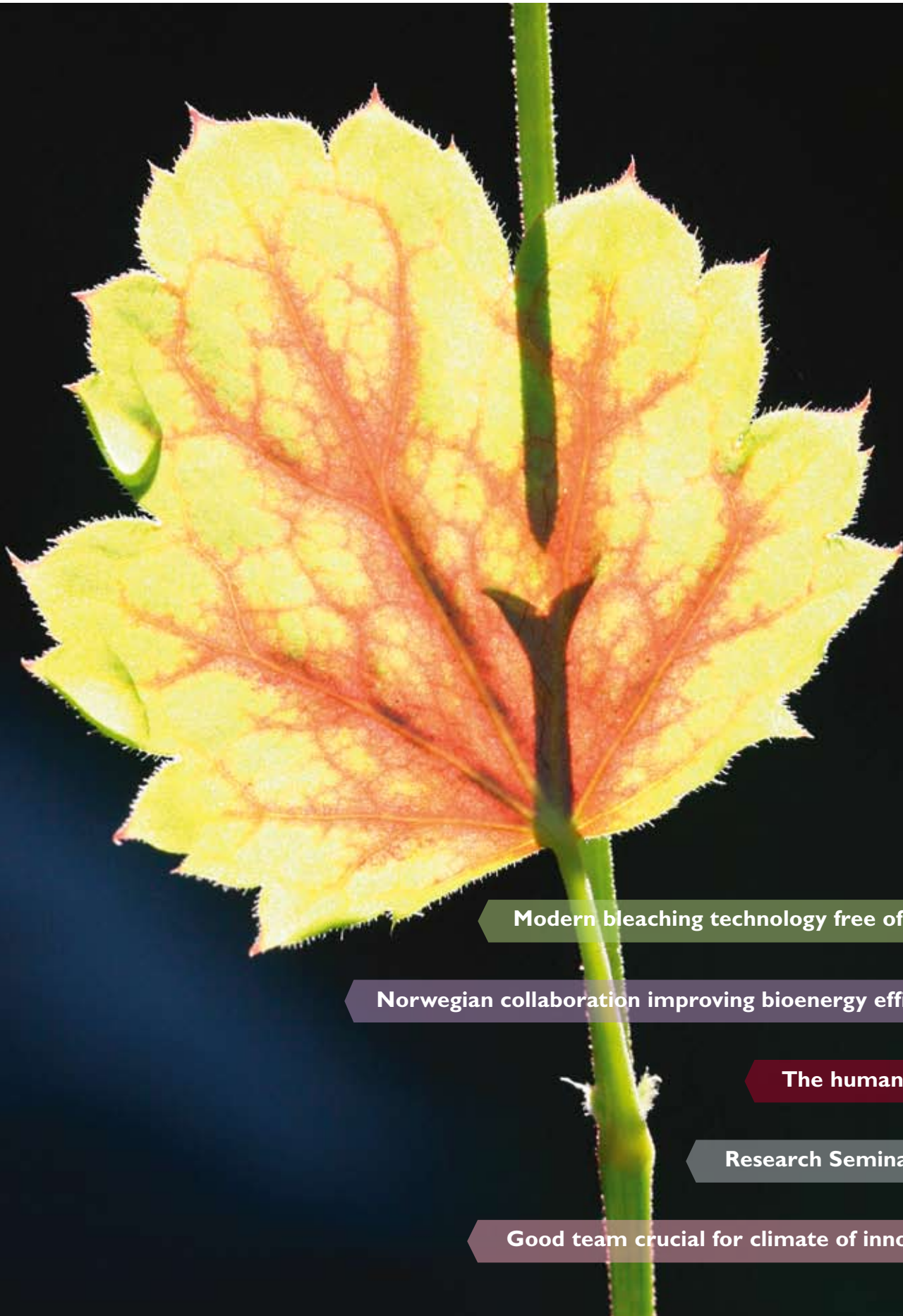


beyond

science
research
application

CURRENT AWARENESS FROM THE INNVENTIA GROUP

#3/2010



Modern bleaching technology free of dioxin

Norwegian collaboration improving bioenergy efficiency

The human factor

Research Seminar 2010

Good team crucial for climate of innovation

PHOTO: BEATRICE JOHANSSON

Modern bleaching technology free of dioxin



Elisabeth Bergnor at Innventia.

Five years ago, reports came from the Swedish Environmental Protection Agency (SEPA) concerning increased levels of dioxin in the water outside forest industry plants along the Baltic Sea coast in Sweden. There was concern that this rise in content could have connection with the utilisation of chlorine dioxide (ClO_2) in bleach plants, so called ECF Bleaching (Elemental Chlorine Free), which is currently the normally preferred bleaching method. Now, a study carried out at Innventia has shown that, with today's modern methods, there is no formation of dioxin during the bleaching of industrially produced softwood sulphate pulp.

"The great dioxin alert in the mid 1980s started a discussion that led to bleaching with chlorine gas (Cl_2) being discontinued and mainly being replaced with ECF Bleaching. For various reasons, part of the ECF Bleaching was abandoned in favour of TCF Bleaching (Total Chlorine Free)," says Peter Axegård.

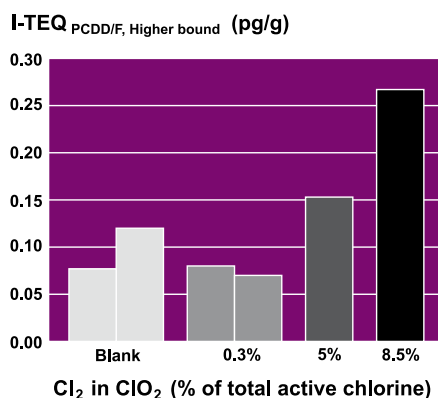
During the 1980s, Peter was actively contributing to the development of modern chlorine dioxide bleaching technology. He is now the Director of Biorefining, a Business Area at Innventia.

"You could say that approximately 95% of the sulphate pulp in the world today is being bleached according to ECF. When a new bleached pulp mill is being built, ECF Bleaching is the one that is normally chosen."

Concerns and discussions are still arising, such as in the case of the Baltic Sea¹ and where completely new mills are being built. Peter was in demand as an expert in the public debate surrounding the construction of a new mill in Uruguay a few years ago.

"If you bleach using chlorine dioxide and do it the right way, no increase in the content of dioxin can be detected," he states.

To verify this thesis, Innventia recently carried out screening studies, in which pulp samples that had been bleached using different methods were compared.



The formation of dioxins increases with increased content of elemental chlorine in the ClO_2 -solution.

Elisabeth Bergnor, the Project Manager, relates, "In the trials, we compared the ECF Bleaching with the TCF Bleaching of an industrially produced unbleached oxygen delignified softwood pulp. The chlorine dioxide solution used had a low proportion of elemental chlorine, as occurs in modern industrial chlorine dioxide processes. The results confirmed our assumption, namely that

the ECF bleached pulp contains as low amount of dioxin as the unbleached pulp and the TCF bleached pulp. The content of dioxin is thus at the same background level in the unbleached as in the bleached pulps."

The investigation also studied how the formation of dioxin is affected by the 'purity' of the chlorine dioxide, i.e. the content of chlorine in the chlorine dioxide. It showed that, when the chlorine content reaches 5% (calculated as active chlorine) or higher, which occurred with the older techniques, a formation of dioxin starts. This is totally in line with earlier investigations, where a high content of chlorine showed itself to be decidedly the most important cause of the formation of dioxin during the bleaching of pulp².

Elisabeth emphasises, "The purity of a chlorine dioxide solution is a prerequisite for dioxin-free bleaching. With today's modern chlorine dioxide generators, it's possible to obtain a chlorine dioxide that contains less than 0.8% elementary chlorine, calculated as active chlorine." ●

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 **Screening-studier utförda på**
Innventia visar på att det, enligt dagens moderna metoder, inte sker någon generering av dioxin vid ECF-blekning av industriellt tillverkad barrvedssulfatmassa. I studierna jämfördes massaprover som blekts på olika sätt; ECF-blekning jämfördes med TCF-blekning av en industriellt tillverkad oblekt syrgasdelignifierad massa. Den klordioxidlösning som användes hade, som är fallet i moderna industriella klordioxidprocesser, en låg andel elementärt klor. Resultaten bekräftade att den ECF-blekta massan innehåller lika lite dioxiner som den oblekta massan och den TCF-blekta massan. Dioxinhalterna är alltså på samma låga nivå i de oblekta och blekta massorna.

1) Following careful evaluations of a large amount of data, a 2009 report from SEPA came to the conclusion that the main cause of the increase in values of dioxin in the Baltic Sea is airborne emissions.

2) Reference list: Dioxin formation in Pulp and Paper Mills of India (Thacker et al, 2007), Effect of dioxin reduction with ECF conversion in kraft pulp bleaching mills in Japan, (Toyota et al, 2007), A survey of pulp and paper mills: operating conditions and effluent quality in relation to fish reproduction, (Kovacs et al, 2009), Uruguay vs Argentina International Court of Justice; case verdict 2010, www.dioxinfacts.org – American Chemistry Council

The key question in the quest for efficient bioenergy is how to create a perfect solution throughout the entire value chain. Every step needs to be optimized and industries need to have the best possible economy, when it comes to every single fibre used. PROFIT, a PFI project, has addressed these issues and, through extensive cooperation with scientific partners, the paper and wood industries and energy companies are now more than a year into the project, which will help the forest sector to improve its overall profitability.



Kai Toven at PFI.

Norwegian collaboration improving bioenergy efficiency

“The main aim is to attain profitable bioenergy production and improve the quality of paper, by integrating the paper mill with a bioenergy production plant,” says Kai Toven, Project Manager at PFI. We have organized the project into three “teams”, viz. Logistics, Bioenergy and Paper.

“Logistics” is focusing on solutions for how the existing logistics and raw material handling systems in a paper mill can be utilised for attaining a cost-efficient system for an integrated paper and bioenergy production. This part of PROFIT necessitates cooperation among a wide spectrum of partners.

“Bioenergy” is focusing on technology for the energy densification of biomass and for a process integration of paper mills and bioenergy plants. In the short term, the objective is to establish the potential for a plant producing pellets with superior energy density. In the long term, the aim is to build a bioenergy plant for biodiesel.

“Paper” is focusing on technology for the separation and handling of fibres in the production of both bioenergy and paper production, in order to ensure that each production line receives the right fibres.

The owner of the project is Norske Skog, a paper producer.

“We need to renew our business plan to ensure long-term profitability,” says Ole Petter Løbben, Business Developer at the Norske Skog Follum Mill and Manager of the project at Norske Skog. “We have high expectations that the PROFIT project will show us how to put every fibre to its optimal use and how to make better use of our process infrastructure in finding new profitable business opportunities.”

Berit Rødseth, the Project Manager at Moelven, a major wood company, stresses that every single step in the value chain must be operating at maximum efficiency in order to generate profitability.

“Moelven has been involved in bioenergy production in Sweden since the 1990s. We want to bring our knowledge and know-how to the PROFIT project. Unfortunately, Norway has unpredictable conditions when it comes to governmental support of bioenergy, compared to Sweden, which makes the financial outcome of PROFIT less easy to predict.” ●

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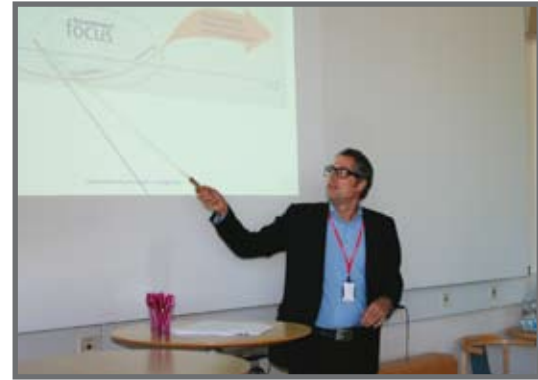
PROFIT is running from mid 2009 until mid 2013. The major partners involved are Norske Skog, Viken Skog, Andritz, Follum Energy Central, Moelven Industries, Xynergo, Begna Bruk BioVarme, PFI and Chalmers University of Technology.



I det PFI-ledda projektet

PROFIT samlas forskning, pappers- och träindustri samt energiföretag för att tillsammans finna en integrerad lösning som både leder till lönsam bioenergiproduktion och förbättrad papperskvalitet. Projektet är indelat i tre avdelningar: Logistics, Bioenergy och Paper.

Inom Logistics studeras hur varje steg i de befintliga systemen kan optimeras för en effektiv integration av pappers- och bioenergiproduktion. Målet för Bioenergy är att skapa potential för produktion av pellets med högre energidensitet. Paper handlar om optimerad fiberseparering. Projektet ägs av Norske Skog men involverar ett stort antal företag och organisationer.



This year's Seminar was based on the following concepts: Being Pro-active, Return on Investment, Timing and Opportunities. A new idea was tried out on the first day, with short presentations on five innovative areas at Innventia. Following each presentation, those attending were given the opportunity to discuss and reflect on what they had heard in 'beehive' groups. The day ended with a question time and a panel discussion with the presenters. The aim of this was to give full rein to the participants' creativity. The second day was more traditional, with three parallel sessions, in which new exciting results were presented from cluster research and collaborative projects, with a display of posters during the breaks. ●

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Research Seminar 20–21 September, 2010

The annual Innventia Research Seminar
for Partner Customers



What ideas are you taking away with you?



Paulo Pavan, Fibria

"I was especially interested in the business models. I found insight into how I can take up new ideas and ways of thinking in my company. It was rewarding to see different examples of how other companies have worked on those things."



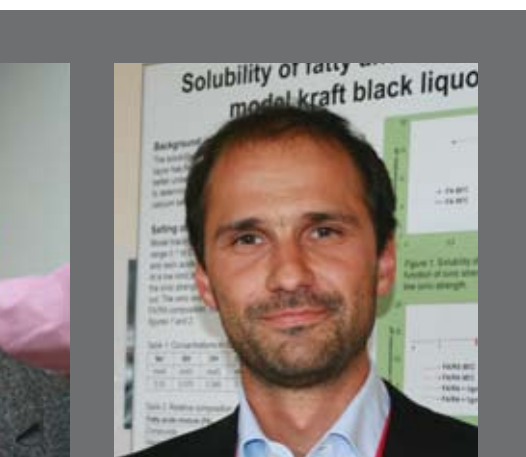
Helena Thunberg, Korsnäs

"I thought it was very interesting to hear how it's possible to discover new ways of working with different materials, especially nanocellulose and lignin. Lignin is still enormously demanding on resources, but that problem will probably be solved. There was an incredibly large amount of information on offer during the seminar, with very good discussions between all the presentations."



Badri Mahmoud, Stora Enso

"Above all, I found the presentation on the first day very motivating and was extremely interesting to hear about nanoparticles, the part about colour being affected by temperature and the part about the package that opens and closes. Even if there's no direct application today, think of the future! You have to start imagining and thinking in new ways. It was all very imaginative."



Andreas Anzel, Andritz Pulp & Paper

“So much new thinking! The primary reason for my coming here was to meet everybody, followed by learning more about what Innventia does and is able to do. It has been extremely interesting to hear about lignin and how plastic can be replaced by paper. I think that the strand running through lignin is quite exciting.”

We welcome our new Partner Customer Specialty Minerals (SMI) to Innventia.

SMI, a subsidiary of Minerals Technologies Inc, is an international manufacturer of high performance minerals.

COMING EVENTS

NOVEMBER

- 9 Lic. seminar: Ludovic Gustafsson Coppel: Whiteness and Fluorescence in Paper – Perception and Optical Modelling
- 22-24 Packaging Diploma Course, session IV
- 24 Foresight workshop

DECEMBER

- 1 Seminar on Women's working environment

For further information on coming events, see www.innventia.com

New tool for supporting sustainable decisions

EFORWOOD, an EU Project, came to its conclusion earlier this year. A significant product that came from the Project is the ToSIA (Tool for Sustainability Impact Assessment), a tool that will facilitate making well-founded decisions and comparing different alternatives, all from the perspective of sustainability.

The tool is built on a number of sustainability indicators that describe the three core areas that deal with financial, environmental and social aspects and how these change with time. ToSIA is used both to describe current performance and analyse implications of future scenarios to show how the different indicators are affected and to attempt to provide answers to questions, such as, “What will happen if ...?”; for example, “What will happen if the demand for newsprint changes?” or “What will happen if the use of fibre-based packaging increases?”

Now that the Project has concluded, ToSIA and its databases will be maintained and further developed by a network of former Project Partners, such as Innventia, and other future users. This network is called the ToSIA Management and User Group (TMUG). ●

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Aiming for efficiency and improved properties

As of June 2010, Innventia is coordinating BoostEff, an EU project, to demonstrate the industrial and economical capacity of a new method, called Aq-vane, for producing multi-layered paper. This technology will result in a durable paper with lower production costs and reduced raw materials utilisation

Using three existing industrial production units belonging to Stora Enso, Holmen Paper and Tarnaise des Panneaux, the possibilities of the new technique, together with existing techniques, are being adapted to demonstrate the potential product and the production process involved. The results from the project are going to be used as a basis for three investment projects



involving technical specifications and economical results.

“BoostEff signifies a completely new way of working,” states Daniel Söderberg, a Research Manager at Innventia. ●

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Siv
Lindberg

Among all the technical experts at Innventia, there are certain researchers that possess quite a different expertise. Siv Lindberg has a PhD in psychology and is one of the key people in the Human Product Interaction (HPI) research and consulting work at Innventia. The main emphasis of this work is how people perceive products and how they interact with them.

Siv began her career with a BA at Stockholm University, where she studied how people experience community noise, e.g. traffic, planes etc. In 1995, she applied for and gained a postgraduate appointment in the Paper Colour Printing (PFT) Programme and, in this way, came in contact with Innventia, then called STFI. Since then she has been one of the company's foremost print quality experts and a scientific expert for matters concerning perception psychology. In recent years, this operation has expanded and is now complemented with consumer behaviour and usability.

"Thanks to the merger of STFI and Packforsk, we could establish an operation that encompasses the end user perspective across Innventia's value chains: print, packaging and new materials. We make many different analyses and studies. But, irrespective of whether you're studying the whiteness of a paper or the ability to handle a package, it all has one thing in common, namely how people interact with products. This is a field that's continually developing and where you are constantly in unknown territory."

Siv likes to be a part of an area that is constantly developing and when things are moving fast. In her spare time she likes the outdoors as well as just pick up a book or watch a movie. ●

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The human factor

Unseen is unsold! A product must stand out on the shelf in order to sell itself. Packaging is the largest and sometimes the only advertising channel for a lot of products. But how can a package compete with other packages for consumer attention in a store setting? Studies in psychology and consumer behaviour provide insight into what guides consumers and their choices.

"Packaging should provide us with the information we need to make our choices," says Siv Lindberg, a psychologist and researcher at the Innventia HPI (Human Product Interaction) Laboratory.

According to Siv, there are many things involved in choosing a product in a supermarket such as brand recognition, package design, the position of the product on the shelf, how many 'facings' (the number of products of the same kind that are next to each other). Furthermore there are variables outside the store such as whether it is being shown in a commercial at the time.

"For many packaging manufacturers, e.g. board producers, it is important to understand how their packaging material behave during the converting process in order to ensure that the material is shown to advantage. It's here we can support them by providing insight into consumers' perceptions of packaging."

Siv is currently writing the final report of the PaperSense Project, which concerns the role of paper in media and

communication. One part of the Project dealt with the store as a media channel, e.g. how we perceive the various types of in-store media, such as packaging, in-store TV, and shelf labels.

Siv explains, "To obtain answers to such questions, we record shoppers' eye movements, when they are shopping in a supermarket and ask questions regarding their choices upon completion of their shopping trip. Eye-tracking data gives a clear picture of what attracts attention during shopping, how the actual choice in front of the shelf is made and how much is observed regarding in-store media."

On the other hand, eye tracking data cannot tell what a people are thinking when they are facing the shelf and making product choices. That is why the picture is complemented with interviews and analyses of the choices that have been made. In PaperSense, 112 shoppers were interviewed, with eye-tracking data for approx. 75 of them. These data are now being cross-tabulated with sales data.

Siv continues, "At the time for this investigation, SCA launched a new packaging for Edet Soft kitchen towels, which is more environmentally compatible than the previous one. During the eye-movement study, we exposed one group of shoppers for a commercial for Edet Soft shown on the in-store TV and the other group not. It's very interesting to see if in-store TV has an impact in choosing a specific product." ●

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Role of packaging in work environments

Prior to packaging reaching the store shelf and the consumer, it has gone through many stages and middlemen. The facts are that, today, many of these stages are still being done manually. Innventia is presently collaborating with Public Health Sciences at the Karolinska Institute (KI) and The Centre for Musculoskeletal Research at the University of Gävle in a project which aims at investigating and developing new solutions that could contribute to improvements in the handling of packaging in the food industry, with a special focus on work environments for women. The Project Manager is Birgitta Nilsson at Innventia.

“There is still a great deal of manual work done in the food industry. This is often carried out by women. Today, the focus is on packaging that is effective in stores, while work associated with packaging has ended up in the background. Our supposition in this Project is that

packaging can be improved for more efficient handling and so we want to investigate whether we can make manual handling at the foodstuff producers better by making modifications to the packaging.”

Three different case studies were carried out jointly with Göteborgs Kex, Jästbolaget and Karamellpojarna in the Project. The studies were pursued in focus groups that took all the stages in the operations throughout the entire chain into consideration, from the materials to the finished goods from the factory. The results will be presented on 1 December at a final seminar at Innventia, and some new solutions to packaging will be suggested.

“Our primary goal was to raise the issue of the manual handling of packages, at both the fillers’ and the packaging producers’, with focus on how packaging materials and packages can be made easier to handle. Caution should of course



PHOTO: EVA BERNMARK, KI

The current work with packages for yeast (500g of dry yeast) involves a lot of steps in handling them, when the secondary packages are to be filled. In the study, the corrugated board supplier (SCA) developed a proposal that meant a somewhat altered size to the primary package, mechanical construction and a new shape to the corrugated board box, which resulted in a decrease in the number of operational steps and a reduction in the load on a package of dry yeast.

be taken if generalizing these three case studies but our results indicate that, in collaboration with packaging producers, it is possible to improve the manual handling of packages for women in the food industry. ●

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PHOTO: EVA BERNMARK, KI

At Göteborgs Kex, a box of corrugated board was found too pliable and a particular package too slippery. The box that was slippery caused the people working there not only to drop products but also to suffer muscular tension due to the fact that they had to try to hold the packages together and not drop them when they were being packed. The problem was solved partly because the supplier of the packages (Ekmans) selected a frictional lacquer to put on the primary package and the supplier of the secondary package (Stora Enso) increased the thickness of its material by one level. (Left) KI measuring the load involved in the work during the existing production and (Right) on prototypes in the simulated production.



Förpackningen är viktig som kommunikationskanal. Den ska ge konsumenten den information som han/hon behöver för att göra sitt val. Tack vare studier i konsumentbeteende kan företagen få insikt i vad som styr konsumentens eller kundens val.

I projektet PaperSense, som handlar om papperets roll i media och kommunikation, har studier med ögonrörelsekamera i kombination med intervjuer och analyser, genomförts för att ta reda på olika informationskanaler i butiken uppfattas. I ett annat projekt om kvinnors arbetsmiljö i livsmedelsindustrin har tre fallstudier gjorts för att undersöka och utveckla nya förpackningslösningar som kan bidra till en förbättrad manuell hantering i livsmedelsindustrin.

Are you a wrinkler or a folder? – tactile investigation at Innventia

In the first half of 2010, Innventia started a new Research Cluster in the field of tissue. The overall aim is to generate an increase in competitiveness for the six participating companies. The Tissue Cluster has been divided into two projects. The first one is “Low energy fibres and processes”, while the other one is “Tissue structure analysis”. In the “Tissue structure analysis”, Innventia has recently carried out an introductory consumer investigation among its person-

nel and visitors, where participants test kitchen roll paper and toilet paper in a virtual environment.

Annika Kihlstedt, a participant in the Project, comments, “It’s great that we’ve started a new Tissue Cluster and, in addition, that we can involve colleagues and visitors in this evaluation. The response has been extremely good.”

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Let us know by sending an e-mail to info@innventia.com.

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SVERIGE



PORTO BETALT

Good team crucial for climate of innovation

Pia Wågberg has just arrived home from a four month stay in Silicon Valley, outside of San Francisco. She participated as one of five fellows in the Vinnova Fellowship Programme. The goal was to gain a deeper understanding of how innovation works in Silicon Valley and to bring back inspiration to Sweden.



View from the bell tower overlooking Professor Yi Cui's building for mechanical engineering at Stanford University.

"I went there to study the well known innovation climate of Silicon Valley to see if Innventia (as an innovation partner) can learn from it. I quickly noticed that entrepreneurship permeates the whole area in a lot of different ways. Everyone is trying to establish interdisciplinary networks with a lot of action and less structured processes. However, as Silicon Valley is suffering from "innovation tourism", meaning that a lot of people from all over the world come to Silicon Valley to visit and learn from the most innovative companies. You therefore have to have a value proposition or a good contact to get admitted," Pia explains.

"On the other hand, everybody is open and curious. There are lots of opportunities for meeting new people. Open seminars and events are organized every day at most companies and institutes and anyone can attend them either for free or for a smaller fee."

Pia thinks that other explanations as to why the climate of innovation is so distinct in Silicon Valley depend on there being a lot of money available for starting up new companies. People delight in other people's success, while, at the same time, it is acceptable to compete and not always be a winner. Everybody knows that having a good team is crucial.



An almost daily occurrence for entrepreneurs, who make a pitch to investors at Plug&Play, the company where Pia had an office. This is one of many significant opportunities for establishing new contacts.

Pia visited many universities, institutes and companies during her stay. She organized two different study trips for colleagues from Innventia and The Royal Institute of Technology (KTH), one concentrating on innovation processes, as a part of the Fellowship Programme. The other trip was much smaller and had a more technical focus.

Pia adds, "I'm convinced that the trip will contribute to valuable ideas and insights to Innventia and its customers."

"I have learned a lot about Intellectual Property Rights (IPR) and licensing and obtained tangible suggestions for Innventia. I have made many interest-

ing connections during my stay. Among others, Innventia will meet Aerospace Corporation from Los Angeles, which has developed new inkjet printed sensors. At Stanford University, we came in contact with an interesting professor, who uses paper as a basis in his research into batteries. Our expertise in fibre materials has led to KTH sending a diploma worker to him as a start of a collaboration that will be of interest for Innventia as well. Finally I have to say that the fellowship really has given me a deeper insight into what innovation is all about and I hope to be able to use this in a beneficial way for Innventia." ●

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Pia Wågberg har genom Vinnovas Fellowshipprogram spenderat fyra månader i Silicon Valley för att få en djupare kunskap om hur innovationsarbetet fungerar där. En del av uppgifterna var att lära sig mer om hur institut och företag samarbetar och hur de arbetar med patent och licensiering. Pia besökte många universitet, institut och företag och fann en utbredd strävan att skapa tvärvetenskapliga nätverk. Hon organiserade även två olika studieresor för kollegor från Innventia och KTH, den ena med inriktning mot innovationsprocesser, den andra mot att se nya tekniska möjligheter.

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