

## **Saliva detection paper**

### **Collaborative research gives 'CSI' new weapons**

Page 4

# Product properties and fibre quality – A contract research opportunity for paper enhancement

A collaborative project with STFI-Packforsk can provide paper makers with a securer basis for the link between fibre raw materials and the quality of paper.

“At STFI-Packforsk, we are able to carry out a complete fibre survey, by combining cross section analysis, using microscopy, fibre length measurement, “industrial” refining and sheet making and laboratory tests,” says Ulla-Britt Mohlin at STFI-Packforsk. “The methods used in the industry, such as measuring freeness and fibre length, often provide a good basis for process control. However, for development work, these are not enough, when it comes to establishing the fundamental connections between fibres and the properties of products.”

Ulla-Britt Mohlin is one of the world’s most knowledgeable fibre researchers, while having the experience gained from working for almost 40 years at STFI-Packforsk. Ulla-Britt’s experience and knowledge are the fundamental resources that make it possible for STFI-Packforsk to offer the industry answers to the most basic questions about properties of fibres. Other resources include leading microscopologists and expert laboratory technicians, together with technical equipment that is at the scientific front, such as industrially relevant methods for fibre treatment and papermaking and advanced methods for measuring the properties of fibres and paper sheets.

## Window to the fibre

A number of years ago, Ulla-Britt was the one who coined the phrase, “open the

window to the fibre”. She has still not changed her opinion.

“Today, it’s possible to find out exactly what fibres look like, the variations they have and the effects they make on paper production. There’s no excuse for continuing to be content with indirect methods or only analysing some of the factors that affect the final output. These days, many companies follow the quality of fibres by only studying changes in one parameter, e.g. freeness or fibre length. However, since changes in these parameters can have several explanations, it is necessary to supplement this routine work by developing an understanding as to how other fibre properties, relevant for the final paper properties, may have changed. We, at STFI-Packforsk, with our know-how and wide-ranging analytical techniques are able to establish the actual links. We can also give advice on how mills can best follow the properties of fibres in their own operations.”

## Why do a survey

Ulla-Britt gives raw material changes, change of pulp supplier or new process equipment as examples of factors that can make it desirable to carry out a comprehensive analysis of fibre quality and its effect on sheet properties.

“If you change the type of wood, or, for example, if you want to chart the differences among fibres from wood originating from different harvesting areas or that have grown at different altitudes, STFI-Packforsk has the unique expertise for charting the links between the properties of wood and fibres. This expertise includes knowledge, know-how, measurement equipment, databases and simulation tools (See Beyond #2, 2006).



Ulla-Britt Mohlin at STFI-Packforsk is one of the world's most knowledgeable fibre researchers.

Since STFI-Packforsk has access to industrial low consistency (LC) refiners, which are part of the equipment at the EuroFEX Pilot Plant, it is possible to make realistic analyses of how the fibres react during industrial LC refining.

“It’s so easy to draw wrong conclusions when evaluating an LC refining trial,” states Ulla-Britt. “At STFI-Packforsk, our industrial sized LC refiners are in excellent condition. They are used as tools in our research. And, in addition, we possess vast experience from many years of analysing the test results. In this way, we come to the right conclusions for our clients about how certain refining conditions influence the fibre properties in the pulp they are using.” ●

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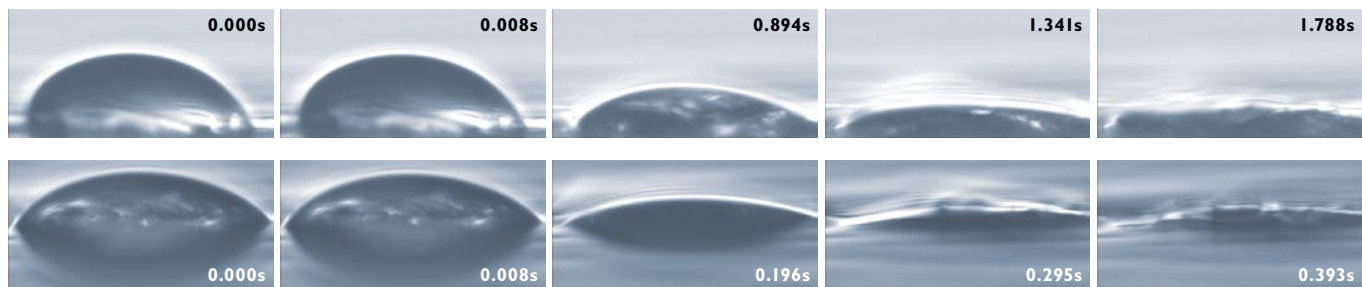


## De fiberanalysmetoder

som används inom industrin, i form av till exempel fiberlängdsmätning, ger ofta bra stöd i en uppföljande analysverksamhet. Men alla enstaka metoder är otillräckliga när det gäller att fastställa de grundläggande sambanden mellan fibrer och produkttegenskaper. Därför bör man någon gång komplettera sina enstaka metoder med en grundläggande undersökning. Enligt fiberforskaren Ulla-Britt Mohlin är det idag möjligt att ta reda på exakt hur fibrerna ser ut, vilka variationer de har och vilka effekter de ger vid papperstillverkningen.

– På STFI-Packforsk kan vi genomföra en heltäckande kartläggning genom att kombinera mikroskopi med fiberlängdsmätning, arktillverkning och laboratorietester. Därmed kan vi lägga fast de verkliga sambanden och även ge råd om hur bruket sedan bäst kan följa fiberegenskaperna med sin egen laboratorieverksamhet.

# MicroDAT shows absorption rate of micro sized drops



A droplet of deionised water being absorbed by (top) an offset coated paper and (bottom) a porous inkjet paper.

At STFI-Packforsk, a new measuring instrument has been developed, working on the same principal as an ink jet printer. When making measurements on MicroDAT (Micro Drop Absorption Tester), tiny drops of the size of approx. 300 picolitre ( $10^{-12}$  l) are fired at a piece of paper at high speed, approx. 2m/s. As a result, researchers are given greater possibilities of studying how the surface locally absorbs a liquid, which of course is of great importance to ink jet printing and other printing technologies.

Ink jet printers are the most common type of printers on the consumer market. To gain an understanding of how the ink is dispersed and absorbed into the paper, drop absorption equipment is used. Such an apparatus is normally only able to deal with larger volumes of drops and the speed of application is extremely slow.

MicroDAT was developed in the Surface Treatment Group in connection

with Erik Svanholm's doctoral thesis. In his dissertation, titled *Printability and ink-coating interactions in inkjet printing*, Erik studied how liquids interact with various kinds of coated surfaces used in ink jet printing, among other things. To study this, it was necessary to have an instrument modified for ink jet, but there was no commercial instrument to be had.

"Ink jet has potential. The technology can be used for printing on most substrates, such as paper, paperboard, textiles, plastics and metals. It was therefore important to develop an instrument that could handle all the possible substrates," says Erik.

MicroDAT makes it possible to study drop absorption under conditions similar to an ink jet printer. A sequence of photos is taken at a speed of 120 frames per second and these are then imported into MatLab, a calculation programme.

Following analysis, all the data are sent to the customer as an Excel document.

This new state-of-the-art equipment is not only available for ink jet printing technology. Göran Ström, who is responsible for the Coated Surfaces Cluster, describes how MicroDAT is made use of in other fields.

Göran explains, "We ascertain how quickly water or water solutions are absorbed into various surfaces, locally. This produces information on the average rate of absorption of a surface as well as the local variations in the rate of absorption. This consequently shows how homogenous the surface is. This is significant, when it comes to many printing technologies, as in offset printing for instance, mainly for the absorption of the dampening solution but also the absorption of the ink." ●

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Erik Svanholm defended his doctorate thesis at the end of February on the subject of *Printability and ink-coating interactions in inkjet printing*. The aim of his work was to gain an increased knowledge of the mechanisms that control the absorption and the fixation of inkjet droplets on coated papers.

 **MicroDAT** är ett nytt mätinstrument för att studera hur vätskor sprids och absorberas i papper. Instrumentet fungerar enligt samma princip som en bläckstråleskrivare med hög applikationshastighet och möjlighet att hantera droppar i picoliterstorlek på olika typer av substrat. Därmed har forskarna större möjligheter att studera hur vätskor som färger och fukt-vatten beter sig på papperet vid tryckning. MicroDAT utvecklades vid STFI-Packforsk i samband med Erik Svanholms doktorsarbete. I sin avhandling har han bland annat studerat hur olika vätskor interagerar med olika typer av bstrykningsskikt för bläckstråletryck. Enligt honom är en av inkjet-teknikens fördelar att den kan användas för tryck på de flesta substrat som papper, kartong, textil, plast och metall. Därför har det varit viktigt att utveckla ett mätinstrument med samma möjligheter.





Everyone working with the products must wear masks, protective gloves and hairnets, so as not to run the risk of tiny amounts of DNA ending up in the product before being used.

# Saliva detection paper

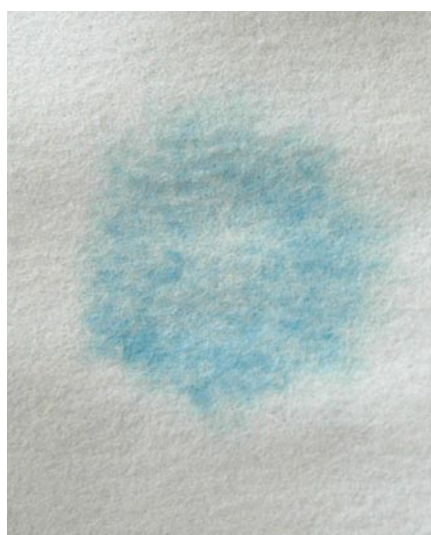
## Collaborative research gives 'CSI' new weapons

Magle, a pharmaceutical company, has developed a new weapon in the fight against crime. Using specially prepared paper, forensic investigators are able to quickly locate traces of saliva. Extracting DNA from the stain, this facilitates positive identification of alleged criminals. The product consists of a filter paper modified on the surface by using production techniques at STFI-Packforsk.

In collaboration with Magle, STFI-Packforsk used its unique expertise in the field of paper to develop a working technique to produce this new product. The collaboration has resulted in a product that can be used uniformly by all crime laboratories, worldwide.

### Recognising saliva

The background to the project is Magle's acquisition of Phadebas®, a laboratory reagent, from Pharmacia Diagnostics.



Phadebas consists of chemically modified starch, with a bound-in blue dye. It is used to measure  $\alpha$ -amylase, an enzyme mainly present in saliva.

"We discovered that a large number of customers were crime laboratories that had detected the possibility of using

Phadebas in their investigations," explains Eddie Thordarson, the Marketing Director at Magle. "These labs dissolve Phadebas tablets in water and spray the mixture onto filter paper. By pressing this paper against a surface, it's possible to trace the presence of saliva and, consequently, proceed with DNA analysis. Phadebas is the only certain means of locating saliva stains, since they're invisible to the naked eye. In addition to tracing DNA, Phadebas differentiates between saliva and other body fluids, which don't react to the test. This also makes it possible to establish a certain course of events surrounding a crime."

There are some obvious disadvantages associated with each forensic lab producing its own Phadebas papers. Not only does the quality of the paper used differ from laboratory to laboratory, but the amount of applied Phadebas does also, which naturally reduces the value of the technique as case evidence.

"We saw the opportunity of creating a well defined product," Eddie continues. "Offering a commercial product for



Michael Karathanasis

Michael Karathanasis is, at the same time, a new and an old personality at EuroFEX. He took up his appointment as Project Manager at the Pilot Plant as recently as 1 December, 2006. Before then, he worked in the Company for almost 6 years with coating and printability. The next step to the Pilot Paper Machine was not such a big one, however.

“Some form of fillers is almost always used in paper. I’ve worked for 10 years with all the possible aspects of coating and, during that time, I’ve come up against many different issues and problems applicable to the field of paper making. Today, the focus is on cheaper production.”

“One way of reducing production costs is to increase the amount of fillers,” Michael relates. “We can do trials with various kinds of raw materials and in different amounts. EuroFEX is such an excellent instrument for this.”

EuroFEX is important, but for a problem to be solved and for developments to be successful, fruitful discussions must take place among those involved.

“Discussions are vital for identifying what customers’ needs are and how we can help them,” says Michael.

The need can sometimes manifest itself in things other than pilot trials and solutions to problems. It may happen that Michael and his colleagues are asked to produce a certain type of special paper in smaller volumes. The Magle Project, written about in this issue, is just one example of this.

After taking his degree in 1996 in paper chemistry/coating at the Åbo Akademi University, Michael started at MoDo, as it was then, in Örnköldsvik, Sweden. His career then continued at a pigment supplier’s in Copenhagen, in the department that developed coating pigments and fillers. Following this, he was employed at STFI, as it was then called, in the January of 2001. ●

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identifying saliva, we’re able to increase the consistency of the method and to disseminate the technique to more users. In this way, we increase our revenue and create additional value, by strengthening the Phadebas brand.”

## Speedy project

This development project was launched in January, 2006, and the new product was launched by Magle as early as the third quarter that same year. A technical aid of this kind is not subject to the same set of regulatory demands as are pharmaceuticals, enabling a short time-to-market. Yet, the development project also progressed very quickly.

Eddie continues, “There aren’t many places where such a project could have been managed, like it was done in the collaboration between STFI-Packforsk and Magle. We had had no previous contact with STFI-Packforsk before this project. We went looking on the Internet for a collaborative partner in the field of paper technology and immediately found the right department at STFI-Packforsk.”

The development project involved screening for an optimal filter paper quality, selecting process conditions and producing the product specification. The evaluation work was carried out by Magle, in co-operation with its established customers. In reality, it involved an association that started from scratch, with expert researchers that could make rapid progress on the work. At the same time, enormous demands are made on accuracy and purity with the development and production of criminal investigation products. Everyone working with the products must wear masks, protective gloves and hairnets, so as not to run the risk of tiny amounts of DNA ending up in the product before being used. The product must also be of uniform quality.

“The development phase went as well and as fast as anyone could have reasonably imagined,” says Eddie. “Some work



Eddie Thordarson from Magle worked together with researchers at the EuroFEX pilot plant.

remains with regards to optimising the production process. Otherwise, there’s only the marketing & sales. We estimate that there are about 1,000 laboratories in our market that will be interested. Most of these are in the USA, Australia, Great Britain and Japan.”

## Collaboration led to support

The collaboration between an SME, Magle, and a well-established research company, STFI-Packforsk, made it easier to apply for and receive support from Nutek for this development work.

“This is proof of the potential that exists in collaborative work between STFI-Packforsk and an SME,” says Torgny Persson, Manager of the STFI-Packforsk Group, EuroFEX. “STFI-Packforsk is a world leader in research on paper materials and their use. Furthermore, it has such an established position that it makes it easier to receive financial support from research financing bodies. We have experts, well trained project managers that can run demanding development projects, in this case, Michael Karathanasis. From their side, many SMEs have solid ideas and very good know-how and knowledge in their own specific fields. The collaboration between Magle and STFI-Packforsk is an excellent example of how well this can work and of how a collaborative project can take a concept all the way to placing a finished product on the market. It took less than a year to achieve this, from start to finish.” ●

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\* Small & Medium Sized Enterprise



## Läkemedelsföretaget Magle

har utvecklat ett nytt verktyg i kampen mot brottsligheten. Med ett specialpreparerat papper kan brottsplatsundersökare på ett enklare och snabbare sätt lokalisera små salivresten från en brottsplats. Produkten består av ett papper med ett speciellt ytskikt som applicerats i samband med produktionen på STFI-Packforsk.

I produkten ingår reagenset Phadebas som är det enda säkra sättet att lokalisera salivfläckar, då dessa är osynliga för blotta ögat. Tidigare metoder att använda Phadebasbelagt filterpapper har några uppenbara nackdelar: Såväl papperskvaliteter som pålagd mängd Phadebas skiljer sig mellan laboratorier, vilket naturligtvis sänker teknikens bevisvärde.

– Genom att framställa en färdig produkt för att identifiera saliv, kunde vi öka trovärdigheten och även sprida tekniken till fler användare, säger Eddie Thordarson, marknadsdirektör på Magle.

Utvecklingsprojektet inleddes i januari 2006, och redan under hösten samma år lanserades den nya produkten kommersiellt av Magle.





# Providing the industry with new tools

Biomime, the Swedish Centre for Biomimetic Fibre Engineering, is an interdisciplinary centre for developing new possibilities for tailor-making the properties of fibres. Biomime is based at the Royal Institute of Technology (KTH) with nodes at STFI-Packforsk and the Umeå Plant Science Centre (UPSC). The task of STFI-Packforsk in Biomime is to evaluate and put the industrial benefit of the research to the test as well as to assist in working towards the research being applicable to the industry. This depends on the unique two-sided expertise present at STFI-Packforsk, viz. its high level of expertise in the field of wood fibres, combined with its sound knowledge of the raw materials, processes and products of the paper industry.

“Biomime is still in quite an early phase,” comments Mikael Lindström, a Research Manager at STFI-Packforsk and manager for that part of Biomime that is responsible for evaluating the relevance of the research to the industry.

“The leading scientists from STFI-Packforsk, involved in Biomime, are currently working on developing advanced analytical methods. The traditional methods of analysis in paper production are often based on analysing fairly large samples, for example kilos of wood that are cooked to become pulp and paper and which are then tested in a laboratory. In Biomime, we have to develop analytical methods that provide realistic results, while using very small amounts in the samples. We have to be able to demonstrate whether changes in the fibres produce the properties that the industry requires.”

There are highly qualified researchers from STFI-Packforsk who are working

with this, among them being Tommy Iversen, Lennart Salmén and Fredrik Berthold.

STFI-Packforsk is also involved in developing efficient means of communicating information between the industry and Biomime.

Mikael continues, “We must be able to verify that there is a need for modifications to the fibres that Biomime is doing research on. This places enormous demands on STFI-Packforsk being successful in communicating rapidly and accurately with both the industry and the scientists in Biomime. One means of reaching the industry is through our already existing cluster, New Fibres for New Materials. However, we are also looking into a number of other ways of communicating with the companies.”

Biomime has its roots in an earlier, more informal collaboration among STFI-Packforsk, KTH and UPSC, in which Tuula Teeri, professor from KTH and enzyme researcher, was already playing a central role. In the second half of 2006, Biomime, a research centre, was formally established, with financial support from the Swedish Foundation for Strategic Research (SSF). Today, all the participating researchers, including those from STFI-Packforsk, have been gathered together in Alba Nova, the name of a research building at KTH.

“One day a week, all the participants must be present,” Mikael recounts. “This is when we have our meetings, seminars and similar activities, which ensures that we are able to keep the research centre unified and guarantees that we are all working towards mutual goals.”

On many occasions, Professor Tuula Teeri, the Director of Biomime, has

emphasised the strength there is in having leading scientists in biotechnology and plant research working together, along with leading researchers and representatives from the industry.

“These projects raise the level of knowledge on both sides,” Tuula points out. “It’s important for all of us to see the links among enzymes, processes and potential paper properties. We, as biotechnologists, gain a better understanding of what the paper industry is striving for and the demands that will be made on paper surfaces in the future. At the same time, it’s vital that the industry is given an insight into the opportunities and possibilities offered by the techniques and technologies we are working on.” ●

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 **Biomime är** ett tvärvetenskapligt centrum som ska utveckla nya möjligheter att skräddarsy fiberegenskaper. STFI-Packforsks uppgift inom Biomime är att värdera och pröva den industriella nyttan av forskningen, och att medverka till att forskningen arbetar mot mål som är relevanta för industrin. Just nu arbetar forskarna intensivt på att utveckla avancerade analysmetoder som kan ge realistiska resultat med mycket små provmängder.

– Vi måste kunna visa om förändringar av fibreerna ger de egenskaper som industrin vill ha, säger Mikael Lindström.

Biomime bildades hösten 2006, med ekonomiskt stöd från Stiftelsen för Strategisk Forskning, SSF. Chef för forskningscentrat är professor Tuula Teeri, KTH. Enligt henne kan den tvärvetenskapliga forskningen ge kunskaper om sambanden mellan enzymer, processer och möjliga pappersegenskaper.

# Symposium to celebrate 50<sup>th</sup> anniversary of Research Foundation

Thursday, 22 March, 2007, marked the 50<sup>th</sup> anniversary of the Gunnar Sundblad Research Foundation, with a symposium on the topic of "Future directions for the Swedish pulp and paper industry". The symposium, held at STFI-Packforsk, was a stage in the implementation of the NRA\* part, aimed at pulp and paper production.

An important part of the NRA is *Branschforskningsprogrammet*, an industry research programme for the Swedish wood and forest industries. In order to chart the needs and come up with co-ordinated initiatives for applications for

projects, pre-studies are being carried out on the different branches of the pulp and paper industry with, among other things, financing from the Gunnar Sundblad Research Foundation.

"The concept is to gather together all the significant research parties in the sector, in Sweden, to mark out a common direction to take," says Helena Vollmer, who is responsible for the Secretariat at the NRA, together with being the Marketing Co-ordinator at STFI-Packforsk.

The main part of the agenda for the symposium consisted of reports from pre-studies, when process managers presented



Members of the Sundblad family.

their visions, needs and potential for their particular areas.

"The most impressive thing about the symposium was to be given a very good synthesis, a comprehensive grasp of the different fields. That was exceptional," comments Helena.

Another interesting point on the programme was an Anniversary Lecture on Gunnar Sundblad, an innovator, engineer and industry pioneer.

"The Foundation is 50 years old. However, it is 93 years since Gunnar Sundblad first published his account of the significance of central research for the industry," related Per Jerkeman in his homage.

The concluding speech was delivered by Lars G Sundblad, Gunnar Sundblad's son. Following this, further discussions took place in a merrier form around the buffet tables. ●

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\* *The National Research Agenda – for the Swedish forest based sector*



Per Jerkeman



The symposium was followed by discussions around the buffet tables.

Forthcoming event at STFI-Packforsk:

## 4<sup>th</sup> Pulp and Paper Chemical Analysis Seminar

**"Modern analytical techniques for the future mill"**  
Stockholm, 10 - 11 September, 2007

The Pulp and Paper Chemical Analysis Seminar is a biannual Nordic Forum for those interested in chemical analysis in the pulp and paper industry. The forthcoming meeting is the fourth in the series and will take place at STFI-Packforsk on 10 - 11 September.



Among the topics:

- Process analysis
- Characterisation of components in process streams (lignin, carbohydrates and extractives)
- Biorefinery – analytical demands
- Product safety analysis

Information about the programme and how to register is available on our website, [www.stfi-packforsk.se](http://www.stfi-packforsk.se).

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### COMING EVENTS

#### SEPTEMBER

- 10-11 4th Pulp and Paper Chemical Analysis Seminar
- 17-18 Research Seminar for STFI-Packforsk Partner Customers

#### OCTOBER

- 4 Meeting in Technical Committee for Product Protection, Kumla
- 16-17 ECOTARGET open workshop, Lodz, Poland

For further information on coming events, see [www.stfi-packforsk.se](http://www.stfi-packforsk.se)

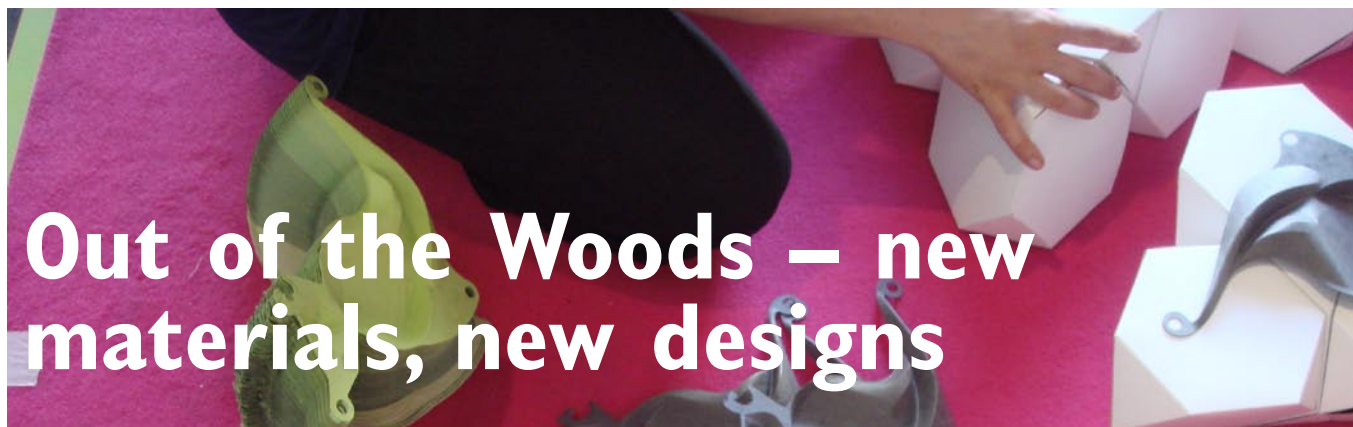




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# B



# Out of the Woods – new materials, new designs

For the last couple of years, STFI-Packforsk and Konstfack, the University College of Arts, Crafts and Design in Sweden, have been working jointly on training industrial designers, among others. The highlight of "Out of the Woods", an optional course, where Master's students from three different course programmes participated, was an exhibition held from 18 to 23 April at The International Furniture Fair in Milan, the biggest and most significant trade fair for the furniture industry.

The aim of the course was to involve designers in the early stages, when developing materials.

Renewable materials are more and more becoming hot topics in discussions about sustainable development. To bring about concrete results, it is necessary that the development of materials and

products goes hand in hand. For several years, researchers in the New Materials and Composites Group at STFI-Packforsk have been developing renewable fibre-based and polymer-based composite materials. In the collaboration with Konstfack, the designers considered areas of usage and possible products.

"We're looking for new materials to work with," says Farvash Razavi, one of the students that had practical work at STFI-Packforsk. "And it's vital to understand their possibilities and limitations."

Researchers from STFI-Packforsk gave lectures at Konstfack on the science of materials, among other things.

For Konstfack, the collaboration also meant that the students were able to utilise the laboratories and pilot equipment available at STFI-Packforsk for their projects and, as a result, come in contact with the production of the materials.

As for researchers, they are often unaware of what designers' concepts are and what they want to achieve with new materials.

"Discussions with the students have opened our eyes. They've given us an understanding of the fact that it's the acoustic, tactile and aesthetic values that are appreciated," comments Mikael Lindström, the person responsible for the course.

"We often think in technical and scientific terms. We therefore place a lot of value on discussions that provide us with new dimensions to research."

Approximately 10 of the design stu-

dents displayed their work at the Fair in Milan. Some were made of wheat gluten, combinations of cellulose fibres, composites of cellulose fibres and chitosan, which originates from prawn shells, while others were creations that take the cycle of nature into consideration.

One of the creations there was of a "kofes", in other words, a piece not actually representing anything. It was created to describe the composite material and its properties, without being associated with any specific product, which, in turn, should curb any thinking as to what it might be used for. ●

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## STFI-Packforsk och Konstfack

har samarbetat om utbildning för bl.a. industridesigners. Höjdpunkten för en tillvalskurs, "Out of the Woods", där Masters-elever från tre olika linjer deltagit var utställningen den 18–23 april på The International Furniture Fair i Milano, den största och viktigaste fackmässan för möbelbranschen.

Syftet med kursen har varit att involvera designers tidigt i materialutvecklingen. STFI-Packforsk utvecklar sedan flera år förnybara kompositmaterial baserade på fiber och polymerer och i samarbetet med Konstfack funderar designerna kring användningsområden och tänkbara produkter. I Milano visades bl.a. en "kofes", ett objekt som skapats för att beskriva kompositmaterialet och dess egenskaper utan att associera till någon speciell produkt.



Mikael Lindström at the Milan Furniture Fair.



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