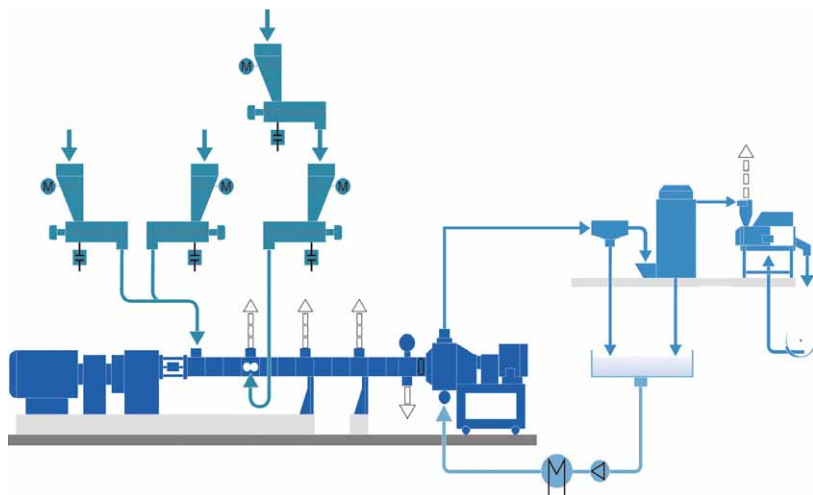
#### Location requirements for bioplastics production

- **Large market** – proximity of consumers with high purchasing power and green incentive.

are concentrated in this region due to it having the largest buying and selling market. The Chemical Industrial Park Knapsack is located just 10 kilometers south west of Cologne and has excellent access to the Rhineland highway network enabling the fast transfer of goods to customers in all of Europe.



Doppelschneckenextruder ZSK MEGAcompounder PLUS/Twin screw extruder ZSK MEGAcompounder PLUS. Picture: Coperion



Set-up for processing biodegradable composites and wood composites. Picture: Coperion

## Sponsor Innovation Award

### Coperion GmbH

**COPERION > INTEGRATED SYSTEM SOLUTIONS · UNIQUE PROCESS ENGINEERING AND KNOW-HOW · GLOBAL PRESENCE. <**

In the Competence Center Compounding & Extrusion of Coperion, you have a partner on hand to provide the optimum solution to every compounding task. This ranges from special applications on laboratory scale to industrial-scale production. As pioneers in the development of the closely intermeshing, co-rotating twin-screw extruder, we have unique expertise and experience in this field. Since the 1950s, Coperion has continued to set new standards in processing machinery and plant design for compounding technology. We plan and implement

compounding systems for the plastics, chemicals and food industries which are tailored precisely to our customers' applications. Under Coperion we now provide you the full range of expertise of formerly Werner & Pfleiderer. Over 10,000 compounding systems delivered all

over the world are proof of our unique system and process competence.

With a total of 27 locations around the globe Coperion has over 2.100 employees worldwide. We are the worldwide market and technology leader of compounding systems and bulk materials handling systems. The close cooperation of the three Coperion Competence Centers Compounding & Extrusion, Materials Handling and Services gives our customers the confidence of receiving the optimum solution for every project within the shortest possible time.

### Processing of biodegradable composites

Since biodegradable materials were introduced, Coperion's ZSK twin-screw extruder has been heavily involved in

processing them. Starch-based biomaterials were created by combining the production methods of extrusion cooking and plastics compounding. The twin-screw extruders ZSK suit especially for the processing of

- Plastics with granulated starch as biodegradable fillers
- Loose fill on starch basis
- Thermopastical starch
- Polylactid (PLA), PVA, synthetic Copolyester
- Compounds out of mixtures of several bio composites
- Pelletizing and polymerization of PLA

### PROCESSING OF WOOD COMPOSITES / WOOD PLASTICS COMPOSITES (WPC)

Wood Plastics Composites for injection moulding applications are processed similar to Engineering Plastics – by filling, reinforcing and devolatilization. Coperion has comprehensive process and system know-how in compounding Wood Plastic Composites.

- Filling and Reinforcing with 40 – 70 % wood
- Filling and Reinforcing with natural fibres like flax, hemp, cellulose
- Compounding for injection moulding applications
- In-line Compounding (in corporation with Husky)
- Long fibre technology compounding for compression moulding
- Profile extrusion for WPC profiles

#### Contact:

Coperion GmbH

Competence Center

Compounding & Extrusion

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Internet: [www.coperion.com](http://www.coperion.com)



## Premium partner

### Bioplastics Magazine

Founded in 2006, bioplastics magazine is the only trade magazine worldwide that is exclusively dedicated to bioplastics, i.e. plastics from renewable resources and biodegradable plastics including natural fibres.

bioplastics magazine covers all aspects of these biobased plastics and biodegradable plastics, many of which fulfilling both aspects.

The magazine keeps its readers updated about the different bioplastic resins which are available and will come up in future, about chemistry, properties and availability. bioplastics magazine covers the processing techniques of these fascinating materials such as film blowing, extrusion, thermoforming, blow moulding, injection moulding etc. A large part in bioplastics magazine is dedicated to current and future applications. As of today, these are mainly – but not only – packaging applications. Even producers of consumer products such as covers for cellphones, laptop-computers or toys are interested in this family of ma-

terials as well as the automotive industry and many others – or they are already using bioplastics in certain products. Another quite important aspect is the political situation. bioplastics magazine reports about frame conditions, regulations, or the certification of “compostable plastics” according for example to the European standard EN 13432?

bioplastics magazine is THE new information platform for all parties involved. It is read by decision makers in all parts of this business, e.g. the raw material suppliers and compounders, machine and mould makers, converters, brand owners, the complete trade chain (wholesale and retail) as well as scientists and politicians, as bioplastics magazine is an independant and neutral source of information.

With a print run of 5,000 (average, depending on large events like exhibitions or conferences) the estimated number of readers is much bigger, as many copies of bioplastics magazine are circulated or passed on to other interested readers.

Since its start in 2006 bioplastics magazine saw a very positive feedback from its readers. The number of registered readers increased in the first two years by 30 % from issue to issue. In 2007 bioplastics ma-

gazine won an Innovation Award from “Initiative Mittelstand“, Germany. And finally the 1st PLA Bottle Conference (2007, Hamburg) as well as the 1st PLA World Congress (2008, Munich), both hosted by bioplastics magazine were great successes.

The print magazine is published 6 times a year in English language. Subscribers get bioplastics magazine on their desk for EUR 149.00. This also includes access to the online archive with full-search functionality over all published issues.

#### Contact:

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The main emphasis continues to be on flagship international trade fairs for capital goods, run by Deutsche Messe in Hannover. The aim of these tradeshows is to represent the latest markets and highlight international market trends. They are also a forum for applications-oriented demonstrations of the latest technology, as well as new launches of cutting edge technologies and presentations of the latest research findings.

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## Fachagentur Nachhaltende Rohstoffe e.V. (FNR)

Im Auftrag des Bundesministeriums für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV) koordiniert die Fachagentur Nachhaltende Rohstoffe e.V. (FNR) seit 1993 Forschungs-, Entwicklungs- und Demonstrationsprojekte im Bereich nachwachsender Rohstoffe.

Als Projektträger verwaltet die FNR zur



Zeit ein jährliches Fördermittelvolumen von 51,5 Millionen Euro, die aus dem Bundeshaushalt zur Verfügung gestellt werden.

### Projektförderung

Wichtigstes Betätigungsfeld der FNR ist die fachliche und administrative Betreuung von Forschungsvorhaben zur Nutzung nachwachsender Rohstoffe. Das Förderprogramm „Nachwachsende Rohstoffe“ des BMELV gibt dafür die Regeln vor. Derzeit

betreut die FNR über 400 Forschungsprojekte. Allen Projekten gemeinsam ist, dass Ansätze und Methoden entwickelt werden, um heimische nachwachsende Rohstoffe voranzubringen. Durch die Ausschreibung von bestimmten Themen macht die FNR immer wieder gezielte Vorgaben für die Ausrichtung der Forschungstätigkeit zu nachwachsenden Rohstoffen in Deutschland.

### Verbraucherinformation

Ein wichtiger Arbeitsschwerpunkt der FNR sind die Beratung und Verbraucherinformation. Die FNR sammelt aktuelles Fachwissen zum Thema und stellt dieses über Veröffentlichungen interessierten Wissenschaftlern, Privatpersonen, Politikern, Wirtschafts- und Medienvertretern zur Verfügung. Über Messen und Ausstellungen macht die FNR auf das Potenzial nachwachsender Rohstoffe aufmerksam. Und die FNR betreibt eine gezielte Verbraucherinformation zu Produkten aus nachwachsenden Rohstoffen.

### International

Die FNR betätigt sich auch auf europäischer Ebene. Hier koordiniert sie verschiedene EU-Projekten zum Thema nachwachsende Rohstoffe.

### Aktionsplan der Bundesregierung zur stofflichen Nutzung nachwachsender Rohstoffe

Wichtige Impulse erhält die Arbeit der FNR durch den im letzten Jahr verabschiedeten Aktionsplan der Bundesregierung zur stofflichen Nutzung von nachwachsenden Rohstoffen.

Gerade zur Unterstützung des Bereichs Biowerkstoffe sind im Aktionsplan mehrere Maßnahmen, vom Ausbau der Forschungsförderung bis zum Aufbau eines Biopolymernetzwerkes, festgeschrieben.

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### Die AVK stellt sich vor

#### Mitglieder

Die AVK vertritt Rohstoffherzeuger und -lieferanten sowie Verarbeiter von verstärkten und gefüllten Kunststoffen und technischen Duroplasten. Ferner sind Maschinenbauer, Ingenieurbüros, Prüfmänter und wissenschaftliche Institute Mitglieder der AVK.

#### Leistungsspektren

##### Bildung

Die AVK veranstaltet Fachseminare in Zusammenarbeit mit Anwendern, Experten und wissenschaftlichen Instituten, sowie eine internationale Jahrestagung in Anbindung an die Messe COMPOSITES EUROPE. Im Rahmen der Jahrestagung wird auch der AVK-Innovationspreis an exzellente Neuentwicklungen (Produkte, Verfahren) vergeben.

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#### Information/Kommunikation

Die Arbeitskreise der AVK bieten Hilfestellung zur Lösung der zentralen Fragen der Branche. Sowohl technische als auch Marketing-Fragestellungen rund um verstärkte und gefüllte Kunststoffe werden bearbeitet. Die Marketingarbeitskreise der AVK informieren potenzielle Kunden objektiv über die Einsatzmöglichkeiten von verstärkten Kunststoffen und technischen Duroplasten.

#### Networking/Kooperationen

Die AVK hat enge Kontakte zu staatlichen Stellen auf Landes-, Bundes- und EU-Ebene. Als AVK-Mitglied arbeiten Sie stimmberechtigt in DIN und CEN-Ausschüssen mit.

Die AVK ist Mitglied in der European Composites Industry Association (EuCIA) ([www.eucia.org](http://www.eucia.org)) und einer der vier Trägerverbände des Gesamtverbandes der Kunststoffverarbeitenden Industrie (GKV). Nut-

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## **European Composites Industry Association**

EuCIA is the leading European Composites Industry Association based in Brussels. Its main objective is representation of the interests of over 8.000 -10.000 companies active in the production of various types of composites in 10 European countries. Through its Members EuCIA is promoting a good trading environment in a continuously expanding European composites network.

The mission, objectives and activities of EuCIA are best represented by three key pillars: Know – Show – Grow – the World of Composites. The main aims of EuCIA are:

- Promotion of composites applications and their various benefits and properties

compared with traditional materials

- Advocacy efforts targeting the EU's legislative environment
- Development of educational programmes and industry alignment
- Active participation and involvement in innovative developments in the composites sector
- Information exchange among members across Europe, at European level
- Building an international network among various stakeholders

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## **EuropaBio**

EuropaBio's mission is to promote an innovative and dynamic biotechnology-based industry in Europe.

EuropaBio, (the European Association for Bioindustries), was established in 1996 and has 69 corporate and 7 associate members operating worldwide, 4 Bioregions and 26 national biotechnology associations representing some 1800 small and medium sized enterprises.

EuropaBio represents the interests of the industry towards the European institutions so that legislation encourages and enables biotechnology companies in Europe to innovate and provide for our society's unmet needs.

Our corporate members are involved in a wide range of activities in human and animal healthcare, diagnostics, bio-informatics, chemicals, biofuels, crop production, agriculture, food and environmental products and services. EuropaBio also welcomes associate members such as international commercial, financial, asset ma-

agement and other service-providing companies, regional biotechnology development organisations and scientific institutes. The common denominator among all our members is the use of biotechnology at any stage of research, development or manufacturing.

The priorities of the EuropaBio Industrial Biotech Council for 2010 include the implementation of the Lead Market Initiative (LMI) for biobased products, funding for "pilot" biorefineries in Europe, improved access to raw materials and recommendations for the new CAP. Following a successful launch in 2008, EuropaBio is also continuing to develop the European Forum for Industrial Biotechnology (EFIB), which this year will be held between 19 and 21 October in the historic city of Edinburgh, Scotland, as the key EU conference for industrial biotechnology ([www.efibforum.com](http://www.efibforum.com))

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## **Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik UMSICHT**

Fraunhofer UMSICHT entwickelt funktionalisierte Kunststoffcompounds auf Basis fossiler und nachwachsender Rohstoffe. Von der Polymersynthese bis zur Anwendung betrachten wir dabei die gesamte Wertschöpfungskette.

Für den verstärkten Einsatz nachwachsender Rohstoffe haben wir eine Reihe von Compounds auf Basis kommerziell verfügbarer Biopolymere entwickelt. Produkte sind z. B. ein Spritzgießcompound auf Celluloseacetatbasis, ein Foliencompound mit

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Verhalten, zur chemischen Zusammensetzung  
sowie zur Struktur durch.

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## IAR

The "Industries and Agro-Resources"  
Cluster unites stakeholders from research,  
higher education, industry & agriculture in  
the Champagne-Ardenne and Picardy regions  
of France around a shared goal: the added-  
value non-food exploitation of plant  
biomass.

The IAR cluster has defined 4 strategic  
fields of activity under the biorefinery  
concept:

- Bioenergy
- Biomaterials
- Biomolecules
- Green ingredients

The IAR Cluster puts its experience and  
know-how at the disposal of businesses and

research laboratories wishing to exploit the  
wealth of plant-based assets and develop  
R&D projects in the field of non-food ex-  
ploitation of agricultural resources. The  
IAR cluster performs various missions:

- Management of R&D projects, from the  
idea... to the funding
- Coordination and networking of inter-  
regional skills
- Development of international collabora-  
tions and delegations
- Provision of information and strategic  
intelligence
- Promotional and public relations activi-  
ties

Since the cluster's creation 90 R&D pro-  
jects are certified (total budget 266 M€)  
within which 60 projects are financed. The  
public funding commitment (ANR and  
FUI) represents 35 to 40 % of the total  
budget.

Today, the IAR Cluster counts more 119  
members (the list of members is downloa-  
ded on the website)

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## Stiftung Arbeit und Umwelt der Industriegewerkschaft Bergbau, Chemie, Energie (IG BCE)

Die Stiftung Arbeit und Umwelt der Industriegewerkschaft Bergbau, Chemie, Energie (IG BCE) wurde 1990 gegründet. Sie ist die einzige gewerkschaftliche Umweltstiftung in Europa. Im Jahr 2010 feiert sie ihr zwanzigjähriges Bestehen.

Seit ihrer Gründung arbeitet sie nach

dem Leitmotiv „Arbeit und Umwelt“ am Konzept der Nachhaltigkeit. Unser Ziel ist, eine vernünftige Balance aus wirtschaftlicher, sozialer und ökologischer Entwicklung zu erreichen. Hierzu initiieren und fördern wir Projekte, die soziale Sicherheit, nachhaltiges Wirtschaftswachstum und Umweltschutz miteinander verbinden. Die nachhaltige Entwicklung versuchen wir durch Studien, Bildungsmaßnahmen und Beratungen, Veranstaltungen sowie die regelmäßige Verleihung eines Umweltpreises möglichst vielen Unternehmen bewusst zu machen und in die betrieblichen Prozesse zu integrieren.

Nur ein nachhaltiger Wirtschaftsstandort Deutschland eröffnet die Chance, ein vom Ressourceneinsatz unabhängiges Wirtschaftswachstum mit mehr und anspruchsvolleren Arbeitsplätzen, sozialer Sicherheit sowie einer gesunden und intakten Umwelt langfristig zu sichern.

Umwelt- und Klimaschutz brauchen sowohl technologisch innovative Produkte und Dienstleistungen aus den Ideenschmieden von Unternehmen und wissenschaftlichen Instituten als auch sich dem Prinzip der Nachhaltigkeit verpflichtet fühlende Verbraucherinnen und Verbraucher, die energieeffiziente Produkte und Dienstleistungen nachfragen.

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## Verband der Deutschen Holzwerkstoffindustrie e. V. (VHI)

Der Verband der Deutschen Holzwerkstoffindustrie e.V. (VHI) vertritt die gemeinsamen Brancheninteressen der Hersteller von Span- und Faserplatten, Sperrholz, Holz-Polymer-Werkstoffen und Innentüren im In- und Ausland gegenüber der Öffentlichkeit, den staatlichen Organen und anderen Wirtschaftszweigen.

Die jüngste Fachgruppe unter dem Dach des VHI ist die der Holz-Polymer-Werkstoffe. Führende mitteleuropäische Hersteller dieses neuen Werkstoffes schlos-

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sen sich im November 2005 dem Verband an, um vorrangig die Normungsarbeiten zu Holz-Polymer-Werkstoffen abzustimmen, Forschungsarbeiten zu initiieren, den Markteintritt von WPC-Produkten durch Marketingmaßnahmen zu erleichtern und ein Qualitätssiegel zu schaffen.

### Die spezifischen Tätigkeitsfelder des Verbandes sind u. a.:

- Betreuung der Unternehmerforen „Span- und Faserplatten“, „Sperrholz“, „Holz-Polymer-Werkstoffen“, „Innentüren“ sowie der Ausschüsse für „Technik“ und „Rohstoffe“
- Beratung auf wirtschaftlichem, technischem und politischem Gebiet
- Initiierung von Forschungsvorhaben und Marktstudien
- fachspezifische Stellungnahmen zu europäischen und nationalen Richtlinien-, Gesetzes-, oder Verordnungsentwürfen
- Branchenvertretung in Ausschüssen von staatlichen Einrichtungen, Forschungsinstitutionen, nationalen und europäischen Normungsgremien, Fachverbänden und sonstigen relevanten Institutionen.
- branchenbezogene Öffentlichkeitsarbeit und Marketing

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forum Nachhaltig Wirtschaften ist Themen- & Fachmagazin in einem: Im Titelthema werden aktuelle Entwicklungen und Trends kritisch hinterfragt. Das Kapitel „Praxis“ gibt dem CSR-Manager und Nachhaltigkeitsexperten das Werkzeug für den erfolgreichen Berufsalltag in die Hand. „Themen“ wie Energie & Klima, Ressourcen- & Umweltschutz sowie ein „Special“ und ein „Branchenreport“ bringen komplexe Sachverhalte auf den Punkt. Ein „Serviceteil“ bietet Buchtipps, Personalien sowie Veranstaltungshinweise.

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Mit besten Grüßen, Alistair Langer

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# REPORT ON INDUSTRIAL HEMP

Dear Readers,

Welcome to the first edition of The Report on European Industrial Hemp, issued by the European Industrial Hemp Association (EIHA). From now on we plan to inform you annually about the newest developments and products from the European hemp industry and show you the important role of hemp fibre in a sustainable bio-economy, both in the present and for the future.

For example, natural fibres can be used for building and insulating and for the reinforcement of plastics to substantially improve their mechanical characteristics and to create an opportunity for lightweight constructions. Up until now reinforced plastics have still been mainly petroleum-based, but now the bio-based content of the products is already at 30 % for injection molding and at 80 % for compression molding or extrusion. In the future, however, the characteristics of bio-based plastics will also be increasingly optimized by natural fibres. It is possible to produce 100 % bio-based composite materials, which are already on the market in small-scale production.

Flax and hemp have been cultivated in south, central and northern Europe for centuries. Flax is specifically grown for clothing textiles, only its by-product, flax tow (short fibres), is used in technical applications. Hemp is almost entirely grown and processed on modern total fibre lines for technical applications. Hemp fibres are primarily used by European companies, especially in the automotive, building and plastics industries as well as traditionally in the paper industry (cigarette paper, technical papers).

Since the reintroduction of hemp growing in the 1990s many new projects have been launched. This has enabled the cultivation and processing to be technically optimized and made more efficient and in addition, new applications have been developed.

We would like to present to you market reports, new technical developments and products and want to introduce our young Association and its members. The Association was informally founded during the EXPO 2000 in Wolfsburg and then formally in Hu-erth (Germany) in 2005. Hemp processors from France, Great Britain, The Netherlands, Germany and Slovenia constitute the seven regular members of EIHA and guarantee to supply their customers with sufficient raw materials. A further 63 associate members from industry, organizations and research as well as private individuals complete the Association.

We hope you will learn a lot about hemp and its technical possibilities from this first edition. If you are interested in using hemp fibres, hemp shives or hemp seeds in your own manufacturing we would be pleased to co-operate with you. Only through co-operation can we advance the bio-economy and bring about a revolution in the use of raw materials!

Kind regards,  
Michael Carus, Managing Director

P.S. If you would like to meet us personally, John Hobson will introduce EIHA and his company, HempTechnology Ltd (UK) at the Biowerkstoff Congress at THE HANNOVER MESSE on April 21st. We also look forward to meeting you at our exhibition stand in hall 6 / B40.



Michael Carus  
Managing Director  
nova-Institut GmbH



Dominik Vogt  
EIHA Office  
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# EUROPEAN HEMP FIBRES FOR DIVERSE BIO-BASED PRODUCTS

Pictures: Hemp Technology, AGROFIBRE

## The perfect green material

- good mechanical properties
- good for the environment
- good availability at a low cost
- modern industry with high socially responsible standards
- no competition with food production
- fits perfectly with your sustainable business
- reduction of CO<sub>2</sub> emissions

This brochure shows you many examples of hemp fibre based products, which have already been introduced and established on the market, and where you can buy European Hemp Fibre.

## Basic Information on European Hemp

Hemp fibres played an important part in the technical and cultural history of mankind. In 2,800 BC the first ropes were produced in China using Hemp fibres. In 100 BC we know that also in China the first paper in the world was made from Hemp fibres. From the Middle Ages until the end of the sailing ship period Hemp was an important crop in many European countries. Threads, sacks, ropes, water hoses, sails and textiles were all made from Hemp fibres.

Today, China, Canada and Europe are the main Hemp cultivation areas in the world. In 2008 the total cultivation area in the European Union was around 15,000 ha – in 2009 we expect this to have increased to 18,000 ha. These areas will produce around

24,000 t Hemp fibres and 29,000 t respectively. All by-products like shivs (woody part of the Hemp stem) and dust are used. The main countries for Hemp production are France, UK, Germany, The Netherlands and Poland. Hemp fibres, ready to use in your biobased products are price competitive to other domestic and exotic fibres for technical applications. Different qualities are available.

European Hemp fibre is currently used mainly in technical applications like speciality paper (cigarette paper, technical filters), insulation material, natural fibre reinforced plastics (automotive, industrial and consumer goods), mulch and cultivation fleeces. Insulation and plastic reinforcement especially show promising market increases. China and Canada are raising their interest in Hemp fibre instead of cotton fibres in textile applications.



**Michael Carus**  
Managing Director

Last, but not least, we would like to invite you to our 7th International Conference of the European Industrial Hemp Association (EIHA), May 26<sup>th</sup>–27<sup>th</sup> 2010 in Wesseling (Germany). We expect about 150 participants from more than 40 countries.

### The Board of Directors



**John Hobson**  
President  
HempTechnology Ltd. (UK)  
President EIHA



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**Albert Dun**  
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(The Netherlands)



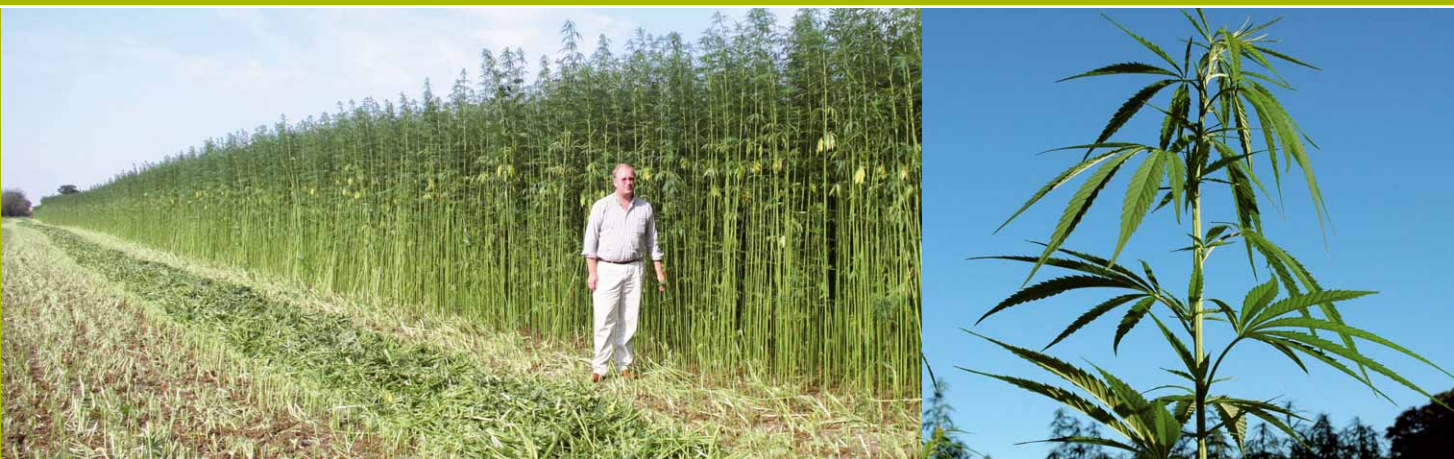
**Daniel Kruse**  
Hempro International GmbH & Co. KG (Germany)



**Mark Reinders**  
HempFlax BV  
(The Netherlands)



**Dejab Rengeo**  
HANNAH BIZ d.o.o (Slovenia)



## The European Industrial Hemp Association (EIHA)

EIHA has formed itself as an association of Regular members, the Hemp primary processing companies within the EU and Associate members who are associations, national organisations, companies and individuals working in the field of Hemp or other natural fibres. Founded in 2005 The European Industrial Hemp Association (EIHA) today has 70 members from 24 different countries (March 2010), seven regular members (hemp processors) and 63 associate members (companies, association, institutes, private persons). Countries with more than 2 members are: Germany (11), The Netherlands (9), Great Britain (7), France (7), Canada (6), Belgium (5) and Switzerland (3).

Join EIHA to support the European Hemp Industry! Benefits for EIHA members:

- All questions by email, letter and phone about Hemp business are forwarded only to EIHA members
- Reduced fee for EIHA conference
- EIHA-Conference proceedings are available for EIHA members only.
- Free access to the huge EIHA database, more than 300 presentations, reports and documents
- Help the Hemp Industry to grow! Help lobbying! Don't let the policy and industry forget Hemp! The yearly EIHA-budget is mainly used for the dissemination of information on Hemp fibres, shives and seeds for industry and policy.
- It is very easy to join EIHA: "Application form of EIHA (PDF)" at [www.eiha.org](http://www.eiha.org)

The Board of Directors decides within two weeks about the membership. The yearly membership fee for an associated member is only 250 €, regular members (processors) pay 1.000 €/year (minimum, depending on the contracted cultivation area).

EIHA was formed originally to give members a voice at the European Commission in Brussels. It has grown quickly into a respected organisation that is an excellent bank of information and a real support to the fast developing Hemp Industry. Each annual EIHA conference allows members and non members alike to exchange views and important developments with their colleagues.

The European Hemp industry is a young and modern industry with new and improved harvesting and fibre processing technologies. It maintains high socially responsible standards, it is good for the environment with a proven high CO<sub>2</sub>-capture. Importantly Hemp does not compete with food production.

Along with a high yield, Hemp produces fibres of the highest quality. Their mechanical properties are equal to the best natural fibres in the world.

Hemp Fibres today are already used in many applications: speciality pulp and paper, automotive, brakes, cases and consumer goods. Sanding discs, insulation, construction, agriculture, sports equipment and many more.

## Innovation

Hemp will and is playing an important role in the production of innovative biobased products like natural fibre reinforced plastics, insulation and construction materials.

Hemp Fibre can improve the technical profile of bioplastics for use in durable applications.

## Environment

No agrochemicals are used in the growing of Hemp crops.

The Cumulated Energy Requirement for producing glass fibres is more than 10 times higher when compared to the production of Hemp fibres in Europe. Also the CO<sub>2</sub>-emissions for glass fibres are 10 times higher compared to Hemp fibres.

Life Cycle Assessments (LCA): Where Hemp has been used in applications it has yielded definite ecological advantages. For example for plastic reinforcement: "Finite resources were spared, there was less pressure on the environment and CO<sub>2</sub> emissions were reduced. If biopolymers were used these benefits are of course further enhanced". (Carus et. al 2006)

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Authors: Michael Carus (Managing Director), Dominik Vogt (Organisation), Lena Scholz (Standards Certification)

# EUROPEAN HEMP PROCESSORS PRESENT THEMSELVES

## Hemp processors in the European Union

In Europe you can buy Hemp fibre directly from the processor. The following Hemp fibre producers are members of EIHA and together they can guarantee high quality standards and a secure continuity of supply. These listed five Hemp processors produce on average each year between 10 and 15,000 tonnes of technical Hemp fibre. This is mainly used in natural fibre reinforced plastics and insulation materials. As Hemp is an annual crop this quantity can be easily increased according to demand.



### Hemp Technology Ltd

**Address** Halesworth Business Centre Norwich Road, IP19 8QJ Halesworth, Suffolk (UK)  
**Contact** John Hobson  
**Mobile** +44 (0)1986 835 678  
**E-mail** john@hemptechnology.co.uk  
**Internet** www.hemcore.co.uk



### Badische Naturfaseraufbereitung GmbH (BaFa)

**Address** Stephanstrasse 2, 76316 Malsch (Germany)  
**Contact** Bernd Frank  
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**E-mail** bafa@swol.de  
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### AGROFIBRE SAS

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## Hemp Technology Ltd

### About Our Company

Since the establishment of Hemcore in 1993 and the birth of Hemp Technology in 2009 we have backed the pioneering vision that Hemp, a once ubiquitous crop, can become an essential industrial feedstock for a

more sustainable future. Due largely to this commitment, industrial Hemp is once again established in the UK, and is helping to create a cleaner and greener World.

### Why Us

Put simply, Hemp Technology is dedicated to the production of Hemp primary

materials of the highest quality. Our products are carefully engineered to suit the requirements of customers throughout Europe.

### Our Service

At Hemp Technology, we strive to ensure that all our products are available when and where required, and are backed-up with the highest level of technical support. We are particularly experienced at engineering the properties of our products to meet customer requirements.

### Hemp Growers

Producing quality Hemp products has to begin on the farm. The Hemp processed by Hemp Technology is all grown in the UK to the highest standards and under the terms of an exclusive supply contract.

### What We do

Hemp Technology is actively engaged in almost every aspect of the Hemp industry. This means everything from crop production and Hemp straw processing through to end-product manufacture, R&D and marketing. Without this comprehensive coverage it would not have been possible to build the industry.

### Primary Processing

At the Hemp Technology facility in East Anglia, our principal activity is the fractionation of the Hemp stem into three main products – fibre, shiv and fines. The Hemp fibre is famed for its toughness, durability and flexibility. We engineer the fibre to suit client-led specifications for use in applications such as automotive composites, insulation, geotextiles and paper. The shiv, which comes from the woody core of the plant, has some unique properties. At



Sports car Lotus Eco Elise, in the main made from different natural fibre compounds, hand lay-up, vacuum bagging and RTM (UK). Picture: Lotus Cars



Cress mat – Hemp fibre fleece (UK/Germany). Pictures: Hemp Technology



Natural fibre door panel for BMW 5 Series, compress moulding (Germany). Pictures: nova-Institut

Hemp Technology we grade and bag the product principally for use as high-grade animal bedding and in construction where it is mixed with lime to produce Tradical Hemcrete (an ecological construction material). The fines are graded and compressed for use as a fuel log.

## INNOVATION

True to our pioneering principles, the new Hemp Technology facility is the largest Hemp processing plant in the world, with a capacity in excess of 7 tonnes of straw per hour. The facility is capable of producing 12,000 tonnes/year of premium grade fibre and 25,000 tonnes/year of shiv.

## GROWING

All our Hemp is grown in the UK under the terms of an exclusive supply contract. Hemp Technology provide all the agronomic information and technical support to ensure that growers are able to maximise yield and quality.

## PRODUCT DEVELOPMENT AND MARKETING

As well as supplying primary materials for industry, Hemp Technology are actively engaged in the development of new products and technologies to drive market growth. For this reason Hemp Technology market a number of own branded products such as Hemcore Biomat and Hemp Insulation. Hemp Technology are also committed to supporting the marketing efforts of our customers.

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## AGROFIBRE SAS

AGROFIBRE SAS is a company specialized in the first transformation of the Industrial Hemp. The natural by-products from this plant are 100 % recyclable, and they place us into the framework of companies heavily involved in reducing CO<sub>2</sub> emissions into the atmosphere.

AGROFIBRE is a company of EURALIS GROUP, the first food and agricultural cooperative group from the South-West of

France. EURALIS ([www.euralis.fr](http://www.euralis.fr)), 15,000 farmers-members and 4,500 employees, achieved a turnover of more than 1.3 billion € in 2008. The strong production capacity of this cooperative group assures the supply of raw material, and places AGROFIBRE as the main supplier of natural Hemp fibre in the world.

The process of grinding implemented in AGROFIBRE is purely mechanical and consists of successive stages of grinding, sieving, refinements / fraying, grading and packaging of intermediate products. The by-products are the fibre and the shives.

AGROFIBRE sells Hemp fibres to second processors for the production of wool insulation, needled felts for reinforced composites, garden and horticultural mulches, and reinforcements in plastic extrusion processes. The shives are sold as animal bedding, garden mulch, and mix with limes to renovate buildings.

AGROFIBRE consistently produce a high responding to industrial applications in the construction market, composites and plastics.

## Composites based on Hemp fibre reinforcement:

Thanks to partnership industrial agreements, AGROFIBRE is also able to offer different types of Hemp fibre mats used for composite applications:

- Needled Mats fibre Hemp + polypropylene fibre in different grammages for thermoforming.
- Needle Mats for pre-impregnation with polymer matrices.
- Needle Mats for contact moulding.
- Needle Mats for formatting infusion.

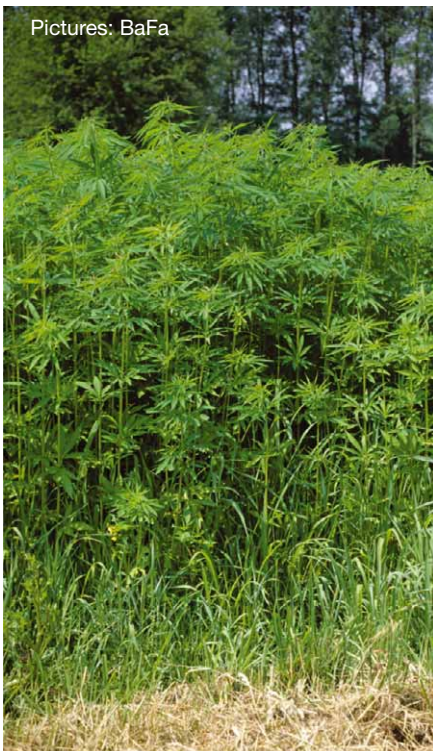
The quality of fibre from process and the expertise of our industrial partners to pro-



Hemp fibre pellets for granule production.  
Picture: nova-Institut

Hemp fibre PP-granules. Picture: nova-Institut

Cases, natural fibre and polypropylen, compress moulding (Germany). Pictures: Hempro International, Winter & Linotech



Pictures: BaFa

duce non-wovens, allows us to fulfil the requirements of the consumers. Our production capacity and know-how allows us to supply mats from 400 to 1,800 gr/m<sup>2</sup>, thickness 4 to 12 mm, packed in rolls.

In collaboration with research laboratories and other industries from the South West of France, AGROFIBRE develops industrial Hemp from local production to be marketed all over Europe.

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Internet: [www.agrofibre.com](http://www.agrofibre.com)

### BaFa Badische Naturfaserauf- bereitung GmbH

- Established in 1996 after the cultivation of industrial Hemp was legalized in Germany.
- Link between agriculture and industry.
- BAFA processes Hemp straw by mechanically separating the fibres from the shives.
- Three quality grades of Hemp fibres are available for the consumer market and are sold on to industrial partners & clients for further processing. Cleaned and dust-free shives are utilized e.g. as horse bedding or in the construction business for structures of almost any kind.
- BAFA has developed a special combine harvester for Hemp in cooperation with corporate partners Götz Inc. (Bühl/Moos), Deutz-Fahr Inc. (Lauingen) and the state-owned Landesanstalt für Pflanzenbau.
- BAFA is con-

tinuously involved in developing new products and solutions, e.g. Hemp insulation for common rafters.

- Active participant in European Union projects like Biocomp and Arbocar.

Technical Fibres VF6 for non-woven applications:

- Automotive industry-Insulation industry-Geotextiles
- Technical Fibres KF S20 for injection moulding
- Technical Fibres SKF 2 for injection moulding

We have a vast amount of experience in developing and modifying natural fibres during the harvesting, retting and decortication stages.

Our ambition is to modify Hemp fibres to meet the demands of our customers and our project partners at the highest levels of quality and durability. The environment comes first in all our various approaches, thus BAFA strives to advance both economic and environmental concerns for the mutual benefit of each.

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### HempFlax B.V.

HempFlax in Oude Pekela, the Netherlands, manufactures and processes durable raw materials, semi-finished products and end products made from ecologically cultivated fibre hemp and flax. With its professional approach to the development and



Urn, Hemp fibre and bioplastics, compress moulding or injection moulding (Germany).  
Picture: nova-Institut





Basin, Hemp fibre and thermoset, Resin Transfer Moulding (RTM) (The Netherlands). Picture: NPSP Composites



and consumers should make an effort to use the possibilities afforded by HempFlax.

With its vision and innovative decisiveness, HempFlax in the Netherlands and Germany gives meaning to the term agriculture. By providing recyclable raw materials, environmentally harmful synthetic fibres made of fossil raw materials – such as nylon and plastics – can be replaced by fibres made of recyclable raw materials.

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innovation of recyclable natural fibre products, HempFlax is the first link in a sustainable industrial chain.

This industrial production chain is a result of sustainable agriculture. Every year, HempFlax obtains new natural fibres, particularly fibre hemp, through contract cultivation with arable farmers in the Netherlands and Germany. By putting recyclable raw materials on the market, HempFlax has gained a leading position in this innovative industrial development. Its main objective is to produce recyclable raw materials for industrial end products and commodities for the consumer market.

HempFlax gives entrepreneurs and consumers the opportunity to give substance to their responsibility for the environment. The sustainable chain functions according to the universal environmental thinking and awareness of right-minded people aimed at continuing the ecological circle as long as possible. Entrepreneurs, managers, banks

ponent for daily nutrition. Apart from that, the oil contains a high percentage of therapeutically significant gamma lenolenic acid, a deficiency of which, can result in severe metabolic disorders. The organism is provided with all 8 amino-acids necessary for natural protein production in the body. 15–20 grams of Hemp oil daily are sufficient to meet the nutritional, essential fatty-acids requirements and protect immune system, heart and cardio-vascular systems effectively. Similarly, the Hemp nut or oil can be used to lower high blood-pressure and cholesterol levels.”

Additionally, there are numerous vitamins and health promoting substances such as sodium, calcium and iron that support and enhance body functions.

**YOUR PARTNER FOR BOTH INDUSTRIES AND RETAIL CUSTOMERS.**

The advantages convince an increasing number of health conscious customers. In the frequently visited online shop [www.hanfhaus.de](http://www.hanfhaus.de) they can order a wide variety of the best available Hemp products at attractive prices, quickly and easily. Besides having a broad variety of foods, there are antiallergics cosmetics, practical, useful accessories for house and home and a designer-collection of nature based, eudermic fashion created exclusively by a selected fashion studio. Trade and industry have also recognised the trend of the times and are focusing on Hemp as a future oriented, sustainable raw material. In the meantime even established bakeries, food manufacturers and specialised stores across Europe are frequent hempnut and Hemp oil customers. And, by the way, Hempro International is the only German producer and main distributor of Hemp products that is

**Hempro International GmbH & Co. KG**

**Love at first bite!**

Health tastes good. Especially if delicious, top-quality Hemp specialties appear on your plate. If you’ve ever spooned tasty Hemp-muesli for breakfast or nibbled on a freshly baked hempnut biscuit inbetween, you easily develop an appetite for more! The mm-effect is guaranteed. But whatever enjoyer, also benefits the body. Daniel Kruse, CEO of Hempro International GmbH & Co. KG and designated expert in Hemp affairs explains why: “Because of its polyunsaturated fatty-acid consistence of up to 90 %, hempnut oil is classified as one of the most valuable and vital cooking oils of all. The perfect relation between omega-6 particularly and omega-3 makes Hemp food an ideal com-



Picture: Hempro Int.

able to hull the hempseed, botanically correctly classified as a nut, from its thin pericarp. This greatly assists the requirements for further industrial processing.

### PROCESSING IN A CAREFUL MANNER.

For Hemp oil production the highest sensitivity is necessary. “We only use the cold-press method to avoid any unfavourable rise in temperature. Due to this gentle process, proteins and fats remain the same and the oil’s natural nutty taste is retained. Because of its ideal composition, Hemp-oil is also perfect for making highly effective cosmetic products. Whoever suffers from dry or cracked skin will be enthralled by the noticeable healing effect. Through the oil-containing and moisturising Hemp skin-care products even neurodermitits, psoriasis or scars are visibly improved. Additionally: “Even Cleopatra used Hemp ointments and baths to keep her skin beautiful and smooth.” reports Daniel Kruse who has worked in the Hemp-market for 15 years and now leads his own company, founded 2002, together with his wife Rebecca.

### BEST PROSPECTS FOR THE FUTURE.

With consequent implementation and focus on product-quality, the Duesseldorf based company has succeeded in rising into the top-league of major European suppliers for Hemp products. And is still making further ground. The turnover has grown in the last years at about 20 % annually. The first two months of 2010 show sales already almost twice as high compared to the same period last year. In the meantime, with a requirement of about 500 tonnes yearly, Hempro International’s need for industrial Hemp has grown to a remarkable ex-



Picture: Hempro Int.

### MATERIAL FOR A THOUSAND AND ONE IDEA.

Hemp can be used in many more ways than any other plant. It offers the basis for clothing and food, oil, energy, paper, building material and cosmetics with skin-care properties. Cultivating this extremely robust crop poses no problems because cannabis sativa needs no pesticides or chemical additives to keep pest and weeds at bay. And even then, a Hemp field produces almost 3 times as much fibres as a cotton field of the same size and even 4 times the amount of paper as a forest! Hemp grows up to 4 meters in 100 days, improves the soil and binds the dangerous greenhouse gas CO<sub>2</sub>. With the invention of new fibres and as a consequence of the marijuana prohibition, Hemp was forgotten as a raw material, However now, this long forgotten multi-talented plant is celebrating a ferocious comeback! In the service of good health!

tent. The greater portion of raw material, both organic- and conventional quality, comes from China, where Hemp started its botanical triumphal procession as one of the oldest used materials of mankind about 10.000 years ago. Our local European re-

sources can not satisfy the growing demand.

The food-series “The Hemp Line” is subject to strict quality control and is certified according to EU regulations for organic farming. Daniel Kruse and his nine employees are constantly extending the product program. Creative potential for new ideas is abundant because Hemp’s possible and potential application knows no bounds. For example, the team is presently contemplating the development of Hemp-milk in various flavours.

One thing has to be clarified though. How did the former banker Daniel Kruse start in the Hemp business? “I have always wanted to work for a sensible balance between ecology and economy. I was introduced to the subject of Hemp for the first time through a newspaper article. It was like a primary ignition. And as you can see today, that spark has turned out to be a strong passion!”, says the successful businessman. By the way, more and more companies are taking environmental responsibility. “Not so long ago, companies from Cologne and Duesseldorf pooled together and formed the association “Das-selbe in Grün” (“The Same In Green”), recounts Daniel Kruse. “We are one of the founder-members, mainly because in an association, sustainability is achieved much more effectively. Apart from that, all parties profit from a professional network with mutual objectives.”

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# 7<sup>th</sup> International Conference of the European Industrial Hemp Association (EIHA)

[www.eiha.org/conf7](http://www.eiha.org/conf7)

May 26<sup>th</sup> - 27<sup>th</sup> 2010

Rheinforum, Wesseling / near Cologne (Germany)

Congress language: English



**Don't miss the biggest industrial hemp event in 2010 - world wide!**

**The congress will focus on the latest developments concerning hemp and other natural fibres.**

The spectrum of participants will range from

- cultivation consultants,
- primary and further processors,
- traders, mechanical engineers,
- investors to enterprises to
- suppliers (for example: insulation material, pulp & paper, automotive).

**They all share common interest in the industrial utilisation of hemp fibres and shivs. Other topics are hemp seeds and hemp oil in nutrition.**

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www.nachhaltigkeitswirtschaften.net



www.biopress.de



www.renewable-resources.de

# 7<sup>th</sup> INTERNATIONAL CONFERENCE OF THE EUROPEAN INDUSTRIAL HEMP ASSOCIATION (EIHA)

## Programme

[www.eiha.org/conf7](http://www.eiha.org/conf7)

Day One: May 26<sup>th</sup> 2010

### SESSION 1: STATE OF THE HEMP INDUSTRY – COUNTRY REPORTS

- 10:00 h     **State of the Hemp industry**  
*Michael Carus* (nova-Institut GmbH, Germany)
- 10:30 h     **Hemp Technology Ltd 2010**  
*Mike Duckett* (Hemp Technology Ltd, Great Britain)
- 11:00 h     **Hemp production in Thailand**  
*Prof. Arkom Kanjanaprachot* (Maejo University and Royal Project Foundation, Thailand)
- 11:30 h     **Industrial Hemp as organic growth medium in Denmark**  
*Bodil Pallesen* (AgroTech A/S, Denmark)
- 12:00 h     **Future of Hemp: cultivation, processing and markets**  
*Francois Desanlis* (Hemp Farmer, France)
- 12:30 –  
14:00 h     **Lunch Break**
- 14:00 h     **Polish cultivars and perspective lines of industrial Hemp**  
*Malgorzata Strybe* (Institute of Natural Fibres and Medicinal Plants, Poland)

### SESSION 2: HEMP FIBRES: SEPARATION AND MODIFICATION

- 14:30 h     **High – performance Hemp fibres and industrial applications: brake linings, gaskets, and others**  
*Dr. Volker von Drach* (ECCO Gleittechnik GmbH, Germany)
- 15:00 h     **Latest developments in chemical fibre decortication**  
*Herbert Costard* (FLASIN Faser GmbH, Germany)
- 15:30 –  
16:00 h     **Coffee Break**

### SESSION 3: HEMP FOR CONSTRUCTION

- 16:00 h     **BRE and the Renewable House**  
*Nicholas Corker* (Building Research Establishment Ltd, Great Britain)
- 16:30 h     **The aims of the International Hemp Building Association**  
*Steve Allin* (International Hemp Building Association, Ireland)
- 17:00 h     **Development of strong Hemp fibres for building construction**  
*Dr. Mizi Fan* (Brunel University, Great Britain)
- 17:30 h     **Characteristics and advantages of Hemp-lime construction**  
*Dr. Mike Lawrence* (University of Bath, Great Britain)



Day Two: May 27<sup>th</sup> 2010

**SESSION 4:  
HEMP FIBRES: REINFORCEMENT**

- 09:00 h      **Hemp fibre reinforced plastics from France**  
*Pierre Amadiou* (Sarl Start Hemp, France)
- 09:30 h      **Innovative Natural Fibre Reinforced Bio-Composite Granules for Cradle-to-Cradle Solutions – China in our hands?**  
*Martin Snijder* (GreenGran B.V., The Netherlands)
- 10:00 h –  
10:30 h      **Coffee Break**
- 10:30 h      **Polypropylene-Hemp compounding with internal mixers**  
*Dr. Hans Korte* (Innovationsberatung Holz und Fasern, Germany)
- 11:00 h      **Innovative bicycle frame made of Hemp and bambus!**  
*Nicolas Meyer* (ONYX composites, Germany)
- 11:30 h      **Fibrous materials from the wet supply chain as reinforcement in composites**  
*Wallot, G.; Gusovius, H.-J.; Pecenka, R.; Hoffmann, Th.* (Leibniz Institute for Agricultural Engineering Potsdam-Bornim)
- 12:00 –  
13:00 h      **Lunch Break**

**SESSION 5:  
HEMP TEXTILES AND MORE**

- 13:00 h      **Hemp Cultivation and Processing in China – Textiles, particle boards and more**  
*Lawrence Serbin* (Hemp Traders, USA)
- 13:30 h      **Hemp in cloths – in the past and today**  
*Robert Hertel* (HempAge AG, Germany)

**SESSION 6:  
HEMP SEEDS AND OIL**

- 14:00 h      **Hemp foods and Hemp milk from Living Harvest**  
*Hans Fastre* (Living Harvest Food, USA)
- 14:30 h      **Marketing for Hemp soap and cosmetics**  
*Dr. Michael Bronner* (Dr. Bronner's Magic Soaps, USA)
- 15:00 h      **Hemp for Food – an update from Canada**  
*Anndrea Herrmann* (Hemp Oil Canada Inc., Canada)

**Panel Discussion and Get Together**

**Organiser**

*nova-Institut GmbH  
Chemiepark Knapsack  
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50354 Huertb (Germany)*



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### Hemp processing: NAFGO taken over by HempFlax New start announced after restructuring

The HempFlax Deutschland GmbH took over the hemp processing company NAFGO GmbH from Neerstedt (Niedersachsen, Germany) on September 1st, 2009.

HempFlax announced a new start “after the restructuring”; the team, well-known to its business partners, will still be operating as normal for its customers. NAFGO started insolvency proceedings at the insolvency court Delmenhorst. The insolvency administrator was Detlef Stürmann.

*Source: HempFlax Deutschland GmbH and Indat.info 2009-10*

### French make cars from flax PSA's Green Materials Plan leads to Hemp and flax composites

PSA Peugeot Citroën is today presenting the latest developments in its green materials plan, set up to limit the eco-footprint of Group vehicles during their service life. The Group has set an ambitious target in eco-design: to include 20 % of green materials in the polymers used to build its cars by 2011. A car is made up of 70 % metal, already largely recycled, 5 % miscellaneous materials (glass, etc.) and 5 % fluids. The rest is plastics (polymers).

The term “green materials” covers natural fibres such as linen and Hemp, non-metallic recycled materials and biomaterials, which are produced using renewable resources rather than petrochemicals. The aim is to use fewer fossil fuel plastics and to increase the use of raw materials from renewable sources to make parts lighter, in some cases, to cut CO<sub>2</sub> emissions from plastics production and to promote plastics recycling.

The Earth's resources are dwindling, so it is important to optimise the way in which they are used. End-of-life processing is therefore factored in from the design stage. The aim is to boost recyclability and thus reduce the potential impact of end-of-life vehicles. As a minimum, 85 % of a vehicle's weight can be reused or recycled, and a further 10 % can be used for energy recovery.

The key feature of the action plan set up by PSA Peugeot Citroën in 2008 is that it concerns all Group vehicles and the three families of green materials. The green material content of each vehicle project must be increased. This approach also involves existing vehicles, with green materials being integrated during their production life. Engineering teams are working in close cooperation with suppliers in order to utilise these new materials.

This effort also gives new impetus to the recycled materials industry. The subject of biomaterials is still at the research stage in the automotive industry. To address the issue, scientific partnerships have been set up as part of research groups bringing together public laboratories, chemical firms and parts suppliers. The aim of these partnerships is to accelerate the application of these materials in the automotive industry.

*Source: PSA Peugeot Citroën, press release, 2009-10-08*

### World's first store of hemp-made clothes opens in China Hemp fiber absorbs moisture and protects against radiation and UV rays

The world's first store selling hemp-made clothes exclusively has opened in east China's Zhejiang Province.

“The Hemp fibre, after being detoxified, excels at absorbing moisture, shielding radiation and ultraviolet rays”, said Zhang Jianchun, a researcher with the General Logistics Department of the People's Liberation Army. “The fiber was worn by soldiers during the national day parade in 2009, and they liked it”, said Zhang.

The store, “Han Ma Sheng Huo Guan,” which opened in Ningbo City Friday, sells hemp-made products including clothes, bath towels and sheets. “I'll try to see if they really have special properties,” said a consumer selecting shirts in the shop.

*Source: Xinhua News Agency, 2010-01-13.*

### UK: Brake pads for trains from Hemp fibre and cashew nut oil Market launch for Ecobrake is planned by 2011

The production of brake linings for trains currently depends on aramid fibres



Hemp fibre brake pad for regional trains (UK). Picture: nova-Institut

such as Kevlar, phenolic resins and an extremely energy-intensive manufacturing process, which makes it costly both in environmental and financial terms. The pads also incorporate significant amounts of heavy metal compounds that are discharged into the environment as they wear.

With funding from the UK government's Technology Strategy Board, the Ecobrake project aims to introduce a marketable alternative composite product employing Hemp fibre and cashew nut oil by 2011. Bringing together European Friction Industries, Aptec Products and Hemp Technology, along with specialists at the University of Exeter, the goal of the project is to develop a new technology to create greener brake pads for mass urban rail transit vehicles, such as those employed on the Docklands Light Railway (DLR) in London.

In describing progress to date at the recent Natural Fibres conference held in London, project researcher Will Newby explained that before 1990, the only fibre employed for such brake linings was asbestos in phenolic resin. “Since asbestos was banned, no fibre has completely replaced it,” he said. “Aramids are now commonly employed, but also metallic and mineral fibres. But with the cost of aramid fibre around £ 20 per kg, any alternative low-cost fibre that can perform some of the work of such an expensive material in composite structures would be significant. Hemp goes some way to meeting requirements in respect of a stable coefficient of friction and resistance to friction heat. It has adequate compression and shear strength – and it is cheap.”

Industrial Hemp is a fast-growing, disease-resistant plant that absorbs carbon dioxide and self-fertilises the land upon harvest. Bast fibres extracted from the stem

of the plant exhibit specific mechanical properties comparable to E-glass, and have been used in the manufacture of automotive composites for some time. The Hemp for the Ecobrake project is prepared by Hemp Technology based in Norwich, UK, and processed by Aptec based in West Auckland, County Durham, UK, using a Laroche opening machine. It is the resin, meanwhile, that dominates the mechanical properties of the pad. It must withstand cyclic loading of high temperatures and stresses but maintain a stable coefficient of friction throughout its working life. Currently, phenolic-based resins synthesised from non-renewable resources are used to fulfil this requirement, but a naturally occurring alternative has been discovered in the husk of the cashew nut shell.

Cashew nut shell liquid (CNSL) is the viscous, dark brown substance found in the husk of the cashew nut shell. It is a sustainable and naturally occurring source of phenolic compounds that can be used to produce thermally stable resins suitable for use in brake pads. At present, this liquid is considered a waste product by the cashew nut industry.

“A new aggressive mixing process will be the key to the success of the Ecobrake project”, Newby revealed. “Aramids fibrillate and form a dense structure and it is this we want to replicate with Hemp in our process,” he said. “We are also now exploring surface treatment of the fibre. Aptec has so far had some success with blends of aramid and Hemp and we are now looking at fibre surface treatments to increase the Hemp percentage. The current market for such brakes in Europe and North America is an annual £ 200m (US\$ 322 m) and the goal is that 20 % of the 1.5 m sets required each year will be Ecobrake pads by 2013.”

Sources: *MobileTex*, 2010-02.

### Hemp Fibre Pellets for Injection Moulding: German Project will start in April 2010

The project's goal is to overcome the most crucial bottle neck in the process chain from domestic natural fibres to natural fibre reinforced plastics: the feed of natural fibres through technically and economically suitable natural fibre pellets into

the plastics industry processes.

Natural fibre reinforced plastics (NFRP) constitute a promising material group, for injection moulding and extrusion. For ecological, technical and economic reasons they are able to replace both glass fibre, reinforced plastics and non-reinforced plastics such as PC/ABS. Yet so far NFRP have managed to take hold in only a few niche products. The technically and economically unresolved problem of feeding natural fibres into plastics industry processes was identified as the most important reason for this.

Natural fibres such as domestic hemp or flax fibres are not free flowing and therefore, given the existing systems, it is only possible at the cost of long process times and loss of quality to feed them into the extruder or heating-cooling mixer in which granulates are produced from natural fibres, plastics and additives. These granulates, just like common granulates, can be used by the plastics processing industry on injection moulding machines for the produc-



Hemp fibre pellets for granule production.  
Picture: nova-Institut

tion of plastic parts.

So far in research and development, fibres or card slivers have been used that are too expensive for industrial production, or special solutions have been developed for small series production that are not suitable for other applications and high throughputs, especially with regard to process times, process safety and economics.

- In the framework of the project, chopping the natural fibres, feeding them into the pelletisation process and pelletisation itself will be developed and optimised into an industrial process on a demonstration plant. The plastics processing industry can then accurately feed natural fibres into their processes without any technical problems and rein-

force plastics with a consistent quality and with a price that will make sustainable use possible for the industry.



Hemp short fibres. Picture: BaFa

Project partners: nova-Institut GmbH, Hürth (project management and economics), Badische Naturfaseraufbereitung GmbH, Malsch (demonstration plant) and Hochschule Bremen (technical analyses). The natural fibre pellets are tested within the project by the companies FKUR, Hiendl and Linotech as well as Fraunhofer WKI.

The project duration is 18 months, and it is financially supported by the Deutsche Bundesstiftung Umwelt (DBU), Osnabrück.

Source: *nova-Institut*

# INCREASING DEMAND FOR EUROPEAN HEMP FIBRES: A SUSTAINABLE RAW MATERIAL FOR BIO-BASED COMPOSITES

From a historic point of view, for more than 2,000 years hemp has been an important raw material for industry. Hemp fibres were used for technical textiles such as ropes, hawsers, boat canvas as well as clothing textiles. In the 1990s, hemp was rediscovered throughout the world as an important raw material for bio-based products in sustainable bioeconomics and ever since then has been in high demand. The most important cultivation and manufacturing regions are Europe and China, and the most important applications are bio-based composites (natural fibre reinforced plastics) as well as construction and insulation materials. The bio based materials sector particularly, still has large, untapped market potentials for both the reinforcement of mineral oil-based plastics and, to an increasing degree, for bio-based plastics.

## SUCCESS STORY AUTOMOTIVE INDUSTRY: CURRENT TRENDS AND NEW APPLICATIONS

In the year 2005 – more recent data is not available – 30,000 tons of natural fibre composites (EU:40,000–50,000 t) wood not included, were used in the automotive industry, requiring 19,000 tons of natural fibres. (EU:30,000 t) European flax (about 65 %) and hemp (about 10 %) were used, with the remaining 25 % covered by imports from Asia (jute, kenaf, coir, abaca). Natural fibre compression moulding is the dominant processing technique (share of > 95 %), it is an established and proven technique for the production of extensive, lightweight and high-class interior parts in medium and luxury class cars. Advantages are lightweight construction, crash behaviour, deformation resistance, lamination ability, depending on the overall concept,

and also price. The disadvantages are limited shape and design forming, off-cuts, and cost disadvantages in the case of high part integration in construction parts. These advantages and disadvantages are well known. Process optimisation is in progress, in order to reduce certain problem areas such as off-cuts and to recycle waste. By means of new one-shot compression moulding presses, soft surfaces can also be directly integrated, something that has not been possible so far with injection moulding.

Between 2005 and 2009, the use of natural fibres in the European automotive industry did not expand, and in Germany even slightly decreased, after it had grown in double-digit figures each year between 2000 and 2005. Since 2009, however, there has been an increasing demand again: new models from almost all automotive companies that will be released on the market this or next year do have considerably more interior parts, made once again with natural fibre reinforcement. On the one hand this is due to the high development of the materials and the fact they've proven themselves in practice, but on the other hand it is also due to the increasing interest by the automotive industry in bio-based materials and lightweight construction – in both fields, natural fibre construction parts can score. In addition, further cost and weight reductions were achieved in recent years especially with regard to compression moulding.

Furthermore new trends are becoming apparent: the automotive manufacturers do not only want to use bio-based materials, but also want to show them to their customers. While up to now natural fibre construction parts have disappeared under a lamination, thus becoming invisible to the

customer, in the near future vehicles will be released on the market that will exhibit the natural fibres under transparent films or lacquers, showing completely new surface effects. Another trend can be noticed in the development of making the plastics matrix bio-based as well, i.e. producing interior parts from PLA or bio-based PP and natural fibres. While such 100 % bio-based compounds will soon be found in Japanese cars, in Europe this still will take a while.

With demand increasing again, new concepts and the support of bio-based products by politics, sales of 40,000 to 50,000 t of natural fibres could be achieved in Europe by 2015, at least 10–20 % of which could be supplied by European hemp.

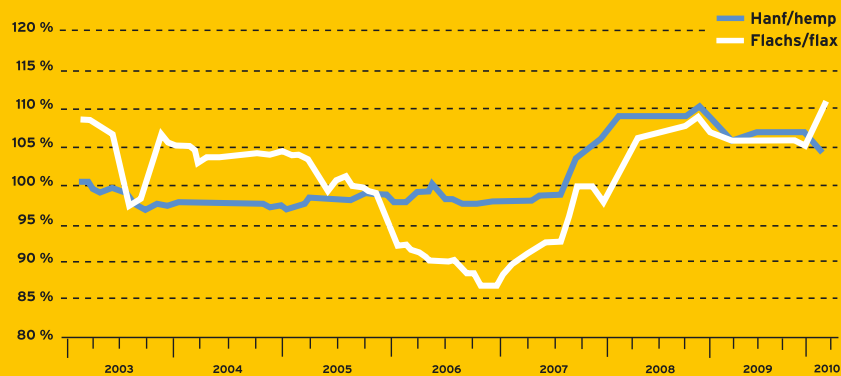
## INSULATION MATERIALS AND MANY OTHER APPLICATIONS

The second road to success are hemp insulation materials of which about 3,000 to 4,000 tons are produced annually and put on the market in the EU. The most important manufacturers and users are Germany, France and Great Britain respectively. The hemp insulation material properties are very good and appreciated by customers. Achieving bigger sales markets is solely hampered by the relatively high price compared to mineral fibre insulation materials. Here only suitable economic-political framework conditions can be of help.

Apart from the automotive and construction industry, there are numerous applications with a smaller volume such as briefcases, other cases, various consumer goods (e.g. letter scales, battery chargers, toys) or trays of grinding/sanding disc and urns. The latter are a good example of a 100 % bio-based product: The urns are produced from PLA, reinforced by hemp fibres, and are fully biodegradable.



## Preisentwicklungsindex: Technische Kurzfasern Hanf und Flachs



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100 % entspricht dem Preis für techn. Hanf-Kurzfasern 2003-03. Basis: Abnahmemenge 1 00 Tonnen pro Jahr

Quelle: nova-Institut GmbH auf Grundlage zweimonatlicher Preisermittlungen von: Badische Naturfaserzubereitung BaFa GmbH (D), Hencore Ltd. (UK), HempFlax B.V. /NL, Holsten Flachs GmbH (D), Linolitas, LT, bis 2007-1-2), NAFGO GmbH (D), Procolex SA Corporation (B, bis 2005-1-0), Sachsen-Leinen GmbH (D, seit 2003-1-0), SANECO (F).

As well as the examples mentioned, in addition to the aforementioned compression moulding, injection moulding plays an important role. The increasing availability of high-grade natural fibre injection moulding granulates will help to quickly develop new applications here.

### NEW PROCESSING TECHNIQUES

For some decades, in the EU and North America there has been intense research going on in new processing techniques for flax and hemp fibres, in order to make the development of new, high price fields of application possible for natural fibres. In this issue you can find more detailed information on two outstanding processing techniques that are close to commercial implementation, already today producing modified hemp fibres amounting to several hundred tons per year: First, the CRAILAR Process from Canada which focuses on the use of hemp fibres in the textile industry, and second, the ultrasonic processing technique of the Ecco Company from Germany which focuses on high-grade technical fibres.

### AVAILABILITY AND PRICE DEVELOPMENT OF NATURAL FIBRES – A CHANCE FOR EUROPEAN HEMP?

While the technical natural fibre market is increasing worldwide, the question of prices and security of supply arises. In important cultivating countries in Asia, the cropping areas for jute and kenaf cannot be

extended, because there is considerable competition for areas which have other uses. There's a better situation regarding sisal, here an extension of cropping areas is possible in the dry regions of Africa and South America – places, where hardly any other crop can be cultivated. But European production is also under pressure: the cropping areas of flax are decreasing due to strong competition from areas with subsidised bio energy as well as the dependency on exports to China which is buying less textile long flax fibres. As for hemp, an extension of cropping areas is possible however, provided that rates of return similar to those of the food and animal food sector and energy crops can be achieved. Areas under hemp cultivation are also on the rise in China, with hemp being expected to replace cotton in the clothing textile sector.

In December 2009, Bangladesh imposed a ban on jute fibre exports for the first time and it was not before February 2010 that it was partly suspended because of certain factors. The reasons for the embargo were to be found in three years of poor harvests and increasing demand particularly from India (packagings) and China (composites), threatening a shortage of the necessary raw material from the Bangladesh jute industry. Due to the embargo, jute prices rose by 50 to 100 %. At the same time sisal prices were increasing, too, due to a severe drought in East Africa.

80 % of jute and kenaf are used in Asian packagings (bags), sisal particularly in the form of tow ropes and conveyor belts. In contrast to these, natural fibre composites

European Hemp and Flax – a prise rise of less than 10 % in over seven years. Source: nova-Institut

still constitute small markets that can be supplied quite easily.

As a result of farmers reacting more quickly to changes in demand, rates of return and a local shortage of area, there has been a general trend leading towards a more dynamic agricultural market with more volatile prices, and this, fueled by speculators, is now affecting the world of natural fibres. For a long time, prices have been quite stable compared to other agricultural products or mineral oil. But it is expected in the future that natural fibre prices will definitely stay below 1 €/kg so that they remain attractive for composites.

The graph shows the price developments of important natural fibres, and as a comparison, the price development of mineral oil and polypropylene. European flax and hemp fibres, after a long period of price stability have only recently shown moderate price increases, and are currently showing particularly good price stability.

To sum up: exciting times for European hemp which, with adequate framework conditions, has a considerable growth potential. ●

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# IN CELEBRATION OF THE INTERNATIONAL YEAR OF NATURAL FIBRES

**EIHA supported the IYNF by activities**



The idea of a United Nations International Year dedicated to natural fibres arose from a Food and Agriculture Organisation (FAO) of the United Nations (UN) meeting in 2004. In the following year, the proposal was endorsed and transmitted to the Secretary-General of the UN. Shortly afterwards, the UN General Assembly proclaimed 2009 to be the International Year of Natural Fibres. In doing so, it noted that the diverse range of natural fibres produced in many countries provides an important source of income for farmers, and thus can play an important role in contributing to food security and in eradicating poverty and hence in contributing to the achievement of the Millennium Development Goals.

## WHY NATURAL FIBRES?

Each year, farmers harvest around 35 million tonnes of natural fibres from a wide range of plants and animals – from sheep, rabbits, goats, camels and alpacas, from cotton bolls, abaca and sisal leaves and coconut husks, and from the stalks of jute, Hemp, flax and ramie plants. Those fibres form fabrics, ropes and twines that have been fundamental to society since the dawn of civilization.

But over the past half century, natural fibres have been displaced in our clothing, household furnishings, industries and agri-

culture by man-made fibres with names like acrylic, nylon, polyester and polypropylene. The success of synthetics is due mainly to cost. Unlike natural fibres harvested by farmers, commonly used synthetic fibres are mass produced from petrochemicals to uniform strengths, lengths and colours, easily customized to specific applications.

Relentless competition from synthetics and the recent current global economic down-turn have impacted the livelihoods of millions of people who depend on natural fibre production and processing. That is why the International Year of Natural Fibres 2009 aims at raising global awareness of the importance of natural fibres not only to producers and industry, but also to consumers and the environment.

## THE IMPORTANCE OF NATURAL FIBRES TO DEVELOPING COUNTRY ECONOMIES

Natural fibres production, processing and export are vital to the economies of many developing countries and the livelihoods of millions of small-scale farmers and low-wage workers. Today, many of those economies and livelihoods are under threat: the global economic recession, and its aftermath, has reduced demand for natural fibres as processors, manufacturers and

consumers suspend purchasing decisions or look to cheaper synthetic alternatives.

Almost all natural fibres are produced by agriculture, and the major part is harvested in the developing world. For example, more than 60 percent of the world's cotton is grown in China, India and Pakistan. In Asia, cotton is cultivated mainly by small farmers and its sale provides the primary source of income of some 100 million rural households. In West and Central Africa, cotton is grown on an estimated 1.5 to 2 million small farms. At least 10 million people work in the region's cotton sector, and raw cotton makes up about 50 percent of exports from Benin, Burkina Faso, Chad, Mali and Togo. Cotton is Mozambique's second most important export, is grown by some 300,000 rural families, and provides work for 20,000 people along the supply chain.

In India and Bangladesh, an estimated 4 million marginal farmers earn their living – and support 20 million dependents – from the cultivation of jute, used in sacks, carpets, rugs and curtains. Competition from synthetic fibres has eroded demand for jute over recent decades and, in the wake of recession, reduced orders from Europe and the Middle East could cut jute exports by 20 percent in 2009. In southern India, the coir industry provides 500,000 jobs. Silk is another important industry in Asia. Raising silkworms generates income



for some 700,000 farm households in India, while silk processing provide jobs for 20,000 weaving families in Thailand and about 1 million textile workers in China. Orders of Indian silk goods from Europe and the USA are reported to have declined by almost 50 percent in 2008-09.

Each year, developing countries produce around 500 000 tonnes of coconut fibre – or coir – mainly for export to developed countries for use in rope, nets, brushes, doormats, mattresses and insulation panels. In Sri Lanka, the single largest supplier of brown coir fibre to the world market, coir goods account for 6 percent of agricultural exports, while 500,000 people are employed in small-scale coir factories in southern India. Across the globe in Tanzania, government and private industry have been working to revive once-booming demand for sisal fibre, extracted from the sisal agave and used in twine, paper, bricks and reinforced plastic panels in automobiles. Sisal cultivation and processing in Tanzania directly employs 120,000 people and the sisal industry benefits an estimated 2.1 million people. However, the global slowdown has cut demand for sisal, forced a 30 percent cut in prices, and led to mounting job losses.

Put together, the sale of natural fibres on the international market place provides as much as US\$18 billion to farmers and processors, but the main beneficiaries to an expanding global market in the last decade have not always been the poorer countries.

## OBJECTIVES OF THE INTERNATIONAL YEAR

The declaration of the International Year of Natural Fibres reflects the importance of this group of commodities to a great many countries, particularly the most vulnerable ones. The key objective of the Year is to im-

prove the lives of the poor who are involved in natural fibre production and processing. An important strategy is to find new markets and uses for natural fibres, especially those produced by small-scale farmers. Much can be done by raising awareness and to ensure that the plight of the millions of natural fibre producers is heard, for many of these producers form the most vulnerable communities in the world.

The International Year is also about promoting the efficiency and sustainability of natural fibre industries and to encourage appropriate policy responses to the problems faced by natural fibre industries; and it is also about fostering effective and enduring international partnerships among the various natural fibres industries. Clearly, there is an important role for fibre crops and their commercialisation in promoting economic development while at the same time contributing to the emerging “green” economy. For natural fibres can also be part of the solution to climate change. Natural fibres are a renewable resource, par excellence – they are carbon neutral by absorbing the same amount of carbon dioxide they produce. During processing, they generate mainly organic wastes and leave residues that can be used to generate electricity or make ecological housing material. And, at the end of their life cycle, they are 100 % biodegradable.

FAO was invited to facilitate its observance, in collaboration with governments, regional and international organizations, non-governmental organizations, the private sector and relevant organizations of the United Nations system.

## EXPERIENCE IN IMPLEMENTATION

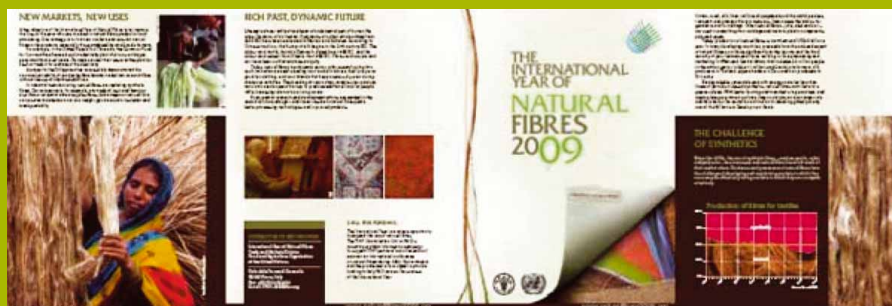
It was unfortunate that the IYNF coincided with the exceptionally difficult economic climate of 2009. Natural fibre commodities, especially those used in industrial applications, are particularly responsive to income changes. Many studies have examined just how sensitive fibre demand is to changes in the level of income. Typically they show that for every 1 percent fall (rise) in income, demand contracts (expands) between 1 to 2 percent. Such responsiveness is much higher than for many other commodities, including food, other raw materials and energy.

Nevertheless, FAO alongside its partners pushed the IYNF agenda to the forefront with noticeable impact. At the heart of the FAO campaign was the IYNF website ([www.naturalfibres2009.org](http://www.naturalfibres2009.org)) with a presence in 8 languages.

The website contains inter alia profiles of 15 of the world’s major plant and animal fibres; fibre factsheets on health, responsible choices, sustainability, technology and fashion; micrographs of 18 plant and animal natural fibres; and a selection of fibre “stories”.

The website also hosts the IYNF logo, a poster and a brochure, in various languages, plus T-shirt and bag designs for printing – all downloadable. A further major highlight of the FAO campaign is the IYNF video produced in seven languages, with funding assistance from the Common Fund for Commodities and the New Zealand Trade and Enterprise.

In April, FAO hosted a fashion show at its Rome headquarters featuring clothing designed by Italian designers who use 100 percent natural fibre textiles such as organic cotton, cashmere, alpaca and silk - in



their creations. The show underscored the connection between the clothes we wear and small-scale fibre producers in developing countries.

Such has been the success of the centralised outreach, that by the end of 2009, around 1000 formal requests to use the IYNF logo had been received, roughly 3000 posters and brochures were distributed, while demand for the video had exceeded several thousand requests. However, key to celebrating the year and promoting its objectives were the host of events that took place outside of Rome. Well over 150 conferences, workshops, exhibitions, seminars, fairs and festivals were organised in 50 countries under the umbrella of the IYNF. These decentralised initiatives have been the key strength in raising awareness about natural fibres. From Belgium to Bangladesh, Egypt to Ecuador, Mozambique to Mexico, China to Canada, Iran to India, Portugal to the Philippines, etc, the sheer number and geographical diversity of the decentralised events underlines just how important natural fibres are perceived around the globe.

**BEYOND 2009**

There is common recognition that the objectives of the Year cannot be possibly realised in the space of 12 months. For this reason, FAO along with key stakeholders are committed to sustaining momentum beyond 2009. For example, the website will be maintained in the years to come, further media events are being planned in 2010, including the redesign of key publicity material. FAO is also encouraging the continuation of events outside of headquarters that aim to keep the spirit of the Year alive.

In addition, FAO forms the Secretariat of the Intergovernmental Group on Jute and

Hard Fibres (especially sisal, coir and abaca). For the central themes of the IYNF, namely the environmental benefits of natural fibres twinned with poverty alleviation and rural development given the location of production, lend themselves arguably more towards these fibres than for other natural fibres. The Group has a far reaching mandate, but at its core, the Group strives to improve the visibility of jute and hard fibres, to identify new markets through promoting product innovation and standardisation, sustainability certification and fostering greater efficiency through investment in R&D.

It is hoped that readers of this newsletter will embrace the objectives of the IYNF and through your actions a difference can be made to the lives of many that depend on natural fibres. ●

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Picture: FAO

**INTRODUCTION**

Since the middle of 1980's the cultivation of fibre plants such as Hemp and flax has gained much importance for European agriculture. In 2005, app. 19.000 t of natural fibres (not including cotton and wood) are used annually as reinforcement fibres in composites for the automotive industry in Germany [EIHA 2009]. The traditional production of Hemp and flax fibres in Europe is based on field drying and retting of the crop and subsequent mechanical separation of fibres from non fibrous parts of the input material. At the usual harvest time in September, weather conditions are often hard to predict for the quality of processed Hemp to high quality fibres for industrial purposes.

**MATERIALS AND METHODS**

A weather-independent post harvest technique is under investigation at the Leibniz - Institute of Agricultural Engineering (ATB). The harvest of Hemp by means of a chopper followed by anaerobic storage is advantageous for the farmer because the weather risk can be avoided in comparison to the traditional supply chain. Additional steps are similar to the ensiling of fodder. Furthermore, with this novel processing technology the whole plant material without any by-products or waste is processed to produce an end product like fibre boards, insulation materials or semi products for composites. A pilot plant with a processing capacity of 1 t/h Hemp silage is built up and tested at the ATB at present (Fig 1).

The technology of the pilot plant enables the processing of different fibre plants from agriculture and forestry. The finished process is a modified dry/half-dry process from the wood industry adapted to agricultural raw materials like wet preserved Hemp (Fig. 2).

# MPOSITES FROM AN ALTERNATIVE R HEMP AND OTHER NATURAL FIBRES

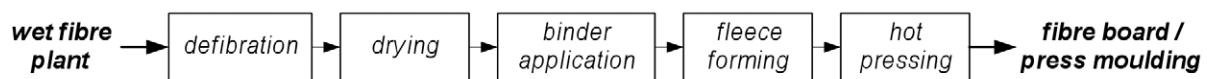


Fig. 2: Process flow for the processing of wet preserved Hemp and other fibre plants

## RESULTS

The pilot plant was put into operation in January 2007 and is being tested at present. First samples boards with densities from 150 to 1000 kg/m<sup>3</sup> have been produced using different natural and synthetic binders. The mechanical properties of these samples are comparable with the properties of commercial products made of wood fibres (Fig. 3). Disadvantageous silage-like odours are released to atmosphere by means of the thermal treatment of the raw material in the first processing stages. Thus, odour troubles in the products are minimized, but still have to be improved.

Tests related to composite technologies have shown that granulate for injection moulding can also be produced from the fibrous material based on wet preserved Hemp. As one of the results favourable geometrical properties like an aspect ratio of 5 up to 15 were measured. The processability as well as the resulting mechanical properties of the composites with polypropylene as matrix material is being investigated at present.

The ongoing research is complemented by economic studies of the whole process chain from agriculture to end products. According to these studies, production costs of fibre boards for subsonic noise insulation amount to 85 to 90 % of the end consumer price for conventional fibre boards when produced in one shift production, respectively 60 to 65 % when produced in two shift production with this new technology.

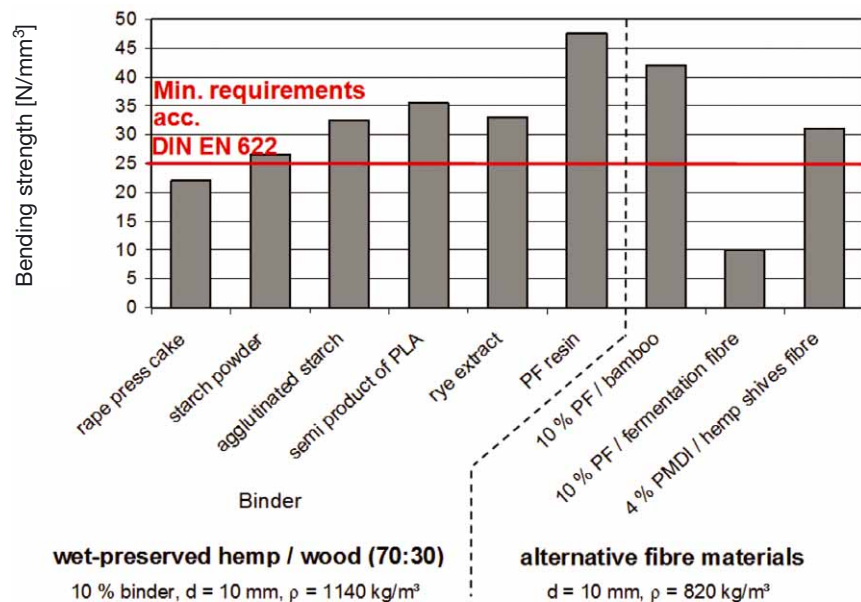


Fig. 2: Bending strength of fibre boards manufactured from different raw materials and binder systems (PLA=Polylactic acid, PF=Phenolic resins, PMDI=Polymeric isocyanate)

## CONCLUSIONS

Experiences with a novel fibre processing plant have shown that wet preserved Hemp can be processed to high quality fibre boards. The novel technology is appropriate for establishing decentralized processing plants at farm level. 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. Further main advantages of such plants for Hemp processing are the alternative source

of income for farmers combined with the enrichment of crop rotation and the environmentally sound production of fibre boards at competitive prices. ●

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# SETRALIT®: ULTRASONICALLY TREATED NATURAL FIBRES FOR INDUSTRIAL APPLICATIONS

A patented ultrasound procedure of the ECCO Group upgrades renewable primary plant fibres to high performance products for multiple application fields.



Ultrasonic pilot plant. Picture: ECCO

Besides their main business, the production of and trade with high-power lubricants, the ECCO group has, for many years, dealt with the research and development of industrial fibres on the basis of renewable resources like annual fibre plants such as flax or Hemp. Before long they encountered a fundamental problem: quality as well as efficiency of the processed plant fibres varied significantly, subject to a number of factors which could hardly be controlled or anticipated: location, soil properties, weather, harvest conditions, agricultural preconditioning, and many other impacts impeded a homogeneous quality standard.

Vegetable fibres could only be used after they had been submitted to the so-called “retting” procedure. In that process the fibre plant straw – after being harvested – is weathered on the land for days or weeks. Bacteria, fungi and other micro-organisms support the rotting by loosening the bonds between fibres and the other straw components as well as among themselves. The main problem is to define the correct moment to interrupt the retting, mainly because weather conditions are often suboptimal. Straw which is over-retted or only half-retted is difficult to process further and yields fibres of inferior performance. Generally this allows outside influences to create considerable and non-predictable quality variations. The so-called “water-retting”, by which the fibre straw is watered for days in basins or rivulets in order to equalize the rotting conditions, could not be established, mainly because of the environmental hazards for biotopes. Therefore it is forbidden in the EU.

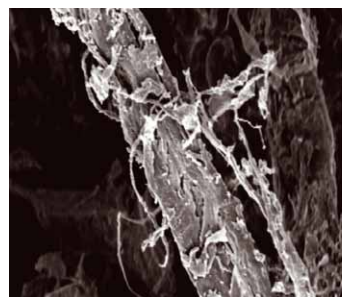
The answer was found by ECCO about 15 years ago. A novel break-down technique produced high-performance natural fibres with an unprecedented quality and at a competitive price. By using the patented

“ultrasound procedure” an upgraded SETRALIT® natural fibre was created. The ultrasound treatment imitates the natural micro-organism retting by a chemo-physical process: Degradation and removal of pectins, waxes, and herbal gums, scents and dyestuffs not only loosens the cell structure but also cleans the material.

Advantages: Compared to conventional field retting requiring days and weeks, the ultrasonic process takes only a few minutes.



Flax fibres gained by ultrasonic treatment. Picture: ECCO



SETRALIT NFU/31-2: ultrasonically treated and fibrillated Hemp fibre. Picture: ECCO

Typically the treated material is in contact with the ultrasound field for only 30 seconds. Moreover, the method developed by ECCO is able to completely control the process, i.e. fibre quality can be planned ahead and will be more homogeneous as compared to traditional production procedures.

Besides the differences in colour, odour,

or wax content which might not always be essential concerning industrial utilisation, the water absorption capacity of the ultrasonic SETRALIT® fibres is many times higher than that of conventional plant fibres. Therefore ultrasonically treated plant fibres can be bleached or dyed faster and more evenly, consuming fewer treatment agents. In other applications the minimized content of contaminating particles (dust, mould spores, and others) and organic residuals, the light colour, the soft grip, and the neutral smell of SETRALIT® fibres might also be advantageous.

The ultrasonic method offers an environmentally friendly and CO<sub>2</sub>-neutral processing of renewable plant products for the industry. These fibre products are medically harmless, and thus present an alternative to conventional and partly questionable materials such as asbestos, aramid or glass fibres.

SETRALIT® fibres are used or have been tested in many products and technical processes. Following the ultrasonic treatment they can be further processed and refined in multiple ways to meet the requirements of the respective end use: cutting, grinding, fibrillating or ultra-milling are typical mechanical aftertreatments. Consequently, SETRALIT® fibres which are components of friction linings differ from those used as reinforcement fibres in plastic compounds or in construction materials. They not only replace other fibre materials, but are also used in new materials which did not previously contain fibres, e.g. in aerated concrete. Other fibre types can be used in gaskets, greases, glues, emulsion paints (e.g. as delustering agent), or may be applied in the paper, textile and nonwoven industries. ●

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# ULTRA FIBRE

Development of a radial cell process for the clean, continuous, high volume production by hydro-acoustic decortication of high quality natural fibres for the SME natural fibre sector.



Pictures: UltraFibre



Fibre reinforced polymers find wide commercial application in the aerospace, leisure, automotive, construction and sporting industries. In recent years there has been much interest in developing natural fibre reinforced polymers for a sustainable substitution of synthetic materials, and also to develop markets for the European non-food crop industry sector.

The major impediment to growth facing the European natural fibre sector is the high processing costs needed to produce the fibres themselves. While natural fibres can be used for a wide variety of applications, other fibres are considerably more cost-effective. The growth in the agro-materials / energy crop sector is causing competition for land with food production and this is driving up the costs of both food and non-food crop products.

There is an urgent need in Europe for more sympathetic integration of food and non-food production; this can be partially achieved through improved process efficiency and productivity. Natural fibre crops

cannot be easily separated into fibres of consistent quality. Therefore, to commercially exploit past research investment on the world market, new research must be undertaken to reduce processing costs and to improve fibre quality, consistency, and efficiency.

The UltraFibre project will address these restrictions in the supply chain by delivering a scalable, economic, continuous, clean- fluidsonics technology to deliver tonnage quantities of high quality fibre, conferring:

- Increased fibre yield from crop mass from 29 % to 40 % by weight.
- Reduced standard deviation in tensile test data by 30 % of the fibres in comparison with conventional retting techniques, indicating improved fibre quality and consistency.
- A 25 % reduction in production costs.
- Integration of a Soft Plasma fibre treatment process conferring a 25 % increase in mechanical properties compared with the untreated fibre.

Commercial thermoplastic and thermosetting composites in targeted end-user applications.

The UltraFibre project started on 1st January 2010, and will run until 31st December 2012. The project is supported by funding under the Seventh Framework Programme of the European Union.

The project consortium comprises SMEs, associations and research organisations from across Europe:

#### SMEs:

- Kenaf Eco Fibres (Italy)
- Marek RadwaDski EKOTEX (Poland)
- AcXys Technologies (France)
- Omega Makina (Turkey)
- MoveVirgo (UK)
- CESAP (Italy)

#### Associations:

- ASSOCOMAPLAST (Italy)
- European Industrial Hemp Association (Germany)
- British Plastics Federation (UK)

#### Research Organisations:

- Smithers Rapra (UK)
- GreenGran (Netherlands)
- InControl Ultrasonics (UK)
- DLO (Netherlands)

For further information about UltraFibre, please visit the project website: <http://www.ultrafibre.org> ●

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## NEW PARTNERS FOR HEMP TEXTILE DEVELOPERS

Naturally Advanced Technologies' quest for commercial partnerships to develop its patented "CRAILAR" enzyme process for the commercial production of Hemp fabrics continues apace with a series of new deals.

Intimate apparel and activewear manufacturer Hanesbrands has signed an agreement with Naturally Advanced Technologies to use "CRAILAR" organic bast fibres in some of its commercial knit products. The new multi-phase joint development agreement for this organic-fibre commercialisation will involve the retrofit of existing dyeing equipment at a Hanesbrands facility to develop a commercially viable use of the '100 % organic fibre'.

NAT has been looking to develop new commercial partnerships for the production of yarns and fabrics from bast fibres such as Hemp using its patented 'CRAILAR' process, which uses enzyme technology to produce soft, comfortable textiles that can compete more effectively with organic cotton. It also recently teamed up with Patrick Yarns, a manufacturer of high performance industrial yarns to make and manufacture CRAILAR Organic Fiber yarns and related products for sale and distribution in North America to third party licensees of CRAILAR.

While NAT's Hemp feedstock grows without the use of chemical fertilisers and pesticides or herbicides and meets the USA's National Organic Program (NOP) criteria, the company also confirmed that the enzymes used in the production process are completely natural, and not modified in any way. The chemicals used are also approved by the Organic Exchange and the Organic Trade Association and are commonly used in food production, organic cleaning solutions and organic cotton processing.

"The agreement with Hanesbrands is a significant step in our plan to commercialise CRAILAR Organic Fibers, a technology that employs a 100 % organic process that uses Hemp as its feedstock," said Ken

Barker, CEO of NAT.

"As previously announced, CRAILAR Organic Fibers were successfully spun on existing cotton systems at North Carolina State University in tests that were sponsored by Hanesbrands. These tests demonstrated the evolution of Hemp fibre from a niche market alternative to a mainstream solution."

"Now Hanesbrands is taking action to develop an in-house facility in North Carolina for processing CRAILAR Organic Fiber. We are very excited to continue working with Hanesbrands in this next phase of our partnership, which will include technology development, marketing initiatives and commercialisation planning."

The deal with North Carolina – based Patrick Yarns will also boost its strategy to commercialise CRAILAR technology beyond commercial apparel knit products. The company is hopeful that the partnership will enable it to grow development in denim, work wear and related apparel markets, as well as the home furnishings and carpeting industries.

"We are very excited to be working with Patrick Yarns in a partnership that allows us to create a pull through marketing strategy with fabric and finishes goods brands," added Barker. "The company has an incomparable track record of partnering with its customers to develop yarns that create brand awareness and market share."

An agreement with commission US-bades textile dyer G.J. Littlewoods Son, Inc. to manufacture 'CRAILAR' organic bast fibres for use in apparel will also secure an initial capacity of approximately 40,000 pounds per week, with the capability to aggressively ramp up from there to meet the needs of its commercialisation plans. Littlewoods, located in Philadelphia,

is a commission dyehouse, specialising in the dyeing of synthetic fibres, as well as natural fibres. It intends to use state-of-the-art conventional machinery to process CRAILAR.

With this in mind, the company anticipates delivering its first revenue from CRAILAR in the fourth quarter, which, with a loss of US\$ 966,000 in its second quarter ending June 2009, will be a welcome boon. It was back in November 2008, the company announced test results from its trials at North Carolina State University, which were sponsored by Hanesbrands Inc. In the trials, the testers spun Hemp yarn and knitted fabric on conventional cotton equipment with no modifications using CRAILAR Organic Fibres technology. The resulting yarn was knitted into a five-ounce per square yard jersey fabric, which resulted in a 50 % reduction in shrinkage, a 45 % increase in tensile strength, a 20 % reduction in dye uptake and demonstrated wicking capabilities.

Having now outlined plans to shutter its HTnaturals organic clothing business, which impacted the cost of sales, NAT will be somewhat relieved that CRAILAR can at last begin to pay its way.

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Pictures: Hempro Int.

**Biowerkstoff-Report**

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# NACHWACHSENDE ROHSTOFFE UND ELEKTROMOBILITÄT

- Markt, Ökonomie & Technik
- Kommunikation

# RENEWABLE RESOURCES AND ELECTRO-MOBILITY

- Market, Economy & Technology
- Communication



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- Electro-Mobility
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[www.biowerkstoff-kongress.de](http://www.biowerkstoff-kongress.de)
- **International Conference of the European Industrial Hemp Association (EIHA) (Wesseling)**  
[www.eiha.org/conf7](http://www.eiha.org/conf7)
- **Deutscher Elektro-Mobil Kongress (Bonn)**  
[www.e-mobil-kongress.de](http://www.e-mobil-kongress.de)

## Verbände und Gremien

**seit 2003:** Mitglied des Industrie-Arbeitskreises Verstärkte Kunststoffe, Technische Vereinigung (AVK-TV), Untergruppe „Naturfaserverstärkte Polymere“; seit 2006 Mitglied des Steering Committees

**seit 2005:** Geschäftsstelle der European Industrial Hemp Association (EIHA) ([www.eiha.org](http://www.eiha.org))

**seit 2005:** Mitglieder der FAO Hard Fibre Group, Rom (für European Industrial Hemp Association)

**2007:** Gründungsmitglied des Clusters Industrielle Biotechnologie (CLIB 2021) in NRW

**seit 2009:** für EIHA Mitglied der „Industrial Task Force on BioBased Content of Materials and Products“ (Brüssel, european bioplastics) und CEN/BT/WG 209 „M/429 – elaboration of a standardization programme for bio-based products“ (Brüssel, CEN) (für European Industrial Hemp Association)

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