



SIK – THE SWEDISH INSTITUTE FOR FOOD AND BIOTECHNOLOGY



# SIK • 2007

Research and business



... is an industrial research institute owned by SP Technical Research Institute of Sweden. The purpose of the Institute is to strengthen the competitiveness of the food industry.

... has an annual turnover of approximately SEK 90 million. Two-thirds of its income comes from industry in the form of assignments and membership fees, and around one-third comes from research funding from IRECO Holding, the EU and VINNOVA as well as various research foundations and research councils.

... conducts strategic and applied research for industry in accordance with a goal-oriented research programme and in the form of joint industrial projects.

... offers comprehensive consultancy services in product and process development and problem-solving of both an acute and strategic nature. SIK also provides advice and service in R&D matters.

... is the specialised resource for the co-ordination of R&D for the Swedish Food Federation (Li).

... maintains a strategic alliance with the British research institute Campden & Chorleywood Food Research Association Group.

... is a member of an international network made up of other centres of knowledge and communicates know-how, ideas and information via regular customer contacts, reports and seminars.

... provides tailored training courses for individual companies and participates in graduate and undergraduate course programmes at universities and colleges in Gothenburg, Lund and Uppsala.

... has around 90 employees, most of whom are university graduates. The head office is in Gothenburg and there are regional offices in Lund, Uppsala, Umeå and Linköping.



## Contents

• A challenging yet positive year	3
• Avoiding <i>Listeria monocytogenes</i> in production	4
• Pulsed electric fields – alternative to pasteurisation	5
• Just as sweet – with less sugar?	6
• Proteins from African cereals open up new possibilities	7
• Continuous microwave heating offers many advantages	8
• Expert systems promote product development of food for microwave preparation	8
• Consistency-adapted nutrition improves food experience in elderly persons with eating difficulties	9
• Integrated simulation technology for safe, sustainable food processes	10
• Nutritional and structural design of healthier foods	11
• Convenient access to collective packaging expertise	12
• Programmes and seminars 2007	12
• Climate issues set their mark on the food industry in 2007	14
• REELIV – a tool for sustainable food production	15
• Research year 2007	16
• EU projects in which SIK is involved	17
• SIK PhDs during 2007	18-19
• Research projects during 2007	20-21
• Reports	22-23
• SIK Board	25
• Industrial Advisory Group	25
• The SIK Members' Association	26
• SIK Industrial Research Reward	26
• The SIK Members' Association	28

# A challenging yet positive year

Interest in knowledge-driven product and process development is on the increase. Health, taste and climate issues complement already important areas such as nutritional content, purity and safety. SIK's broad expertise within new and established areas is a strong platform on which to build up industrial process, production and product development projects, leading to increased exports and profitability in the Swedish food industry.

Looking back, 2007 was a financially challenging year for SIK and unfortunately we were compelled to make certain staff cuts. To meet the demands facing us as we enter 2008 we have implemented changes in our organisation to highlight more clearly the importance of close co-operation with customers. We have organised a group that will focus on developing collaboration with member companies and other customers. It will also analyse needs, propose measures and find partners in areas where SIK's in-house expertise is insufficient. We have also commenced the task of co-ordinating our finance and human resource activities with the resources within the SP Group.

## Exciting projects and co-operation

Fortunately, we have also seen many positive signs, such as the continued inflow of new and exciting research projects. An excellent example is the major Vinnova project SuMo, where SIK, together with Chalmers University of Technology, is working to produce new biomaterials. Another is SweChoc, the chocolate centre which SIK and YKI have established together with a number of national and international companies.

Co-operation with the Swedish Food Federation is continuing to develop positively. A natural link between SFF and SIK ought to reinforce conditions for the industrial work being done at SFF, combined with the expertise in food theory at SIK, to develop into a strong, positive force in the future.

## Award-winning employees

Several of our employees have experienced major success. Our environmental group received the Food Prize 2007 from the food association LivsmedelsFöreningen. The group's successful work within food and the environment is attracting more and more attention. We consider our expertise within this area to be at the very forefront in Europe.

One of our unit managers, Professor Anne-Marie Her-

mansson, was awarded the IVA Gold Medal 2007 for her work in building up and developing her research area – structure and material design in biological materials – into a leading international competence centre.

## SIK subsidiaries

Following the sale of SIK Valiguard at the beginning of 2007, SIK has only retained a minority holding in Food Radar Systems (FRS). Based on previous SIK work, FRS has developed unique technology to detect undesired objects in food in a way that existing technology is unable to do. The company has now installed its first equipment at a food company. There is growing interest in both the technology and the company.

## New research strategies

A great deal of work was done in 2007 to develop new research strategies for the next three years. In collaboration with all the member companies, SIK has spent the summer and autumn compiling the wishes and assessments of the members. SIK's task will now be to as far as possible secure financing linked to this strategy. The new strategy will focus on three areas: "Sustainable food production" is an area in which we will build up general know-how in production systems and conditions. "Product design based on consumer needs" is an area in which we aim to define consumer needs, wishes and demands, and from which actual product features and functions can be produced. "Process technology for unique product quality" deals with the role of the process in achieving the desired product features and functions.

We have unquestionably a challenging, important and exciting future ahead of us!



*KLAS HESSELMAN  
PRESIDENT*

# Avoiding *Listeria monocytogenes* in production

The consequences for a food manufacturer affected by *Listeria monocytogenes* are devastating: sick consumers, product recalls and costly production stoppages. Preventive hygiene work and carefully considered HACCP plans reduce the risks.

The number of *L. monocytogenes* is not permitted to exceed 100 per gram of food (refrigerated, ready-to-eat) during the shelf life. All food companies must be able to demonstrate that bacteria do not reach this limit. Maria Lövenklev, a microbiologist at SIK, maintains that preventive hygiene work and carefully considered HACCP plans are the most essential if the demands are to be met.

"But it could be difficult to prevent the occurrence of *Listeria monocytogenes* completely. We have noticed an increase in the number of questions dealing with ready-to-eat products and noted an interest in what we call challenge tests.

## Bacteria added

With a challenge test microbiologists at SIK can assess whether or not the products permit growth of *L. monocytogenes*.

"Bacteria is added to the food, often in the original packaging, which is then stored under actual storage conditions in terms of time and temperature," says Maria Lövenklev.

## Close co-operation

During the storage period analyses are made to determine the bacteria content. The work is done in close co-operation with the client. Factors such as raw material quality, pH and salt content are taken into account to acquire as correct a picture of reality as possible. The answers generated by the tests indicate whether *L. monocytogenes* managed to survive and grow in the product during the promised shelf life. The results indicate the shelf life the product could have. It is also a matter of evaluating changes in recipes or additives which could affect *L. monocytogenes*.

"We also use predictive microbiology to make theoretical

calculations of how quickly the bacteria increase/decrease in number under product-like conditions. The results could be used to give a rough idea of whether a product is safe or not," explains Maria Lövenklev.

"We also acquire knowledge of whether it is the composition of the product or the process that needs to be improved. The results often need to be confirmed using challenge tests.

## Creates new opportunities

DNA-based analytical techniques have given researchers new potential to understand the features and activity of microorganisms in different biological systems. These techniques have up to now only been used in research projects although expanded use is predicted in the future. A study was published recently where it was shown that *Listeria* becomes 100 times more aggressive in the human body if it comes from an anaerobic environment.

"Although it has yet to be investigated, this could mean that *L. monocytogenes* in food stored without oxygen is more dangerous than if the food is stored in an air atmosphere," says Maria Lövenklev.

## New criteria for food

In 2006, new microbiological criteria came into force in the EU. The aim is that food produced and distributed within the EU should maintain a high level of food safety, thus ensuring that consumers do not become ill when they eat the food. For refrigerated, ready-to-eat food, which can be eaten without being cooked or prepared first, there is a limit of 100 *L. monocytogenes* per gram of food. The products in question include pâtés, cold sauces, smoked and gravad fish, soft cheeses, sliced sandwich meats and salads.



# Pulsed electric fields – alternative to pasteurisation



*The products that are included in the project are milk, eggs, vinegar and mixtures of these products.*

## **Part of an EU project**

The work on PEF is part of an EU project ([www.highqrte.eu](http://www.highqrte.eu)) dealing with non-thermal methods for the production of ready-to-eat meals. The project will run from 2006 to 2009. SIK is co-operating with researchers and companies in Italy, Lithuania, Spain, the United Kingdom and France. Apart from biological safety, the project also includes the study of other quality parameters such as sensory features, nutritional content and functional features in the PEF-treated products.

With the aid of PEF (pulsed electric fields) pumpable food can be treated in such a way that the number of microorganisms is reduced whilst leaving the overall quality unaffected. Microbiologists at SIK are working on the development of a new type of treatment chamber for a high, even level of bacteria inactivation.

"We are working to combine PEF with slight heating and preservatives to achieve sufficient microbiological safety. The products that are included are milk, eggs, vinegar and mixtures of these products," says Pernilla Arinder, a microbiologist at SIK.

### **Damages the cell membrane**

The PEF technique is based on exposing the bacteria to an electric field for a short period of time causing damage to the cell membrane. This damage could lead to bacteria being inactivated or their growth being seriously impeded. To acquire a better understanding of what happens with microorganisms on the DNA level when they are treated with PEF, SIK has developed analytical techniques that quantify activity in certain genes.

"We are particularly interested in genes associated with the damage that occurs in the cell membranes of the bacteria when they are treated with PEF," says Pernilla Arinder.

### **Combined with heat and a preservative**

The newly developed chamber offers a good reduction in *L. monocytogenes* and *Salmonella*. There is therefore an excellent chance that PEF could be an alternative to traditional pasteurisation in the food industry. Pernilla Arinder states that a reduction of five log units has been achieved for *L. monocytogenes* and seven log units for *Salmonella typhimurium*.

"We will now be studying the effect of PEF in combination with a preservative and heating. Trials indicate even better bacteria inactivation and thus a longer shelf life compared with PEF alone.

### **Must be adapted to each product**

The PEF process must be adapted to each individual product. The effect of the treatment depends, apart from PEF parameters (electric field, pulse length and number of pulses), on the microorganism in question and on the features of the food.

"Treatment of acidic foods such as juice thus differ from less acidic foods such as dairy products," states Pernilla Arinder.

# Just as sweet – with less sugar?

Is it possible to reduce the sugar content in food without affecting the taste? This was the question that Karin Holm, an industrial PhD student at SIK and Danisco Sugar, sought to answer.



Karin Holm is employed at Danisco, a leading sugar producer with over 2,300 employees. Is it not strange for a sugar manufacturer to support research aimed at reducing sugar consumption? The company's head of development, Lars Bo Jørgensen, does not feel that it is strange at all. He believes that greater knowledge of sugar and its function in food will benefit Danisco in the long term.

"There's a great deal of talk about reducing sugar in food and customers are looking for products with less sugar. We have chosen a strategy where we develop our products in line with the needs of customers and we initiate research that provides us with know-how about what happens when the amount of sugar is reduced," he says.

## No artificial substances

The easy way of course would be to replace sugar with some form of artificial substance such as sucralose or aspartame. However, Karin Holm is careful to point out that her research is not about artificial sweeteners. It should be real sugar but less of it. She also points out that sugar not only improves the taste of food but also contributes to creating a desirable consistency and structure. Mustard, ketchup, yoghurt and desserts are examples of products rich in sugar in which Karin is interested.

"The secret could be to find a solution where the actual structure of the food is designed in order to facilitate the controlled release of the sugar taste. This would allow the amount of sugar to be reduced," says Karin, who quickly makes simple sketches to demonstrate her line of thinking.

## World-leading researchers

At SIK she not only has access to advanced laboratory resources but also excellent help from people with world-leading knowledge within the structuring of food. One example is the VINN Excellence Centre, which is headed by Professor Anne-Marie Hermansson. Together with Chalmers University of Technology and a number of companies the Centre conducts both basic and applied research to produce new products and services. Another resource is the Institute's taste panel, comprising 20 people who are trained to make accurate assessments. They have helped Karin in her research by testing jam and confectionery containing different amounts of sugar.

## Wants to benefit society

In December 2007 Karin was roughly half way through her four-year project. If everything goes according to plan she will take her licentiate degree in summer 2008 and her PhD a



*The sweet taste in pectin-added jelly (marmalade) was examined and we found that the sweet taste can be attributed more to the type of pectin rather than the actual concentration, which is new and interesting information. Photo: Marie Ullnert/Bilduppdraget*

couple of years later. Karin has an MScEng in bioengineering and she had no plans to go into research when she graduated from Chalmers University of Technology. However, the possibility of benefiting society attracted her.

"I want my work to lead to something concrete. I felt that working with sugar and food was an important area."

Karin Holm's research is also supported by the KK Foundation.

# Proteins from African cereals open up new possibilities

A reduced need to import expensive wheat into Africa. New, biodegradable packagings made from renewable raw materials.

Projects in which SIK researchers are working on cereal proteins together with colleagues in South Africa are opening up a whole range of new possibilities.



"This can be explained mainly by the fact that the protein is too tightly bound in the physiological structure and the water cannot penetrate the softer proteins to form a viscoelastic dough," says Mats Stading.

"Using other methods it is possible to also produce elastic doughs from these proteins. In Sweden, gluten-free bread can be baked and in Africa local cereals can be used, avoiding the need to import expensive wheat.

## Renewable raw materials

The same proteins can also be extracted from by-products such as bran and spent grain. These are good sources of protein which, apart from baking, can also be used as bioplastics. They form gastight films which can be used in packagings to protect foods that are perishable. As they are produced from cheap, renewable raw materials they are also good for the environment," Mats Stading points out.

When baking bread a foam structure is created made up of the proteins and starch in the flour. The foam builds the porous structure, which in turn produces the texture and mouth feel that we associate with high-quality bread. Most of the bread in Sweden is baked using wheatflour, which contains gluten protein.

"Gluten has unique properties that make the dough both viscous and elastic," explains Mats Stading, a researcher at SIK.

## Retains the foam structure

Gluten stabilises the foam structure formed during fermentation when the bread is baking. Other cereals, such as oats, barley, maize and African cereals such as sorghum, contain similar proteins although these lack the properties that produce the viscoelastic doughs necessary to produce the porous foam structure.

Through co-operation between SIK, Chalmers University of Technology and the University of Pretoria, South Africa, researchers have studied the foam-forming features in sorghum, a cereal which is nutritious, can withstand drought and produces good harvests under harsh conditions. The components in the flour, the starch and the protein kafirin have been extracted and studied individually for use in food or in technical applications. The flour, containing different additives, has also been formed into dough and its viscoelasticity has been examined.

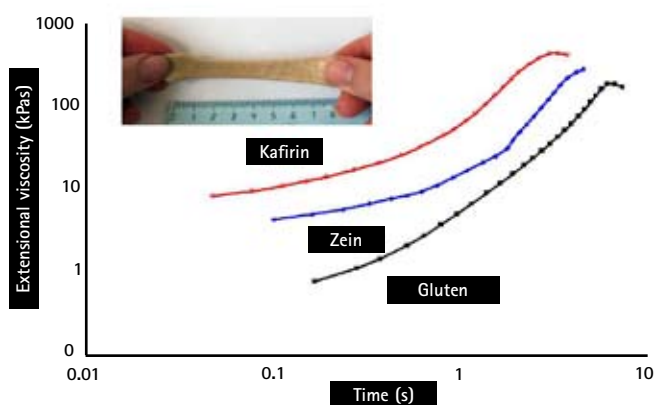
Sorghum flour has proved that it does not form a viscoelastic dough on its own regardless of the heating, solvents, additives or kneading.

## Shelf life doubled

In various projects researchers have extracted avenin from oats and kafirin from sorghum. The substances were transformed into thin biofilms which are used to preserve fruit and nuts. A whole series of benefits were noted:

- The shelf life of pears in the store was doubled
- Consumer panels from South Africa, who are used to fresh produce, found the packaging material (which is in effect invisible) sensorially acceptable
- The material actively reduced microbial spoilage

"The results indicate, among other things, that it is possible to improve the profitability of the companies in Sweden and Africa that produce agricultural products," states Mats Stading.



Sorghum field.  
Photo: John Taylor



The photograph shows a dough produced from the sorghum protein kafirin and the graph shows its properties compared with protein doughs made from wheat (gluten) and maize (zein). A good dough should have a high level of resistance to extensional flow (extensional viscosity) and the resistance should preferably increase the more you extend. All three protein doughs in the graph have curves which point upwards and thus have the correct extensional properties for successful baking.

# Continuous microwave heating offers many advantages

Continuous microwave heating of pumpable products has aroused considerable interest in industry. The advantages include reduced processing time and increased production capacity as well as the potential for more efficient use of energy and improved quality features. Continuous microwave heating often entails less shear than more traditional technology and with greater heating uniformity at the cross-section.

At SIK we have developed a pilot-scale facility for continuous microwave heating of pumpable products. The facility, which has recently undergone a capacity increase, can be used for different types of pumpable products and has been designed to achieve even heating.

"This technology can complement or replace existing conventional heating technologies as part of a larger process," says Birgitta Raaholt.

The equipment can be used flexibly, in combination with conventional equipment such as a scraped surface heat exchanger, tube heat exchanger or homogeniser. This process would then become a stage in a larger totality. There is also the potential to connect measuring equipment to monitor temperature and pressure and to determine flow profiles online (UVP).



*Continuous microwave heating of pumpable products. The product is pumped into a Teflon pipe which passes through the microwave heating unit. In doing so the product can be heated whilst being pumped. Even heating can also be achieved by taking into account the flow profile as the product being transported in the middle of the pipe moves forward more quickly than in the outer surface.*

"A pilot-scale facility for continuous microwave heating also offers the opportunity to scale up studies of quality features from small scale to pilot scale," says Birgitta Raaholt.

## Expert systems promote product development of food for microwave preparation

SIK has developed an expert system which has led to a suitable design for packaged ready-made meals to facilitate more even heating in a microwave oven. The work is part of the EU project NovelQ (work package 22).

In the expert system the user can choose interactively from different menus which ready meal components are to be included in a certain dish. Based on this choice the expert

system produces the most appropriate geometry, size and position for each component. The arrangement is then presented in the form of a schematic drawing.

"The expert system can be used as an aid in the development of ready meals or other foods intended for the microwave oven by facilitating a more even heating process," says Birgitta Raaholt, microwave expert at SIK.

### Can be tailored to specific wishes

In industry the product development process has been promoted by reducing the time from product concept through to market. The system also means that the new design of existing dishes may result in improved heating uniformity.

"Expert systems can be tailored entirely to industrial requirements in order to satisfy the needs of an increasingly competitive market," says Birgitta Raaholt.



# Consistency-adapted nutrition improves food experience in elderly with eating difficulties

**New Findus products adapted to elderly persons with eating difficulties and continued research in this field. These are two positive results of a Vinnova-financed project in which SIK and a number of companies and universities have taken part.**

SIK, Findus, Lyckeby Culinar and Källbergs Industries have run the three-year, Vinnova-funded project "Consistency optimisation and sensory design for health and well-being in the elderly".

"The aim is to produce a knowledge platform to develop nutritional, tasty food for elderly persons with chewing and swallowing problems, dysphagia," explains Karin Wendin, head of the Sensory Science and Consumer Group at SIK and project co-ordinator.

## Eating problems affect many

It is estimated that approximately 40 per cent of persons aged 70 or older have some form of chewing and/or swallowing dysfunction.

"We also know that elderly persons have a poorer sense of smell and taste. Generally, this can lead to a loss of appetite with malnutrition as a result," says Karin Wendin.

"Earlier studies have shown that a consistency-adapted diet can improve appetite significantly and thus the quality of life for elderly persons suffering from dysphagia.

## Carrots and meat

When manufacturing products the project participants worked with a carrot system and a meat system. Ingredients and preparation varied depending on the pre-determined trial design. Three products from each system were selected for inclusion in the eating studies, where elderly persons had the opportunity to be involved in the testing. In conjunction with the eating study, health and chewing and swallowing status were also studied.

Alongside this there was also a study aimed at evaluating the preference for a more coarsely cut, consistency-adapted diet.

"We noted that a coarser consistency meant that the products were regarded as being tastier and juicier and at the same time they were easy to swallow," says Karin Wendin

## Well-attended seminar

The project was concluded with a seminar in Gothenburg. Karin Wendin stated that there was enormous interest and the

number of participants quickly reached the 100 maximum.

Speakers spoke about how the sense of smell and taste interact with how we can chew and swallow different types of food and also ways of compensating for the reduced sense of smell and taste in the elderly.

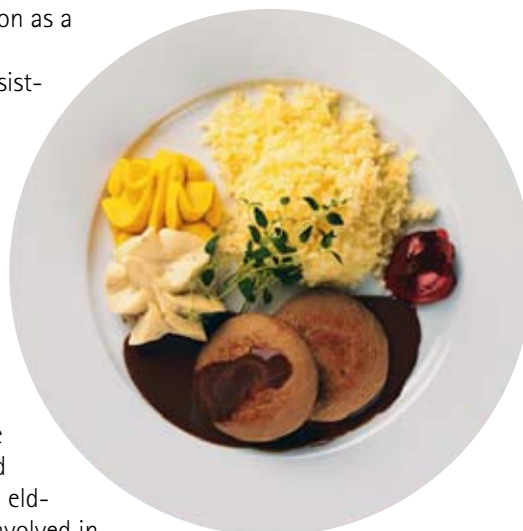
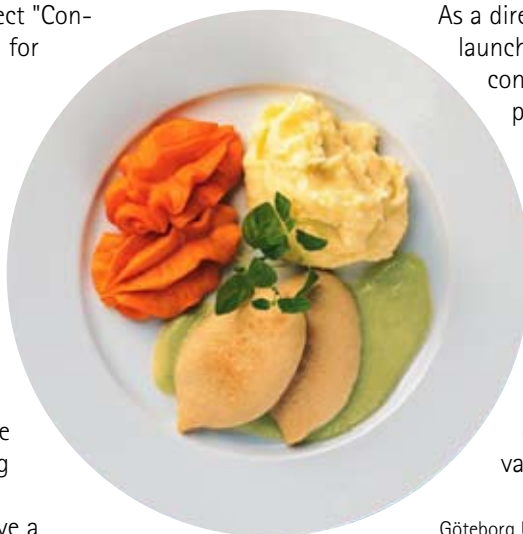
"We also noted that further knowledge was required regarding taste experience, consistency, particle size, saliva and saliva stimulation."

As a direct result of the project Findus has launched products with a new and coarser consistency. These are included in the company's range of foods adapted to people with chewing and swallowing problems.

## Further research

At the end of 2007, VINNOVA decided to fund a one-year continuation project. The project started in January 2008. The aim is to define different consistency parameters, such as viscosity and particle size, in different dietary consistencies adapted specially to various dysfunctions.

Göteborg University, Sahlgrenska University Hospital and MAS University Hospital also took part in the project.



# Integrated simulation technology for safe, sustainable food processes

The EU project REPRO (Reducing Food Processing Waste) deals with developing processes to make use of food by-products. SIK has developed and demonstrated an integrated approach to facilitate the rapid, effective evaluation of different process alternatives, taking into account technological, financial, environmental and microbiological aspects.

SIK has evaluated two processes, the manufacturing of snacks from spent grain, a by-product in beer production, and the processing of trimmings from red cabbage for different ingredients such as nutritional fibre, pectin, pigments and products with health-promoting properties.

"We have developed a general working method and applied it to the two different processing lines. With the aid of the model we can study the effect of different parameters and find weaknesses rapidly and simply," says Karin Östergren, a researcher at SIK who explains enthusiastically about working with snacks.

## Drying is the critical phase

The snacks product has been developed by researchers at Manchester Metropolitan University in collaboration with a research group from Gaziantep University. A process proposal has been analysed with the aid of SIK's simulation model. In production researchers could see very quickly that the drying stage of the wet spent grain was a critical stage in terms of environmental impact. By pressing the grain hard before drying energy consumption can be reduced significantly and in doing so reduce both cost and environmental impact.

"We could also note that the shorter drying time did not

affect the microbiological status of the end-product," says Karin Östergren.

In this case it was the microbiological status of the ingredients that was crucial to the final microbiological quality as the time spent in the extruder, where the product is shaped and heat-treated, must be short to ensure the sensory quality is satisfactory.

## Rapid scenario analyses

The advantages of using an integrated model compared with separate models is that when the model is in place different scenarios can be analysed by simply pressing a button. What is produced is a unified analysis based on exactly the same input data. This allows the smooth, rapid evaluation of a large number of scenarios in order to find a profitable and sustainable process solution which satisfies the quality requirements.

The REPRO project will come to an end in spring 2008.

"We now hope to be able to use and develop our tool in different food processes," says Karin Östergren.

## Making use of valuable waste

In the food industry large volumes of 'waste' are generated which are really of food quality but lack an outlet. The EU project REPRO deals with the development of new process technologies in order to handle this type of food by-product in a sensible, sustainable way through further processing. A basic requirement in the project is that the process should be safe, financially viable and environmentally sustainable. The project co-ordinator is Professor Keith Waldron, IFR, United Kingdom.



The REPRO research group during a visit to Gothenburg in June 2007.  
Photo: Keith Waldron

Trimmings from red cabbage can be developed into different ingredients, such as nutritional fibre, pectin, pigments and products with health-promoting properties.

# Nutritional and structural design of healthier foods



Tomatoes contain a beneficial antioxidant known as lycopene, which has attracted the interest of researchers as it is considered to reduce the risk of developing certain diseases.

Healthy Structuring has its starting point in epidemiological studies, suggesting that the consumption of high levels of fruit and vegetables may reduce the risk of chronic diseases, including cancer and atherosclerosis. However, few people manage to reach the recommended daily intake of 600 gram. More attractive ready-to-eat products could contribute to increased consumption and a high bioavailability of key nutrients in these products could contribute to the beneficial health effects.

Healthy Structuring is a major European project involving scientists at SIK - the Swedish Institute for Food and Biotechnology, IFR - the Institute of Food Research, the Institute for Agricultural and Urban Ecological Projects at the Humboldt University in Berlin, Chalmers University of Technology, Unilever, the University of Murcia, Tetra Pak and KU Leuven University. The aim of the project is to improve the nutritional and structural quality of ready-to-eat fruit and vegetable products, particularly ready-meals containing tomatoes, carrots and broccoli.

The approach involves using new and innovative technologies and optimal mixtures of raw materials. It focuses on optimising processing to increase the bioavailability of important micronutrients whilst ensuring the minimisation of microbiological risk and the retention or introduction of consumer-preferred textural properties. Using this information, model food formulations will be developed, manufactured and evaluated. The results will be of significant relevance to industry, particularly small and medium-sized enterprises, and dissemination will be achieved through different routes, including an SME platform.

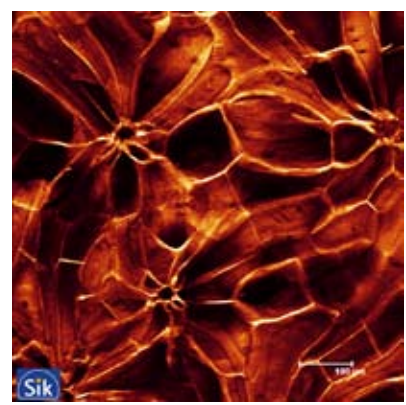
The role of SIK lies in determining macro- and microstructural and functional characteristics and the effect of different processing solutions on structure. During the first project year the effect of storage on structure was evaluated using confocal laser scanning microscopy. The effect of pre-treatment, both conventional and microwave and ohmic heat treatment, on structure and texture has been evaluated.



**Healthy Structuring**



Healthy Structuring has received funding from the European Community's Sixth Framework Programme - STREP project FOOD-023115.

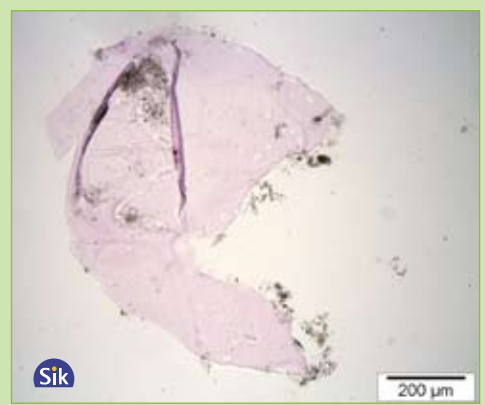


Microscopy image of the xylem (inner part) of carrot.  
Photo: Siw Kidman



The image to the left shows a whole cell from a tomato which has undergone heat treatment followed by mixing. In the image to the right the process has been reversed - mixed first and then heated - resulting in damage to the tomato cell. This shows how differences in the process affect the whole product.

Photo: Evelina Höglund



## Convenient access to collective packaging expertise

SP, SIK and YKI have considerable collective expertise within the packaging field. To make it easier for customers to find the right product and to make use of the synergy effects achieved when several specialists work together, the SP Group Packaging Centre was founded.

"Assignments extend across the whole spectrum, from simple investigations and tests to complicated research projects on the international level," says Anders Leufvén, a researcher at SIK. He gladly directs questions to appropriate persons in areas that fall outside the competence of SIK. The website ([www.sik.se/sppack](http://www.sik.se/sppack)) is also an excellent means of finding the right contact and project example.

As a food institute, SIK has obvious competence with regard to matters con-

cerning the protection demands a specific product makes on its packaging. Thanks to the SP Group Packaging Centre companies are considerably better equipped to deal with areas where knowledge of, for example, polymer chemistry and surface phenomena is required.

"We can also tailor active, innovative packaging solutions to different foods much more effectively than we could previously," says Anders Leufvén.

"Up to now the SP Group Packaging Centre has been commissioned by individual companies. Now we are beginning to make use of our collective expertise so that as a group we can approach funding bodies and public authorities.

*SP Group Packaging Centre – three leading areas of expertise in one packaging*

- **Tests, analysis and certification**  
Material characterisation  
Food quality  
Dangerous goods  
Medical packagings
- **Expert consultation**  
Packaging advice  
Training  
Hygiene and safety
- **Research and development**  
New materials  
New packaging solutions  
New test methods  
Smart, active packagings



### Programmes ...

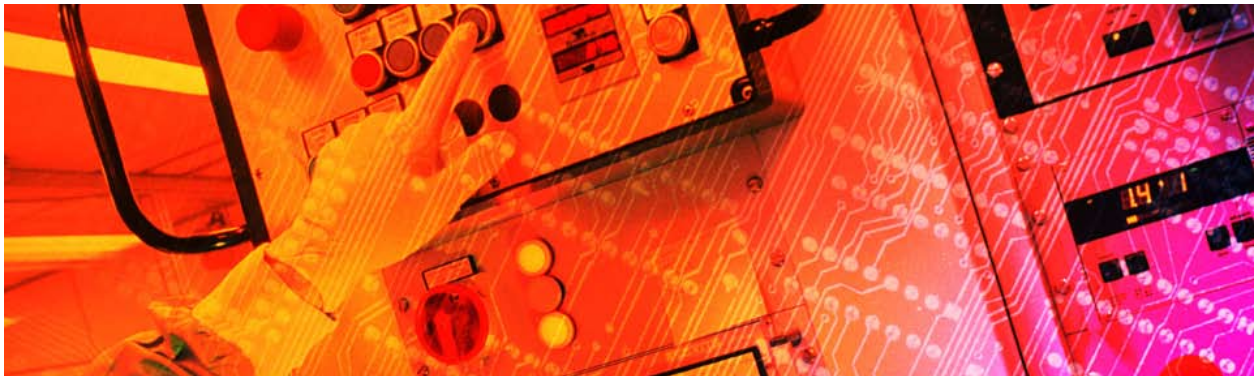
- Grundkurs i sensorisk analys
- Mjölkbekämpning
- Har du koll på kallrökta korven?
- Köttets ABC
- SPÄCKATs emulsionsskola
- Hygien och HACCP för restauranger
- HACCP – grundläggande
- SPÄCKATs grundkurs i charkstillverkning
- SPÄCKATs saltskola
- HACCP – fördjupning
- SPÄCKATs fermentering
- Livsmedelsmikrobiologi med laborationer – konfirmeringsrutiner
- Klarar din pizzeria de nya EU-kraven?

- Grundläggande livsmedelshygien
- SPÄCKATs receptberäkningskurs
- Temperatur i livsmedel
- Livsmedelsmikrobiologi med laborationer – grundläggande
- Workshop i Lean Production
- Träning av sensorisk panel
- Livsmedelsmikrobiologi – teori
- Mögelsvampar med laborationer – grundläggande
- Syrningsteknik

A large number of in-house training programmes have also been run.

### ... and seminars 2007

- Färs forskning på SIK
- Lean Production
- (Im)possible packaging
- Ultraljudstekniker i in-line applikationer
- Konsistensoptimering och sensorisk design för hälsa och välbefinnande hos äldre
- Mat och klimat
- Hälsoprodukter från örter och bär



## *Developing for the future – investing in know-how*

All learning starts on the individual level and an organisation only learns if the employees learn. A focused investment in training is an excellent means of ensuring development, success and improved competitiveness.

In a company's strategic competence development programme we can be involved throughout the whole process, from making a skills inventory and needs analysis to implementation and evaluation.

Our training prospectus (only available in Swedish) contains a presentation of our well-known and well-attended courses as well as innovations that we have developed based on the indications and wishes of customers and sector organisations. All open courses can also be run as in-house courses at companies. Certain courses are suitable for combining with others – or why not as part of product or process development?

*Welcome to SIK – your partner in competence development!*

Would you like to know more about SIK's training activities?  
Contact Marita Wallenius, phone: +46 31 335 56 00, e-mail: [marita.wallenius@sik.se](mailto:marita.wallenius@sik.se)



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# Climate issues set their mark on the food industry in 2007

**"Al Gore and the UN Climate Panel are all well and good but it was Tesco's statement in January 2007 that got the food industry in Sweden moving," says Thomas Angervall, head of the SIK Environmental Group, which is now receiving more and more assignments from Swedish companies.**

Tesco chairman Sir Terry Leahy's promise to his customers that food sold in his stores would be 'climate-labelled' has put pressure on the industry to find out more about how their products affect the climate from a life cycle point of view.

"Introducing 'carbon footprint labelling' for the majority of the tens of thousands of products sold in the supermarkets is no easy task. It requires an extensive calculation process and at present too little is known about the impact on climate of different foods," says Thomas Angervall.

## **Simplification required**

To achieve such product labelling with absolute figures (for the greenhouse gases carbon dioxide, methane and nitrous oxide, expressed in carbon dioxide equivalents), simplifications will need to be made in the calculation process.

"First and foremost we must broaden our knowledge of the impact on climate change of different foods. If we step up our efforts we can probably see carbon footprint labelling of food within a few years."

The food chain accounts for approximately 25 per cent of greenhouse gas emissions in Sweden. Minimising emissions is one of the most pressing issues facing us at the present time," states Thomas Angervall.

"Regardless of what form climate labelling or demands from customers or the authorities will take it is important for the food companies to tackle the issue. Public awareness is high. If the companies take their climate work seriously they will have an excellent opportunity to profile themselves and reinforce their competitiveness."

In Sweden Krav and Svensk Sigill are working on in-

roducing more production-oriented climate labelling for summer 2008. The National Food Administration will also begin environmentally adapting its nutritional advice during 2008. The ICA store chain stated in autumn 2007 that they will be making demands on their suppliers to reduce the climate impact of their range.

## **Several new assignments**

In 2007, the SIK Environmental Group received several assignments from food companies wanting to know how their products affect the climate and what measures are most effective to reduce the impact on climate resulting from their products from a life cycle point of view. This is measured in the form of GWP or carbon dioxide equivalents. One of the customers is ICA. SIK's Environmental Group has produced GWP figures for 100 of ICA's own brand goods.

On the research side a new project has commenced to study the impact on climate of Swedish milk and meat production. The study has been commissioned by the Swedish Farmers' Foundation for Agricultural Research.

"The project will also include imported animal products," says Thomas Angervall.

## **More knowledge required**

SIK's Environmental Group is working intensively to source public funding to increase knowledge of the impact on climate resulting from food.

"At the same time it is important that industry and commerce continue to place assignments with SIK so that we can acquire a more complete picture of the impact on climate arising from different foods based on actual consumption in Sweden. There is also a need to increase our knowledge of the large number of imported food products.

"We have a relatively large environmental/GWP database which covers around 100 food products. We could need to double our know-how if we are to produce a simplified method for climate calculations."

## **Sweden at the forefront**

With knowledge and data related to the impact on



climate of their products has excellent potential and generating competition. This issue is a major issue in the start that Sweden has the credibility of our food products.

For the SIK Environmental Group it has been an eventful year. In addition to the work for 2007 it also arranged "LCA in Foods" and the network with over 70 participants and three members.



# REELIV – a tool for sustainable food production

How can food production be conducted sustainably both from a financial and environmental point of view at the same time? This was the question that researchers at SIK and Chalmers, along with industrial participants from Arla Foods, Ingemar Johansson i Sverige AB, Kiviks Musteri and Lantmännen Axa Foodservice AB, asked two years ago.

"Since then we have produced a tool that can be used to first evaluate weaknesses and strengths in existing production lines and then propose alternative production methods that can reduce environmental impact and improve production efficiency," says project manager Karin Östergren.



## Combination tool

The tool is based on a combination of environmental system analysis (life cycle assessment) and simulation of production flows (discrete event simulation). The production line is simulated in detail and is site-specific and in order to acquire a broader perspective of how production can affect the external environment in detail, environmental data from a life cycle point of view has been entered into the same model. This means the simulation of variations in production are reflected directly as variations in environmental impact.

"Through this combination we acquire results from the analysed production in the form of availability, effect on production frequency, volume of waste, energy consumption, impact on the greenhouse effect, acidification and eutrophication," explains environmental researcher Johanna Berlin.

The main result from REELIV is the simulation

tool although the working methodology has also given the food industry 'new glasses' to help them see their production from a life cycle point of view. Using this new knowledge, industry can also work more actively to bring about change in other parts of the processing chain.

## Reduced wastage most significant

Of all those involved in the food chain agriculture often has the greatest impact on the environment. From a life cycle point of view waste raw material or waste products later on the food chain have a significant environmental impact. Reducing waste also proved in the REELIV project to be the most important measure which industry can take from an environmental point of view. This is also demonstrated in the results from previous life cycle assessments. Waste generated in production could at times be difficult to discover before measurements are made.

The difficulty can probably be attributed to the fact that the volumes of waste are naturally much less than the volumes of raw materials and the volumes of the finished product. 10 kg or 100 kg of waste per day could perhaps go unnoticed. However, the simulation model provides an answer to how much of the environmental impact can be attributed to waste, where in production it is taking place and the actual volume of waste.

Other measures which reduce the environmental impact of production are improvement in energy efficiency and a switch to a more eco-friendly source of energy.

## Insight into the environmental impact of production

"It is important for each producing company to know the environmental consequences that result from changes in production, particularly today with the considerable interest in the environment at every stage in the food chain," says Johanna Berlin.



ts, the Swedish food industry for building up added value competitive advantages. The climate internationally and the head in this area could enhance the

mental Group 2007 was an on to receiving the Food Award ed the International conference seminar "Food and climate" ts, which has now become a etings planned before the sum-



# Research year 2007

SIK's research is aimed at building up knowledge which, now or in the future, will generate benefit for companies. This is our starting point when formulating our research strategies. We re-examine and reformulate the research strategies every third year and in 2007 we prepared the new strategies for the forthcoming three-year period, 2008–2010.

This has taken place through a very active dialogue with our member companies. The Industrial Committee in particular has devoted a great deal of effort to gathering opinions and identifying future knowledge needs from an industry point of view. Together with the Industrial Committee we have linked these needs to the areas in which we have specific core competence in order to prioritise focal areas in which we can create most benefit and achieve the greatest impact.

Principal areas of interest that have emerged through the dialogue with industry include health, environment, convenience and flavour perception. These are areas in which there are growing expectations, demands and needs among consumers. The biggest challenge facing the food industry in the future is to be able to predict, understand and satisfy consumer wishes of this nature. We have therefore chosen "Food for the consumer of the future" as a title for our new research strategies.

Our research will concentrate on building up three knowledge platforms which will act as support and a basis for ideas for industry when developing food for the consumer of the future.

- **Sustainable food production**

Building up general know-how in production systems and preconditions for food production.

- **Product design based on consumer requirements**

Defining what consumers' needs, wishes and demands mean and transforming them into actual product features and functions.

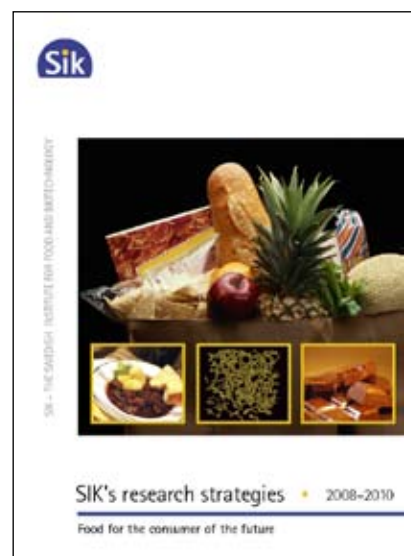
- **Process technology for unique product quality**

Highlighting the role played by processes in achieving the desired product features and functions.

The three platforms are based on interaction between our core competencies and competencies outside SIK.

An important activity during 2007 with regard to the interaction with competence groups outside SIK was the start-up of SuMo: a competence centre for supramolecular biomaterials. This is one of the extensive competence centres to which VINNOVA granted funding in 2006. The Centre is run by Chalmers University of Technology in close collaboration with SIK, with Anne-Marie Hermansson, Unit Director at SIK, as Programme Director. Collaboration with many prominent research groups at Chalmers is being initiated here and also with a consortium of companies representing different sectors, including the food industry.

*New research strategies for the three-year period 2008–2010 were formulated during 2007.*



Four of our PhD students graduated in 2007. This took place at four different universities: Chalmers University of Technology, Karlstad University, Lund University and Örebro University. This is further evidence of our broad, external research co-operation.

SIK has for long time enjoyed a strong position within EU research programmes and a significant proportion of our research funding comes from the EU. EU projects also have an important role to play in building up networks with leading knowledge centres internationally. During 2007 the first announcements were received within the EU seventh framework programme and we have devoted a great deal of energy to the application process. We have already had our first project approved: Nafis-pack, which is focused on safe, innovative packaging. Several projects have moved onto the second round and a final decision will be made at the beginning of 2008.

Under the leadership of the confederation of food and drink industries of the EU, a European technology platform (ETP) has been established: Food for Life, which has formulated a strategic research agenda with an horizon of approximately 15 years. SIK has played an active role in this work. From this base a Swedish national platform has been built up and during the year SIK led the work within the framework of this platform to formulate a national research agenda for food. The aim is to act as a base for bringing together and guiding Swedish players and financing bodies in the task of ensuring strong Swedish food research in the future.

2007 was the year in which the climate issue had its major breakthrough. Global warming came into focus, both in the media and on the political front. This also became a vital issue for the food industry, which needed to identify the contribution to greenhouse gases and global warming made by materials, processes, transport etc. There are also demands for information about the GWP (Global Warming Potential) of the end-product. At SIK we were well prepared to assist with our competence, built up through research over a long period, in food-related environmental issues and life cycle assessment. This is an example of research building knowledge for the future benefit of companies but also an example of the fact that the timeline from research initiative through to industrial need is not always easy to predict.

HANS LINGNERT  
RESEARCH DIRECTOR

# EU projects in which SIK is involved:



## FOOD (FP7)

- Nafispack - Natural antimicrobials for innovative and safe packaging  
Contact person: Tim Nielsen

## FOOD QUALITY AND SAFETY (FP6)

- Grain legumes – New strategies to improve grain legumes for food and feed  
Contact person: Ulf Sonesson
- REPRO – Food processors to reduce disposal of co-product wastes  
Contact person: Ulf Sonesson
- HELENA – Healthy lifestyle in Europe through nutrition in adolescence  
Contact person: Gunnar Hall
- Doublefresh – Towards a new generation of healthier and tastier ready-to-eat meals with fresh ingredients  
Contact person: Anders Leufvén
- Optim'Oils – Valorisation of healthy lipidic micro-nutrients by optimising food processing of edible oils and fats  
Contact person: Katarina Nilsson
- NovelQ – Novel processing methods for the production and distribution of high-quality and safe foods  
Contact person: Lilia Ahrné
- Healthy structuring – Nutritional and structural design of natural foods for health and vitality  
Contact person: Maud Langton
- HighQ-RTE – Innovative, non-thermal processing technologies to improve the quality and safety of ready-to-eat meals  
Contact person: Elisabeth Borch

## NANO-MULTIFUNCTIONAL PROCESSES

- Controlled release – New controlled release systems produced by self-assembly of biopolymers and colloidal particles at fluid-fluid interfaces  
Contact person: Anne-Marie Hermansson

## MARIE CURIE

- BioPowders – Research training in food powders  
Contact person: Lilia Ahrné

## RESEARCH AND INNOVATION

- IRC Western & Southern Sweden and Iceland  
Contact person: Bruno Hedlund



## SIK PhDs during 2007

### *How is it possible to improve films and coatings used in packagings?*

Approximately four per cent of the world's annual oil production is used in the plastics industry. A large proportion is used for packaging. Interest in degradable materials manufactured from renewable raw material is considerable as they could be an alternative to petroleum-based materials in certain applications, with a subsequent reduction in the negative impact on the environment. Maria Petersson, a PhD student at SIK, SCA and Chalmers, has studied how films and coatings used in packagings can be improved. She has now presented her results and conclusions in a dissertation.

"Packaging should protect the contents against different conditions in the surrounding environment. When a food is packed it is important, for example, to check the migration of moisture and oxygen between the product and the surrounding environment. Permeation of water vapour, i.e. that it migrates through the packaging material, could lead to drying, increased microbial activity or texture changes, whilst the migration of oxygen could lead to oxidative reactions and rancidity," explains Maria Petersson.

Biopolymers, such as polysaccharides and proteins, are renewable. Materials manufactured using biopolymers are also often degradable. Many biopolymers and lipids are even edible and can therefore be used in food applications, such as protective barriers on the surface or inside the food.

"Many biopolymers are effective oxygen barriers. Fortunately, they are sensitive to moisture. If these materials are to be a viable alternative to petroleum-based plastics the moisture sensitivity must be reduced. This can be resolved, for example, by mixing hydrophilic biopolymers, such as polysaccharides and proteins, with hydrophobic lipids, such as fats and waxes, and utilising the positive properties of each component," explains Maria Petersson.

When manufacturing films containing more than one component, phase separation often takes place during the film formation process. The phase separation and how the different components divide up in the finished film, i.e. its microstructure, can be utilised to tailor and optimise different material properties, such as barrier properties.

Another interesting area of use for films and coatings is as a bearer of active substances which can be released from the material into the product.

This could, for example, be utilised to counteract food being destroyed by a microbial attack through the release of antimicrobial substances which then acquire a locally inhibiting effect on the attacking bacteria.

Adding active components to a coating instead of directly in a food also makes it possible to reduce the total volume of additives in the food and yet still retain the effect on the product.

*Title of the dissertation: Enhancement and characterisation of films for barrier and release applications.*

### *New ultrasound-based method offers improved process control*

By measuring the properties of a liquid food quickly, continuously and directly in production there is greater potential to monitor and control the processes. Ultrasound technology also provides the opportunity to develop new foods with improved product properties. This is demonstrated by SIK researcher Johan Wiklund in his PhD dissertation.

The technique which Johan Wiklund is working on is known as UVP-PD. This stands for Ultrasound Velocity Profiling in combination with the measurement of the pressure difference, PD. In simplified terms the technique means that it is possible with the aid of ultrasound to measure the flow characteristics of liquid foods, i.e. the consistency and rheology. The flow is visualised at the same time to provide a clear picture of what is happening. By receiving information continuously about how the food performs, it is quicker and simpler to discover and rectify quality shortcomings or disruptions and to control the process.

"It also gives rise to more reliable control of stoppage times in a closed system, which could be a critical factor in heat treatment or chemical treatment of a process liquid during a fixed period of time," says Johan Wiklund.

Measurements using ultrasound have many practical advantages as the measurements can take place continuously and without anything being touched directly in the process line. It is possible to use the technique for suspensions with a high concentration of particles, even for large particles and non-transparent liquids.

In addition to liquid foods, this measurement technique is highly suitable for companies working with oil, chemicals, pharmaceuticals and paper pulp. Johan Wiklund states that his work has aroused a great deal of interest in industry. He would now like to see companies that manufacture liquid products make use of ultrasound technology to gain a deeper understanding and greater knowledge of flow and rheology directly in the process line.

"It would also be heartening to see companies that manufacture equipment for the food and pulp industries, for example, using my results to build more efficient equipment and acquire ideas that could eventually become new products."

Johan Wiklund hopes that his research will also result in a commercial product for process monitoring and measurement of rheological properties.

*Title of the dissertation: Ultrasound doppler-based in-line rheometry – development, validation and application.*

## *Control the smell and reduce the oxygen content using latex*

Would you buy a packet of tea that did not smell of tea? Or a cheese that smelled of plastic? Aroma affects us as consumers more than we imagine. Standing in the store we quickly base our choice of goods on the design of the packaging, the brand and the smell.

"It is common in packagings made of plastic, cardboard or paper that odours pass between the packaging and the food," says Anna Nestorson, a PhD student at SIK and Karlstad University.

To reduce the problem of odour migration, Anna has tested coating the surface of cardboard packagings with latex. Latex is really plastic particles in a water solution. The particles are small and therefore have a large surface in relation to their weight. The diameter of a latex particle is less than one 10,000th of a millimetre. The latex is placed on the surface of the cardboard, which is then dried to remove the water. What remains is a plastic layer with properties that can vary according to the appearance of the plastic particles.

Within the framework of the project experiments are being conducted on controlling how odours migrate through latex films by modifying the surface of the latex particles. By changing the volume of oxygen groups on the surface the uptake and transport of the odours through the film can be affected.

The results can be used to create packaging materials where the loss of aromatic compounds from the food into the packaging can be reduced.

Anna Nestorson has also looked at the possibility of creating aroma-releasing packagings.

"The packaging manufacturers are extremely interested in creating material that smells, for example, of coffee but where the product's own aroma is kept firmly inside the packaging by means of an impenetrable barrier layer.

The packagings of the future will not only protect their contents but will also actively contribute to tastier and more sustainable foods.

"Of the many different variants it is the oxygen-absorbing packaging that is the most promising," says Anna Nestorson. Oxygen is devastating when it comes to the shelf life of food. If oxygen can be excluded and removed, the food can be stored for longer in a packaging without it going off.

In the other part of the project Anna Nestorson has worked on developing cardboard packagings with inbuilt oxygen scavenging. This work has been conducted in collaboration with the National University of Singapore.

"By binding oxygen-consuming enzymes to the latex particles a material is created with inbuilt oxygen scavenging. In conjunction with the breakdown of oxygen and in the right environment they could be active for a long time. Studies show that enzymes linked to the plastic layer retain their oxygen-scavenging function. No extra step in the manufacturing process is required to give the cardboard that extra function, which is a major financial advantage.

*Title of the dissertation: Dispersion coating for active food packaging.*

## *Ready meal consumers mapped*

We eat ready meals most often for lunch at work – or alone in front of the television. And we do so for reasons of time and convenience. This has been demonstrated by SIK researcher Mia Prim in her PhD dissertation in which she has conducted a survey of ready-meal consumers.

The aim of Mia Prim's research is that producers should be able to improve the attractiveness of ready meals by adapting them better to the consumer. In order to acquire more knowledge of the needs and situation of consumers she has studied the eating habits of a large number of people in Gothenburg and their attitudes to ready meals.

"I wanted to understand why they bought ready meals and at the same time describe typical ready meal situations and confirm crucial factors when buying ready meals."

The survey showed that the participants most often eat ready meals at work for lunch or for dinner at home. At work they often eat with colleagues while talking. When eating dinner people eat mostly alone in front of the television. Many wanted to see ready-made stews, more vegetables and food with more taste.

"For a working lunch saving time is most important. When it comes to dinner at home it is mostly a matter of convenience," says Mia Prim, who also saw a difference between men and women:

"Women are generally more demanding, particularly when it comes to food and health. However, the purchasing frequency among men and women is the same."

Mia Prim feels that the food industry and stores ought to cooperate in order to make ready meals more attractive. At present stores are not designed optimally to sell food which is ready-made.

"I hope the companies make use of my work in order to adapt their products better to the consumers' meal situations and the need for easily available food solutions. Ready meals are eaten because they are good, they save time and they are convenient. The growth potential is enormous."

*Title of the dissertation: Ready meals from the consumers' perspective – attitudes, beliefs, contexts and appropriateness.*

# SIK research projects 2007

## *Product design of tomorrow*

Active starch-based coatings  
Project Manager: Mats Stading

Biogradable films as an environmentally friendly packaging solution for fruit  
Project Manager: Mats Stading

Healthy lifestyle in Europe by nutrition in adolescence (HELENA))  
Project Manager: Gunnar Hall

New products from foamed sorghum  
Project Manager: Mats Stading

Oxygen scavenging and aroma affecting enzymes embedded in barrier coatings  
Project Manager: Anders Leufvén

Scientific basis for an international standard on "easy to open" packages  
Project Manager: Annika Åström

Towards a new generation of healthier and tastier ready-to-eat meals with fresh ingredients  
Project Manager: Anders Leufvén

The VINN Excellence Center: Supramolecular biomaterials – Structure dynamics and properties  
Project Manager: Anne-Marie Hermansson

Healthy structuring – Nutritional and structural design of natural foods for health and vitality  
Project Manager: Maud Langton

Controlled release – new controlled release systems produced by self-assembly of biopolymers and colloid particles at the fluid-fluid interface  
Project Manager: Anne-Marie Hermansson

### *PhD projects:*

Structure-failure behaviour of biopolymer gel mixtures  
PhD student: Jenny Brink  
Supervisor: Anne-Marie Hermansson

Ready meals and consumers' meal experience  
PhD student: Mia Prim  
Supervisor: Gunnar Hall

Active product packaging interaction surfaces  
PhD student: Anna Nestorson  
Supervisor: Anders Leufvén

Enhanced films for controlled release  
PhD student: Maria Petersson  
Supervisor: Mats Stading

Structure design for optimal sweetness intensity in food model systems  
PhD student: Karin Holm  
Supervisor: Anne-Marie Hermansson

Material properties of biopolymer films and foams  
PhD student: Thomas Gillgren  
Supervisor: Mats Stading

## *Product safety and consumer trust*

LOGISAFE – Simulation of bacterial growth in the logistics chain  
Project Manager: Alexander Milanov

IMPLISTA Information Platform on International Standards for SMEs in the food sector  
Project Manager: Alexander Milanov

Image analysis as a tool for site-specific weed control  
Project Manager: Niklas Lorén

Consumer acceptance and trust; Recommendations for using health related claims in marketing  
Project Manager: Annika Åström

Packaging of fresh pistachio nuts under various conditions  
Project Manager: Anders Leufvén

The effect of crop variety and soil type on potato aroma  
Project Manager: Tim Nielsen

SAFEferment – Increased safety of fermented sausage by the application of production exposure assessment for VTEC  
Project Manager: Pernilla Arinder

## *Technology development and production*

Sustainable Plant Protection  
Project Manager: Ulf Sonesson

Grain Legumes - Environmental systems analysis of grain legumes for food and fodder  
Project Manager: Ulf Sonesson

Modelling traceability, risk evaluation and risk handling in food process line design  
Project Manager: Karin Östergren

Biopowders  
Project Manager: Lilia Ahrné

LCA of salmon fisheries and aquaculture in the North East Pacific  
Project Manager: Ulf Sonesson

New technologies to reduce disposal of co-products (REPRO)  
Project Manager: Ulf Sonesson

Criteria for sustainability labelling  
Project Manager: Ulf Sonesson

Tools for productive and environmentally efficient food production management  
Project Manager: Karin Östergren

NovelQ – Novel processing methods for the production and distribution of high-quality and safe foods  
Project Manager: Lilia Ahrné

Development of Mozambican shelf-stable fruit products with high quality  
Project Manager: Lilia Ahrné

High Q RTE Innovative non-thermal processing technologies to improve the quality and safety of ready-to-eat meals  
Project Manager: Elisabeth Borch

Expert systems for improving the microwave heating uniformity of prepared foods  
Project Manager: Birgitta Raaholt

### *PhD projects:*

In-line rheology for enhanced food quality  
PhD student: Johan Wiklund  
Supervisor: Mats Stading/Lilia Ahrné

Energy-effective microwave drying  
PhD student: Emma Holtz  
Supervisor: Lilia Ahrné

Decontamination of heat-sensitive powder food ingredients by infrared heating  
PhD student: Norman Staack  
Supervisor: Lilia Ahrné

Osmotic dehydration of mango and papaya  
PhD student: Maida Khan  
Supervisor: Lilia Ahrné

A robot system for sensitive and flexible hygienic handling of food items

PhD student: Anders Petersson

Supervisor: Thomas Ohlsson

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Brink, Jenny; Langton, Maud; Stading, Mats; Hermansson, Anne-Marie  
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# *Networks offer greater know-how and new contacts*

If you want to remain up-to-date on strategic areas of development SIK runs a number of networks that you can join.

SIK currently runs networks in a range of areas, including healthy foods, lean production and food and climate.

Within the networks meeting points are created where the participants can increase their knowledge and stay in touch with the latest developments in strategically important areas.

The network method is also effective in emergency situations such as the acrylamide scare some years ago.



## **How do our networks function?**

Fundamental to the network concept is that the members join forces to decide on the scope and nature of their work in the future. The network should act as a forum where companies can air current problems in an open, constructive dialogue with each other and through informal contacts find out what is in the R&D pipeline.

Through a broad network of national and international contacts SIK has access at an early stage to interesting research results. Within the networks meetings and theme days are arranged to facilitate an active and multifaceted exchange of information and experience between network members, invited speakers and debaters. This contributes to a unique build-up of know-how and expertise among the network members.

SIK website [www.sik.se](http://www.sik.se) contains further information about our current networks.



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[www.sik.se](http://www.sik.se)

## SIK board

The responsibility and authority of the SIK Board are governed, among other things, by the Companies Act, the Articles of Association and the rules of procedure for the Board.

The owner of SIK, SP Technical Research Institute of Sweden, appoints the SIK Board following consultation with the SIK Members' Association. The SIK Board is as follows:

### Members elected at the annual general meeting

Jan Rosenström, Chairman  
Agneta Dreber, Livsmedelsföretagen (Li)  
Bernt Gustafsson  
Gunilla Jönson, LTH  
Maria Khorsand, SP  
Inger C Larsson, Findus Sverige AB  
Jan-Olof Lidfeldt, Karlshamns AB  
Thomas Svaton, Svensk Dagligvaruhandel

### Employee representatives

Claes-Göran Andersson, SIF  
Annika Åström, SACO/CF

### Auditors

Bo Strömberg, Authorised Public Accountant  
Öhrlings PricewaterhouseCoopers  
Bengt Kron, Deputy Auditor  
Öhrlings PricewaterhouseCoopers

## Industrial Advisory Group

The Industrial Advisory Group assists the Board in a consultative capacity and submits proposals concerning guidelines and programmes for the Institute's research activities, knowledge transfer and working procedures for contacts with industry.

The Group monitors SIK's activities and listens to feedback from members of the SIK Members' Association. It also participates in the planning of the Institute's three-year research programme and the evaluation of SIK's activities.

The Industrial Advisory Group consists of some thirty representatives from member companies who have experience of and insight into research and development in the food industry. The Chairman and members of the Group are nominated by the President of SIK and appointed by the SIK Board.

### Advisory Group

Rickard Albin, Campbell Soup Sweden AB  
Kenneth Alness, Svenska Lantmännen  
Henrik J. Andersen, Arla Foods  
Jörgen Andersson, NordMills AB  
Rolf Andersson, SCA Hygiene products AB  
Bert-Ove Bejevik, Tetra Pak Dairy & Beverage Systems AB  
Sandra Flodström, Santa Maria AB  
Pia Fäldt, Aromatic AB  
Bert Holmqvist, Swedish Meats AB  
Håkan Hulander, Abba Seafood AB  
Kjell Ivarsson, Lantbrukarnas Riksförbund  
Lars Bo Jörgensen, Danisco Sugar AB  
Mats Larsson, Lantmännen Food R&D  
Anders Lassing, FMC Foodtech AB  
Mats Lennersten, Göteborgs Kex AB  
Marianne Lindblom, Kraft Foods Sverige  
Christian Malmberg, Cloetta Fazer Produktion AB  
Stefan Olsson, Ecolab A/S  
Hans-Erik Pettersson, Svensk Mjölk  
Hasse Redestam, AB Sardus  
Elisabeth Rytter, Li  
Anna Ström, Unilever R&D  
Ulla Stöllman, Procordia Food AB  
Svante Svensson, Orkla ASA  
Mari Widov, Findus AB

# The SIK Members' Association

The SIK Members' Association is a non-profit-making association. The primary purpose of the Association is to promote technical and scientific research and higher education and to disseminate know-how and applications within food and biotechnology – and related areas – and in doing increase the competitiveness of industry. Members of the Association are companies and organisations that work within or have links to the food and biotechnology industries and collaborating companies. The members make an annual contribution to SIK, which is used to finance in part the research, dissemination of know-how and service at SIK that will benefit the members.

The Members' Association puts forward proposals for the members of the SIK board and appoints the members of the SIK Industrial Committee. Through its board or through representatives from individual companies, the Association also has the opportunity to keep the Institute's management informed about areas that are considered particularly topical from the member companies' point of view.

## The Board of the SIK Members' Association

Peter Elving, Chairman  
Mikael Aru, Procordia Food  
Bo Berg, Milko  
Anne-Marie Dahlén, Svensk Mjöl AB  
Göran Harrysson, Tetra Pak International AB  
Bertil Pettersson, Jakobsdals Charkuteri AB

## Auditors

Bo Strömberg, Authorised Public Accountant  
Öhrlings PricewaterhouseCoopers  
Bengt Kron, Deputy Auditor  
Öhrlings PricewaterhouseCoopers

The SIK Members' Association is a legal entity, independent of SIK.

The address is:

c/o SIK

Box 5401

SE-402 29 Gothenburg, Sweden

Phone: +46 31 335 56 00 (SIK switchboard)

# SIK Industrial Research Award

The SIK Industrial Research Award was established in 2000. According to the statutes:

*"The award is given to a person or persons in industry working for or who have links with food or biotechnology and collaborating companies, and who, through R&D co-operation with an industrial research institute or universities and colleges, have successfully contributed to industrial development in the food and/or biotechnology sectors".*

The winner of the award is selected by an award committee, comprising Nils-Georg Asp, Lund University, Lennart Björk, Swedish University of Agricultural Sciences, Sven-Olof Enfors, Royal Institute of Technology, Lena Gustafsson, Chalmers University of Technology, and Kaj Mårtensson, SIK.

The winners of the SIK Industrial Research Award to date are:

- 2000 Hans Burling, Arla FoU
- 2001 P O Werling, Kraft Freia Marabou
- 2002 Harald Skogman, BioGaia Fermentation AB
- 2003 Rickard Öste, Ceba Foods AB
- 2004 Gun-Britt Fransson, Orkla Foods AS
- 2005 Svante Svensson, Orkla Foods AS
- 2006 Ingmar Börjesson, Lantmännen Food R&D (formerly Cerealia)
- 2007 Christian Malmberg, Cloetta Fazer



Christian Malmberg, winner of the SIK Industrial Research Award 2007. Photo: Henrik Angetun

# Food and the climate threat – we know what you can do!

We determine the impact your product has on climate and help you to make environmental improvements. Make use of our extensive expertise.

There is an increasing focus on the effect that food and food production are having on our climate. Cultivation and processing are certainly having an impact, as are transport, packagings and waste.

We have worked since 1993 on quantifying the environmental effects of food products and identifying potential for improvements. Over the years we have built up extensive knowledge and experience and created a unique environmental database. Allow us to support you in the task of bringing about environmental improvements in your product.



*"We chose SIK as we needed independent information about our fish transport. SIK has access to good databases and is completely up to date on the latest research. We appreciate the attentiveness they demonstrated and the rapid, effective projects their staff have carried out for us."*

*Inger C Larsson, R&D Director, Findus Sverige AB*

*"In our endeavour to learn more about the impact of food on climate and to calculate the GWP of our brands, choosing SIK as a partner was an obvious move. We feel secure with the high degree of know-how and international networks SIK can offer in this area."*

*Kerstin Lindvall, Manager, Environment and Social Responsibility, ICA AB*

## Our environmental experts can provide:

- GWP calculations for your product, production, transport and packaging solutions
- an environmental evaluation of the life cycle of a product
- environmental improvement analyses

Would like to know more? Contact Thomas Angervall or Britta Florén on +46 31 335 56 00.  
You can also send an e-mail: [thomas.angervall@sik.se](mailto:thomas.angervall@sik.se) or [britta.floren@sik.se](mailto:britta.floren@sik.se)



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[www.sik.se](http://www.sik.se)

# The SIK Members' Association

3N Produkter AB, Helsingborg  
AarhusKarlsхамns Sweden AB,  
Karlsхамn  
Abba Seafood AB, Gothenburg  
AcobiaFLUX AB, Gothenburg  
AGA AB, Lidingö  
Almondy AB, Torslanda  
Arla Foods AB, Stockholm  
Aromatic AB, Stockholm  
ASM Foods AB, Mjölby  
Astra Tech AB, Mölndal  
Axfood Sverige AB, Solna  
Backens Skaleri AB, Falkenberg  
Barilla Alimentare SpA, Parma, Italy  
BE-Chark AB, Halmstad  
Berendsen Textil Service AB, Angered  
Bergströms Rökeri AB, Själevad  
Bimbo-group, Mexico  
BioReal (Sweden) AB, Gustavsberg  
Björnekulla Fruktingrunder AB, Åstorp  
Bohus BioTech AB, Strömstad  
Boxholm Mejeri AB, Boxholm  
Bröderna Nilsson AB, Gothenburg  
Campbell Soup Company, USA  
Campbell Soup Sweden AB, Kristianstad  
Cederroth International AB, Upplands-  
Väsby  
Ceres Foods AB, Bjuv  
Charkprodukter i Billesholm AB,  
Billesholm  
Chiquita International Services Group,  
Antwerpen, Belgium  
Cloetta Fazer Produktion AB, Ljungsbro  
CSM Bakery Supplies Division Europe,  
Warrill, United Kingdom  
Dahls Bageri AB, Gothenburg  
Danica Foods AB, Lycksele  
Danisco Sugar AB, Malmö  
Direkt Chark i Gothenburg AB,  
Gothenburg  
ECAB Djupfryst AB, Mjölby  
Ecolab AB, Hägersten  
EcoLean Development AB, Helsingborg  
Eklunds Chark AB, Linköping  
Emballator Lagan Plast AB, Ljungby  
Fam Olsson Kött & Charkuterier AB,  
Askim  
Finax Bröd AB, Trelleborg  
Findus Sverige AB, Bjuv  
Finnerödja Bär AB, Hisings Backa  
Fiskberedning Paul Mattsson AB, Ellös

FMC FoodTech Sweden, Helsingborg  
Foodmark Sweden AB/Rydbergs  
Sallader AB, Spånga  
Fram Foods AB, Lysekil  
Friesland Coberco Dairy Foods, Deventer,  
Netherlands  
Friggs AB, Stockholm  
General Mills Technology Center East,  
Minneapolis, USA  
GG Handel i Skara AB, Skara  
Gisip AB, Skövde  
Givaudan, Lund  
Godbiten Konditori AB, Åstorp  
Gården Partihandel AB, Lundsbrunn  
Gothenburgs Kex AB, Kungälv  
Hot Cuisine, Varberg  
Hägges Finbageri AB, Örnköldsvik  
ICA Sverige AB, Solna  
Iggesunds Paperboard AB, Strömsbruk  
ITI, Technical Institute of Iceland,  
Reykjavik, Iceland  
Jakobsdals Charkuteri AB, Gothenburg  
JMs Kött och Chark AB, Harplinge  
Jojjen AB, Västervik  
Jästbolaget AB, Sollentuna  
Kavli AB, O, Älvsjö  
Konsum Värmland, Karlstad  
Kraft Foods Sverige AB, Upplands Väsby  
Källbergs Industri AB, Töreboda  
Lantbrukarnas Riksförbund, Stockholm  
Lantmännen, Stockholm  
Leksandsbröd AB, Leksand  
Lindvalls Chark AB, Strömsnäsbruk  
LK Chark AB, Halmstad  
Lyckeby Stärkelsen Food & Fibre/  
Industrial, Kristianstad  
Marianne's Farm AB, Ängelholm  
Masterfoods Europe, Verden, Germany  
Mc Neil AB, Helsingborg  
Medipharm AB, Kågeröd  
MicVac AB, Gothenburg  
Milko ek.för., Östersund  
Mills DA, Oslo, Norway  
Munters Europe AB, Sollentuna  
Mälarchark AB, Eskilstuna  
Mäster Olof Kött AB, Gothenburg  
Novozymes Biopharma AB, Lund  
Nya August Larsson Charkuteri AB, Råda  
Opti Sverige AB, Motala  
Orientfalafel i Bjurholm AB, Bjurholm  
Outinens Potatis AB, Övertärneå

Per i Viken Chark AB, Höganäs  
Polarbröd AB, Älvsbyn  
Procordia Food AB, Eslöv  
Pågen AB, Malmö  
Recip AB, Årsta  
Rexcell Tissue & Airlaid AB, Bengtsfors  
Roberts, AB, Örebro  
Saab Aerotech AB, Linköping  
Salico KB, Helsingborg  
Santa Maria AB, Mölndal  
Sardus, AB, Helsingborg  
SCA Hygiene Products AB, Mölndal  
Scan AB, Johanneshov  
Semper AB, Stockholm  
Sigill Kvalitetssystem AB, Stockholm  
Skal-Man i Halmstad Potatis AB,  
Harplinge  
SKF Sverige AB, Gothenburg  
Sodexo AB, Stockholm  
Solanium Långås AB, Långås  
Stora Enso Skoghall AB, Karlstad  
Research Centre, Karlstad  
Strovels AB, Kristianstad  
Sveba-Dahlén AB, Fristad  
Svensk Mjölök AB, Lund  
Lantmännen, Stockholm  
Svenska Lantägg AB, Skara  
Svensson Partiaffär AB, Olle, Olofström  
Swedish Match North Europe AB,  
Gothenburg  
Swedish Oat Fiber AB, Väröbacka  
Swits Bake AB, Malmköping  
Tetra Pak Processing Systems Division,  
Lund  
Topp Chark AB, Bastuträsk  
Trensums Food AB, Tingsryd  
Uggjarps Slakteri AB, Malmö  
Unilever R&D, Vlaarding, Netherland  
Vaggeryds Chark AB, Vaggeryd  
Varbergskött AB, Varberg  
Västfem AB, Gothenburg  
Wasa Medicals AB, Halmstad  
Whirlpool Sweden AB, Norrköping  
Åbro Bryggeri, AB, Vimmerby  
Öresundscharck AB, Malmö



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