iapri

December 2018
Issue 51

GLOBAL PACKAGING RESEARCH

The international packaging research and education newsletter

Norway tackles fish supply chain

Two Norwegian IAPRI members are part of a consortium completing an innovation project looking at the fresh salmon supply chain, aiming to optimise packaging and 'fishing-to-fork' systems.

Bulk bag for transporting salmon

Both Nofima and Østfoldforskning are participating in the SeaPack project, which is funded by the Research Council of Norway, run by SalMar and includes suppliers such as Multivac and Marel. The project started in May 2016 and finishes in May 2019.

Senior scientist at Nofima Marit Kvalvåg Pettersen explains that the first work package focused on increasing yield from the salmon itself, food safety and quality. Another package looked at the reusable plastics crates and liner bags for big batches in transport packaging.

Tests showed it was possible, for example, to reduce the gauge of the film used for bulk-wrapping of fillets without compromising on mechanical strength or essential oxygen barrier. "For the inner liner, the reduction we achieved was approximately 10% of the thickness," says Pettersen.

SalMar says this means it is reducing plastics usage by around 27 tonnes a year.

At Østfold, research scientist Ellen Soldal says: "We are using lifecycle analysis (LCA) to investigate the environmental impacts of industry efforts to improve the processing, packaging and transport of seafood products."

Nofima's current work is focused on consumer packaging, says Pettersen. "Our first study included different pack concepts, and I've submitted an abstract for IAPRI 2019."

IAPRI 2019 Symposium update

Researchers planning to submit papers for the IAPRI 2019 Symposium in Twente, the Netherlands (11-14 June 2019) are reminded that the deadline for receiving abstracts for general-stream submissions and completed papers for the peer-review stream has been extended to 15 January.

The Scientific Committee has been set up, says organiser of the Symposium Roland ten Klooster of the University of Twente, and the website (see below) is constantly being updated. Working Group meetings are planned for the afternoon of Tuesday 11 June, he says.

In terms of accommodation, attendees should consider the U Park Hotel on the university campus, ten Klooster suggests. It is still under construction, but will be completed by February 2019.

www.iaprisymposium2019.org

This issue:

News

Technology spotlight

Member profile

Comment

Change and exchange

Arguably, research and education are all about exchange – whether of information or experience. So it is no coincidence that one of the prime objectives of the new IAPRI website is to facilitate knowledge exchange between member institutes and the individuals who work in these areas.

To make this work, however, it is important that you – the IAPRI members – explore and utilize the features on offer across the website.

Three categories of individuals at each member institute are granted access to the members-only area: Primary Contacts, who are the Delegates representing each institute in votes and ballots; Additional Contacts working within each institute; and Research Experts, who can be listed according to their areas of specialisation in the Research Experts Directory.

Once you have established your user name and password, you can update your contact information and find contact information for other individuals within the IAPRI family. You can join and participate in Working Groups and message boards. In the future, you will be able to post articles and information on your organization that you want others to know.

If you are the Delegate or Primary Contact, you will have the opportunity to promote your member institute by providing information to be shown in the Member Directory. This is available to other members and the general public who visit the IAPRI website, and is part of a searchable directory.

We hope it proves to be a valuable resource for yourselves and your institutes.

Ed Church, Secretary General

MSU's food innovation centre

Six months on from its official opening, the new Michigan State University (MSU) Food Processing and Innovation Center (FPIC) is providing businesses large and small with valuable pilot-scale options in packaging as well as upstream product processing.

Vacuum sealing in the packaging room

Officially opened at the beginning of June 2018, the FPIC is located five miles from the main MSU campus and consists of a 10,000-square-foot site with areas for raw and unprocessed foods, a finishing process room and a packaging room.

Bruce Harte, who is responsible for processing and packaging technical assistance at the centre, says: "The original concept was to accelerate economic development of small (but not start-up) and medium-size companies, by providing them with a leasable, fully-functional food manufacturing plant, where they could produce new products to take to the marketplace."

Harte adds: "Since the FPIC has been approved as a US Department of Agriculture (USDA), Food and Drug Administration (USFDA) and Michigan Department of Agriculture facility, whatever is manufactured can be sold to help companies recoup monies spent on the lease. Companies thus have the opportunity to test out new product ideas without a huge financial risk."

It is not just small and medium-sized businesses using the site. "Large companies are also using the facility as a short-term extension to their pilot plants, taking products from bench-top to small-scale commercial production," he explains.

There is a range of processing and packing systems, with key equipment including a spiral oven, spiral freezer and retort.

www.canr.msu.edu/fpic/

Australian food waste research

Australia's Fight Food Waste Cooperative Research Centre (CRC) has begun work, with members of RMIT University's School of Design about to launch new research projects with CRC industry partners, State government and others in the New Year.

The AUD$132 million (USD$95.4M) CRC is said to be the largest national collaboration now fighting food waste. Karli Verghese of RMIT's School of Design is one of three Research Program leaders, and is working alongside Simon Lockrey, also of RMIT. Both have been involved in developing the 2019 research.

The CRC comprises 44 industry partners, eight university partners and five State governments. The aim is to reduce food waste throughout the supply chain, transform unavoidable waste into "high-value co-products" and work with industry and consumers to encourage behavioural change.

The Fight Food Waste CRC was officially launched in Adelaide on 24 October 2018.

Verghese is leading the Reduce Research Program, which aims to reduce supply chain food losses. The two other programs are Transform, which is researching the transformation of waste resources, and Engage, which is about education, training and behavioural change.

fightfoodwastecrc.com.au

Nestlé creates new packaging institute

With the creation of the Nestlé Institute of Packaging Sciences announced at the beginning of the month, the company has said that its work will be focused on the "discovery and development of functional, safe and environmentally friendly packaging solutions."

The multinational emphasised the link between this announcement and its commitment to make 100% of its packaging recyclable or reusable by 2025. Like other parts of Nestlé R&D, including existing packaging research, it will be located in Lausanne, Switzerland.

CEO of the company Mark Schneider said: "We want to be a leader in developing the most sustainable packaging solutions for our food and beverage products. To achieve this, we are enhancing our research capabilities to develop new packaging materials and solutions. Through this, we hope to address the growing packaging waste problem, in particular plastics."

Consumer research at Nestlé

Schneider made it clear that the institute would be "a part of Nestlé's global research organisation." "It will employ around 50 people and include a state-of-the-art laboratory complex, as well as facilities for rapid prototyping," he said.

Nestlé chief technology officer Stefan Palzer explained: "Cutting-edge science as well as a close collaboration with globally leading academic institutions and industrial partners will deliver a pipeline of highly-performing environmentally-friendly packaging solutions."

Working with its R&D network of academic partners, suppliers and start-ups, the institute would "evaluate the safety and functionality of various sustainable packaging materials", the company said. Areas for research would include recyclable, biodegradable and compostable polymers, it added, functional paper, as well as "new packaging concepts and technologies to increase the recyclability of plastic packaging".

Any new solutions would be tested in various categories before being applied to products.

In 2017, Nestlé invested some CHF 1.7 billion ($1.71bn) in R&D, across all areas including food and nutrition. Some 58% of its global research budget is invested in Switzerland.

Colour management for Clemson

Christmas came early for Clemson University's Sonoco Institute of Packaging Design and Graphics, as well as its graphic communications department, in the form of hardware and software gifts from X-Rite Pantone, along with plans for a new inks and coatings laboratory, to be developed in conjunction with Siegwerk.

X-Rite donated in-kind gifts with a value of nearly $500,000, including the latest versions of its hardware and software for colour measurement and management, with installation and training included in the agreement, with a duration of at least three years.

Clemson says it now has the latest eXact and i1 spectrophotometers, as well as scanning tables, light booths and software including InkFormulation, ColorCert and NetProfiler.

"These gifts will enable us to enhance our capabilities to become a fully functional, professional ink lab," said assistant director of the Sonoco Institute Bobby Congdon.

The institute will also partner with Siegwerk over the next five years to develop next-generation print and ink technology through a new Siegwerk Inks and Coatings Laboratory. Among other objectives, the new lab will aim to support innovation in package design through ink technology and encourage research in energy-curable inks and coatings, says Clemson.

Founded in 2009, the Sonoco Institute offers an overlap between the graphic communications, food & nutrition and packaging science departments. Clemson believes it offers a unique, multidisciplinary approach to packaging.

Sustainable pack award for VTT

VTT, Finland, won in the 'Bio-based packaging' category of the Packaging Europe Sustainability Awards 2018, held in Gothenburg, Sweden, in late October, adding to its success with the structure in question.

The winning pack is a three-layer structure of cellulose each with different properties, said to be ideal for dry food packaging applications. The solution has also won the competition run by Ellen MacArthur Foundation, with the prize of a one-year accelerator programme, and the Ecopack Challenge award, which earned VTT the opportunity to co-operate with Marks & Spencer.

The Ellen MacArthur accelerator programme is progressing, says VTT research scientist Anna Tenhunen. "We are speeding up development of the material," she explains. "Our work focuses at the moment on the recyclability of the material and on upscaling."

Cushioned impact

In recent years, environmentally-driven emotion rather than science-based testing appears to have motivated many choices and specifications in transport cushioning. Several presentations at the Zhuhai Conference last June addressed some of the technical challenges in this area.

The type of protective packaging used for transport varies from application to application, depending in part on the value of the item and in part on likely hazards in transit. Preferences also vary from country to country, although screwed up balls of kraft paper seem to be an international lowest-common-denominator.

In Japan, a significant amount of research is going into making the specification and testing of cushioning materials (especially corrugated board) easier and more consistent. Kobe University professor Katsuhiko Saito says: "In Japan, you'll often see a switch from plastics foam to paper cushioning, such as corrugated board, for environmental reasons."

It is common for a single sheet of corrugated board to be folded so as to cushion products such as home electric appliances. "This is totally like Japanese 'origami'," says Saito. "But without plenty of experience, it is impossible to design the type of board cushioning appropriate to a given product."

Research at Kobe's Transport Packaging Laboratory has focused on transferring current thinking on plastics cushioning into the corrugated board arena. As Saito explains, establishing the cushion curve of plastics foam requires "a great many experiments". But recent research has shown that the cushion curve can be estimated even on the basis of a single dynamic compression test.

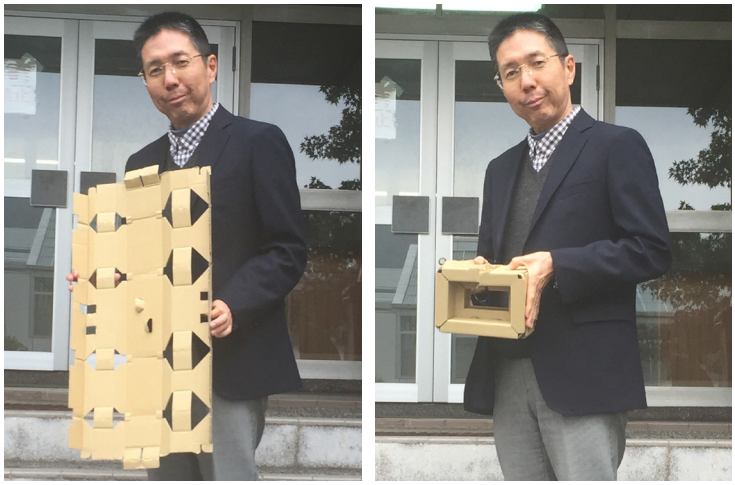
"Our own study found that with corrugated board, the limit of buckling can be estimated by the thickness of the board," he says. "Furthermore, we suggest that basic and easy design with simple folded board is possible by considering the law of the conservation of energy, and by carrying out only one dynamic compression test."

Costly and complex testing

The Kobe team presented a paper on these findings at the Zhuhai Conference in June. At future IAPRI events, Saito says he would be keen to compare notes with other researchers from elsewhere in the world specialising in transport packaging.

Another Japanese paper delivered in Zhuhai on the topic of tests for cushioning was from the Shinyei Testing Machinery Company. It proposed a 'simple shock test method' as an alternative to the more complex and costly damage boundary curve (DBC) test.

General manager Kazuaki Kawaguchi explains: "In Japan, small companies don't have sufficient time or budget to conduct a DBC test, because the shock test machine required for a DBC test is expensive for them. Lack of budget also means they cannot prepare a sufficient volume of test samples. So we have proposed a simpler test method with a lower cost."



Saito demonstrates the complex folded corrugated-board cushioning common in Japan

In 2016, Shinyei conducted research in its home market to determine why companies did not carry out a DBC test. Of those questioned, 19% said it was because of the difficulty of preparing enough test samples, and a further 12% blamed the cost of the shock test equipment.

The equipment supplier responded by exploring the possibility of creating a shock test system which was not only simple and affordable, but which also required only one test sample. According to Kawaguchi, trials with a portable shock test system suggest that it will provide critical acceleration data relatively simply – but also approximately. As he says: "If you need more accurate values, the current DBC test should be carried out with a specialised shock test machine."

The new method and machine are both still under development, he adds. Plans for follow-up research include applying the new test method to actual product, and comparing results to outcomes from current DBC test methods.

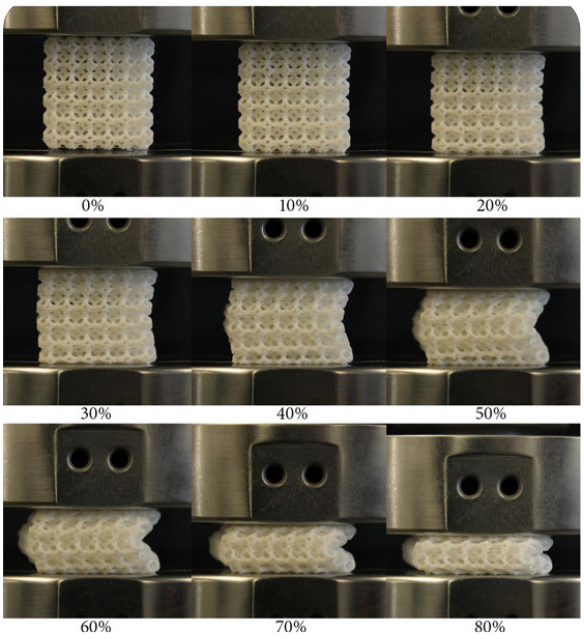
Board performance

One important variable in the performance of fibre-based cushioning (and packaging in general), of course, is moisture content in the board. Kobe University's Saito says: "When temperature and humidity are in a standard state, our completed study can apply to corrugated board cushioning folded in its various forms." But he adds that more work would be necessary to ▶

predict how moisture content in the board affects performance.

A team from Chinese co-host at the Zhuhai Conference Jinan University tackled a similar theme in another paper presented at the IAPRI event. Song-Ping Yang and Zhi-Wei Wang authored a paper on the influence of relative humidity on energy absorption of honeycomb paperboard. The research compared performance based on static compression testing and simulation at 30%, 50%, 70% and 90% relative humidity.

The relationship between thickness-to-length ratios in the honeycomb core, relative humidity and compression energy absorption is an important one, the researchers concluded. They also established that there was a good correlation between theoretical and experimental energy-absorption curves, suggesting that such curves can be used to relate material performance to relative humidity, and so help to optimise cushioning design.



Compression of 3D-printed cushioning foams

Other challenges with these traditional cushioning materials include the limited range of density and foam thickness, he adds.

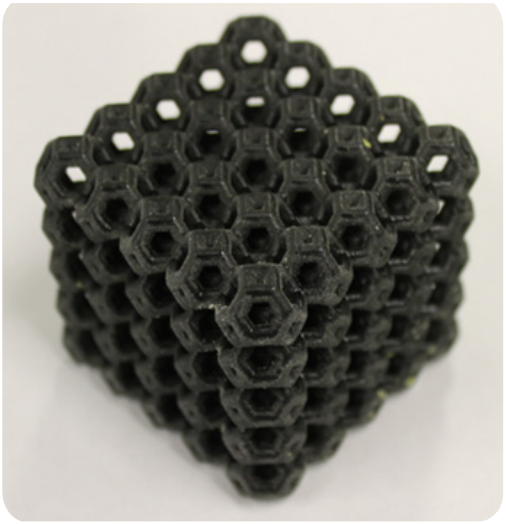
Instead, he and a team at RIT have been investigating the applicability of 3D-printed foams to cushioning. Once again, this research featured at the June IAPRI Conference.

Printed to fit

"Compared with the random cellular nature of foams produced by conventional extrusion processes, 3D-printed foams have a well-defined, repeating unit cell shape, size and density," says Changfeng. "This type of cushioning can be reused many times, since it is very resilient, while most traditional cushioning is single-use material."

The 3D-printing process provides engineers with the opportunity to tailor cushion materials in terms of size, shape and density for particular applications.

Another paper presented at the Zhuhai Conference, this time from teams at Shenzhen Polytechnic and Xi'an University of Technology, examined other aspects of paper honeycomb cushioning and its behaviour. To investigate the effects of vibration, researchers compared values under a finite element analytical model with experimental values, and found that the difference was less than 10%. They concluded that analytical models can be used in future to predict the natural frequency of different paper honeycomb structures.



RIT's 3D-printed cushioning

At Rochester Institute of Technology (RIT) in the US, Changfeng Ge of the Department of Packaging Science points out a common feature of those polymer foams traditionally used for cushioning, such as expanded polystyrene, expanded polyethylene, as well as polyurethane and polypropylene foams. "Conventional cushion foams have a network of random cell shapes and sizes, and the cushion performance is determined by the collective behaviour of these random cell structures," he says.

It will be much more feasible for me to produce energy-absorbing cellular materials using laser sintering

Drawbacks of this approach include, unsurprisingly, cost and productivity. "Thermoplastic polyurethane (TPU) and photopolymer are both more expensive than traditional cushion materials, although they can be used multiple times," he says. "And I used the filament extrusion process to print the 3D foam. It's very slow, and post-processing takes time, too."

Changfeng continues: "In future, I will be using a laser sintering machine, which will also process TPU. Since it melts polymer in powder form, rather than the very slow filament extrusion process, it will be much more feasible for me to produce energy-absorbing cellular materials this way. Better yet, there's no support structure to clean out, as there is with the Polyjet process. You just shake the part to remove the loose, unsintered powder from within the cellular structure."

Whether in North America, Asia or elsewhere, the amount of work being carried out in this area on materials new and old, in producing cushioning and in testing it, demonstrates that this protective function is as important as ever. As with so many other types of packaging, environmental performance is continually being weighed up against practical performance and cost against effectiveness.

RISE: Research Institutes of Sweden

Some members may not be aware of the fact, but the precursor organisation to Research Institutes of Sweden (RISE) was one of only a handful of founder members of IAPRI back in 1971.

Packforsk, as it was then, first merged with the pulp-and-paper industry's STFI in 2003, before evolving further with a name change to Innventia in 2009. Then, some two-and-a-half years ago, Innventia joined RISE.

This latest episode in the organisation's history is more than just a name change. Mikael Nygårds, research director within RISE Bioeconomy, Papermaking and Packaging, explains that the organisation is now 100% owned by the Swedish government, whereas Innventia was up to 70% privately-owned, with around 50% in the hands of just five large companies.

"The government understands that applied research is a national asset," he says. "It not only attracts investment but also has a direct impact on the development of our own industries."

Paper and packaging research now occupies a relatively small space within a much larger structure covering many different fields.

In all, RISE has around 2,700 employees. Senior research associate Thomas Trost estimates that there are around 90 or 100 scientists working in the Stockholm region across the twin areas of packaging and papermaking.

'We have new labs and offices, with a fair amount of investment in improved facilities. We want to invest still more'

The hub for packaging research is the RISE Packaging Science Centre, created on the former Packforsk site in Kista on the outskirts of the capital. "We have new labs and offices, with a fair amount of investment in improved facilities," he says. "We want to invest still more."

What kind of support can the organisation offer to industry? Nygårds provides an example: "Say you are a brand-owner with a turnover of several million dollars, transporting glass and wanting to be sure you're doing it safely. You want to investigate the burst strength of your corrugated board. There's a bridge there that needs to be crossed, and we are able to offer expertise and understanding of both the packaging materials involved and the total package."

Although terminology may have changed, the organisation has always had a focus on the bioeconomy, he insists. "We think that is

Mikael Nygårds (right) and Thomas Trost in the RISE packaging lab

where growth lies," Nygårds says. "Of course, plastics will always be there. But we think we can give the most support to industry in the areas of bioeconomy and sustainability."

While industry may no longer have any ownership role, it funds around 75% of packaging research, he estimates. Ongoing research programmes include: one on paperboard, covering areas such as converting, creasing, folding, printing and overall performance; one on corrugated board, examining areas such as transport testing, creep behaviour and other phenomena; and one on renewable barriers.

While some customers are from the Nordic region, many others come to RISE from considerably further away than that. Around 34 companies are signed up to the nine research programmes across paper and packaging, with some 15 of them involved in specific packaging-related programmes.

Trost says: "We also have our Trade & Industry Groups, such as the Packaging and Product Protection Group and our Corrugated Group. These can act as a bridge between the SMEs and larger players. What we offer is a 'helicopter' view of the whole technical area."

In the future, the organisation hopes to work on more EU projects, but also bilaterally with research partners located anywhere from the US to India – including with other IAPRI members, Nygårds adds.

www.ri.se

www.iapri.org International Association of Packaging Research Institutes
IAPRI was established in 1971 as an international membership association to promote packaging research. It is a unique global network which allows organisations to communicate and develop ideas, exchange experiences and in many cases reduce duplication of effort.
For more information please contact: IAPRI Secretary General, Ed Church e: sg@iapri.org
To contribute to the next issue of 'global packaging research', please contact Editor Paul Gander e: paul@gander123.plus.com
Published by Whitmar Publications on behalf of IAPRI