The journal of biodegradable, renewable and sustainable packaging

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biopackaging world is published every two weeks. Each issue includes consultancy-level articles that provide independent analysis and exclusive primary market data on sustainable and renewable packaging trends, markets and technologies. Each issue provides exclusive reporting of latest material and product launches, trials and breakthroughs.
DuPont extends sustainable range

DuPont packaging expanded its Biomax range in September to include the Biomax 300 product. The heat stabilising modifier withstands higher temperatures throughout storage, transport and use, therefore extending the potential for PLA applications.

‘DuPont has demonstrated that PLA articles formed with Biomax Thermal 300 added at low levels (2–4% and on two-stage thermoforming processes), will remain dimensionally stable at temperatures as high as 95°C (200°F),’ explains Susan Homan, North American global marketing manager for sustainable materials at DuPont Packaging.

She adds: ‘It will raise the useful temperature of PLA significantly beyond PLA’s low glass transition temperature (55°C/130°F), which limits applications to those where exposure remains below this temperature, such as chilled food containers.’

DuPont expects the move will extend the usefulness of PLA thermoformed containers beyond chilled foods. The new modifier contains 50% renewable content by weight.

According to Homan, DuPont is continuing to evaluate the development of new offerings that can improve package sustainability, with a primary focus on renewably sourced materials.

DSD widens Green Dot usage

From 2009 Duales System Deutschland (DSD) will allow businesses to use the Green Dot logo on packaging without having to buy into the company’s packaging collection, recycling and disposal service.

Businesses wishing to use the Green Dot must meet the requirements of the German Packaging Ordinance to qualify for the logo and sign a trademark usage contract.

German consumers rely on the Dot for confirmation that companies are meeting their packaging recycling obligations.

According to DSD, 94% of German consumers see the Green Dot as an important sign that manufacturers have taken care with packaging recycling, making its wider availability positive for improving German recycling rates and quality.

‘Packaging recycling in Germany is getting more and more cost efficient,’ says DSD spokesperson Norbert Voll. ‘Maybe the recycling rates will not increase significantly because they have already reached a very high level, but the quality of recycling will improve even more, while getting cheaper at the same time.’

New Purac polymerisation comes online

C SM subsidiary Purac and Sulzer Chemtech have signed a deal creating a new polymerisation and devolatilisation process for PLA.

The agreement was sealed in September and promises to reduce process and product development time for the biopolymer.

‘Purac is very actively involved in setting up a number of partnerships with new PLA producers that will use the lactides from Purac as monomer in their PLA polymers production process,’ says Ruud Reichert, business manager at Purac.

As a result of the deal, Netherlands’ company Synbra will build a new 5,000 ton per year capacity plant. Due to be operating by the end of 2009, the plant will produce Biofoam, a PLA foam alternative, using the Purac/Sulzer technology.

‘The existing PLA on the market does not have suitable properties to allow foaming to low economic densities,’ says Jan Noordegraaf, managing director of Synbra.

The PURAC/Sulzer developments will help Synbra create an economically viable product.
According to Noordegraaf, Synbra can start immediately with making the product it needs on an acceptable scale using its own tailored polymerisation process. The company will start production immediately on what Noordegraaf calls ‘acceptable scale’ using its own tailored polymerisation process.

According to Noordegraaf, a number of forthcoming material launches based on the new process are expected, which will serve multiple markets using the new PLA. ‘By using Purac’s lactide feedstock, Synbra does not have to invest in this first step of the process, which needs a certain economy of scale to be economic.’

**Plantastic packaging**

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**Plantastic sets up new plant in Germany**

Australian biopolymer manufacturer Plantastic is to build a new manufacturing plant in Jena, Germany.

The news were announced in early September and signal an overarching commitment to bioplastics from the German government, which is supporting 45% of the plant’s development costs.

Plantastic hopes to establish thermoforming capacity by the first quarter of 2009, in an initial phase worth €1.2m. This will be followed by rigid sheet production. The move will eliminate sea freight costs, streamlining the supply chain and reducing prices for customers.

Brendan Morris, chief executive for Plantastic, says: ‘This move is supported by government subsidies. The first phase will involve setting up the thermoforming capacity and, following from that, the second phase will cover extrusion.’

He adds that the company hopes to deliver an improved service to customers and increase the speed at which it can bring products to market.

The new plant’s location will enable to company to service a wider market. ‘There are a lot of ways we can service both east and west European markets from Germany and there is a good base of skilled labour. We are getting the maximum amount of subsidies, as they like the technology we are looking to provide.’

**Stanelco doubles sales**

UK bioplastics manufacturer Stanelco has seen its sales double over the past year. The growth is due to both expansion within the bioplastics arm of the company and increasing mainstream customer demand for its products.

Paul Mines, chief executive for Stanelco, explains: ‘We have seen a change in the market over the last six to nine months. Last year a lot of people were trying out biopolymers, but these were the early adopters, whereas now the product uptake seems to be driven both by legislation and mainstream brand owners seeking differentiation.’

According to Mines, the company is broadening its end use applications, moving into areas such as thermoforming and applications beyond waste bags, like products lines in paper coating, cosmetics and dairy.

‘Now we’re seeing the larger converters and the multinational brand owners coming onboard,’ he adds. ‘It’s not a mass adoption of bioplastics yet. Analysts generally forecast growth of 25% over the next five years and we’ve seen a doubling over the last year.’
Companies, governments and consumers all play a role in developing tomorrow’s packaging. To help them, a recent four-year research programme could be about to put innovative new technologies on the map. Biopackaging World investigates

**Sustainable strategies**
As new materials like PLA rush to take on future packaging challenges, it’s worth reminding ourselves of their more humble brothers, paper and board. Amid today’s climate of eco concern, paper retains some handy characteristics compared with petroleum plastics. It is renewable, easily recyclable and suitable for a host of applications. Plus it is highly versatile. Take this versatility and combine it with some nifty thinking and great things could be around the corner.

The Sustainpack research programme aims to assess, develop and improve the potential for all fibre-based packaging. It is no small effort. It is the largest and most important step taken thus far in sustainable packaging, lasting four years and devouring €30 million, €17 million of which was put up by the EU Sixth Framework Research Programme. With 35 partners from 13 countries getting involved, supported by research associations, academia and industry, it looks as if we can expect great things.

Growing demand
Future demands on packaging are ever evolving, with oil prices and climate change battering on the doors of conventional plastics. Hence Sustainpack has identified a set of key targets to improve barrier and performance characteristics while using fewer fibres. Among the programme’s targets is also providing more active and interactive components, and developing new structural design opportunities.

To do this Sustainpack promises to use nanotechnology to extend what it is currently possible to do with fibre-based packaging. This is no longer just about lightweighting or increasing strength. More futuristic nanotech applications are looking to develop dual benefits across the board.

‘Sustainpack aims to create new sustainable materials using fibre-based packaging and incorporating nanotechnology – with nanofibres and clay nanoplatelets,’ explains Stephanie Watts, who has worked on Work Package SP1 and is a packaging consultant at Pira International.

She understands just how bold the project’s goals really are: ‘Taking nanoclays and platelets and making PLA more resistant to temperatures could potentially open up a whole new marketplace for renewable films.’

Should such dreams become reality, we might find reengineered paper or PLA dominating the shelves of our local supermarket before too long. Nanoclays and nanofibrils can do many exciting things. Sustainpack has found it’s possible to blend nanoclay stacks with renewable polymers, in turn building bioplastics with enhanced properties.

Equally, the programme is taking steps towards combining nanofibril cellulose chains to achieve similar effects. It’s also important to create the right atmosphere to keep both consumers and environmental groups onside.
Nano fears

Similar fears to those which have slowed the uptake of GMO biopackaging could stall the adoption for nanotech too. So Sustainpack has used life-cycle analysis to get the best idea of the true environmental impacts, potential disposal or recycling issues and regulating, standardising and classifying the developments.

And from a cash outlook, there is also little value in creating exciting new possibilities if the market conditions aren’t suited to ever making a profit. So the project must also focus on identifying what the market genuinely needs from packaging. It has to deliver solutions to address these requirements and prove the commercial sense of the new applications.

Clearly taking on the challenge is a sizeable job, so the project partners devised a methodology to guide progress. Five technical research projects to meet the overall needs were chosen, guided by an overarching primary theme scoping market needs and directing the underlying work. Specific areas for investigation include a nano facility for cellulose- and mineral-based nanostructures. A focus on renewable composite films comprised Research Project 3, while the fourth looked at coating to enhance barriers. 3-D composite packaging solutions and a final project focusing on communications complete the research landscape.

Real world applications

Alongside this work, Sustainpack also spotted the need for genuine real world demonstrators to help show what is being done. With the sums of money involved, a fair amount of head scratching would clearly result without some physical illustration of otherwise invisible happenings within the lab. The Packaging Solutions Projects set out to achieve this.

Numbering seven in total, they include a lightweighted corrugate box, a barrier coated tray for chilled ready meals with a nanocomposite film lid, and flexible packaging film for frozen food. Packaging film for snack products and a luxury board box featuring both biodegradable windows and anti-counterfeiting technology comprise the final line up.

The range and scope of the project is fairly mind boggling. How do you go about streamlining and organising such an immense amount of research or balancing individual costs with overarching goals?

Watts explains more: ‘The project was set up with initial background work with consumers. This identified the various trends, needs and drivers, as well as the various concerns within the market sectors. Following this, a number of sub projects were set up, one of which acted as an overview of the entire work, while others tackled individual technical opportunities.

‘It’s about increasing the potential and the range of these markets by looking at technology development through, among other things, the integration of nanotechnology,’ says Watts.

With any task of this nature, timescales are always critical. It’s hard to place a finger on just how long it can take to bring products to market. Initial research, consultancy and scoping all play a part in early development, and there’s much more to follow on from there.

‘The key to bear in mind here was that Sustainpack’s aim was to create new packaging materials using fibre-based packaging.’
Every single step has to be achieved before the biopackaging gets anywhere near the marketplace.

Setting the bar high

Glancing over the detail for some of the research projects illustrates again just how high the bar was set. Technical Research Project 2 – Lean and Effective Fibre-based Packaging – sets a material reduction target of 30%. This was working alongside the aim of building bending stiffness for paper and board by 30%. Such targets are unachievable with conventional technologies, but utilising cellulose nanofibrils for reinforcing packaging in ways that can be practically used in standard paper mills aimed to provide the answer.

Tom Lindstrom, leader of the Research Project 2, explains: ‘We succeeded in getting the nanofacilities up and running. From an intellectual point of view, we learnt what were the important parameters for mechanosorptive creep and finally offered two solutions: the use of hardwood fibres and the new cooking method for softwood fibres to make them less kinked.’

Watts adds: ‘Sub Project 2 looked at ways of making packaging leaner and more effective. This isn’t just about lightweighting; it’s using blends of nano and cellulose to increase strength and reduce weight. The third subproject looked at fibre-based composite films – particularly for frozen and ambient foods. Other sub projects covered protective coating technologies for cardboard, for wet or oily products – a potential for replacing PET coatings on board.’

Evidently there’s a need to remember four years is not a very long time to get from the drawing board to the factory gate. Researchers must move from a completely clean slate, completing consumer research, then R&D and testing for the technology. And even if they manage to devise a successful theory it’s then necessary to go through the regulations to make sure the products are safe and certified.

Source: Sustainpack

Seven packaging solutions projects were formed, as a result of the processes of technology mapping and identifying key market needs, which were completed at the outset of the Sustainpack project. The projects are defined in the table below, along with their respective project managers:

<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
<th>Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A corrugated box offering equivalent performance with lighter weight material, incorporating fibre based cushioning, barrier coatings and an RH indicator/logger</td>
<td>STFI, Sweden</td>
</tr>
<tr>
<td>2</td>
<td>A carton offering equivalent performance with lighter weight material incorporating barrier coatings and a 2D barcode</td>
<td>VTT, Finland</td>
</tr>
<tr>
<td>3</td>
<td>A carton offering equivalent performance with lighter weight material, incorporating a laminated barrier film and a 2D barcode</td>
<td>VTT, Finland</td>
</tr>
<tr>
<td>4</td>
<td>A barrier coated tray for chilled ready meals, sealed with a bio-based nanocomposite film lid and incorporating a temperature logger</td>
<td>A&amp;F, Netherlands</td>
</tr>
<tr>
<td>5</td>
<td>A flexible packaging film for frozen food incorporating barrier coatings and a temperature logger</td>
<td>ITENE, Spain</td>
</tr>
<tr>
<td>6</td>
<td>A flexible packaging film for snack products, incorporating barrier coatings and an RH indicator</td>
<td>Pira, UK</td>
</tr>
<tr>
<td>7</td>
<td>A carton board or micro-flute box for luxury goods incorporating a biodegradable polymer window moving image and anti-counterfeiting technology</td>
<td>DTI, Denmark; STU/Ba, Slovakia</td>
</tr>
</tbody>
</table>

Source: Sustainpack

Emphasises Watts. ‘I think this is one of the reasons why many of the technologies being developed by the sub projects are still at various stages of development rather than commercially available.’

Elsewhere, there are equally remarkable achievements. Packaging Solutions Project 1A set about creating a stronger, sustainable packaging format for fresh produce. It would be a stronger corrugated box, combined with fibre cushioning materials to keep fruit from bruising with a sustainable RH indicator. A hefty annual €9 million price tag for damage for fruit and veg on the European market provided a handy catalyst for the work.

The Kraftliner Box from Smurfit-Kappa and a MaterBi cushioning pad came out of the work, and the project’s partner 1B took care of testing...
to ASTM D 1596, ISO 535 and EN 61340-4-1, assessing suitability of the chosen materials to really keep apples or bananas safe.

**Ready made meals**

It’s not just about fresh fruit. The convenience-food market continues to grow, and is a key area where, particularly in the UK, it’s often impossible to grab a sustainable packaging option from the shelf.

So Packaging Solutions Project 4 turned its attention to a renewable package for ready-to-eat chilled food. The material would be fully biodegradable, use less material and limit migration of water and gases. Furthermore, it would resist 4–40°C with 100% relative humidity for ten days, with low permeability to water, gases and incorporate communicative labelling to tell the story.

As a result of the work, concepts and prototypes including tray lidding with nanoclays, coated thermoformable tray materials made from softwood fibres, MaterBi, gelatine and wax were all brought to light.

And there’s more good news in other places. Research Project 5 took a look at 3D composites. Ignoring egg cartons, there are presently very few fibre-based solutions to this sector on the market. So scientists set about modifying lignocellulosic fibres and combining cellulose fibres or nanocomponents with a thermoplastic natural biodegradable polymer.

Christine Chirat, project leader, believed it was possible to prepare thermopressed or thermomoulded 3-D composites from 30% to 50% fibre and a renewable matrix polymer, only regretting there was less time to develop an ‘industrially possible product’.

The diversity of the work and the gains achieved means Watts is comfortable, at this stage, with the successes measured. ‘Sustainpack has also covered cushioning material technologies through one of the sub projects, trying to replace oil-based non-renewable packaging materials like polystyrene.’

She adds: ‘Sub Project 6 looked at creating sustainable and fully printed communicative packaging – such as TTI and humidity indicator technologies and moving images printed directly on to packaging using sustainable “ingredients”.’

**Measuring success**

Nonetheless, it’s likely that the overall legacy of the work will be judged on how many truly sustainable, innovative packaging solutions appear on the market over forthcoming years.

Watt remains positive. She points out: ‘During the initial project, and as a result of the consumer work, a number of demonstrator projects were also set up. These looked at bringing together technology breakthroughs from the sub projects to make finished packaging to meet specific market applications. The market applications were developed through the initial consumer work.’

Some elements of these demonstrators, in particular interactive packaging elements, are closer to commercial availability than other technology breakthroughs, according to Watts.

Whatever the future may hold, it is clear that Sustainpack has made a key effort to overcome some of the crucial barriers preventing a mass market biopackaging breakthrough.

There are other issues too beyond the scope of the project. Matching the UK’s entire plastic packaging requirement from biopolymers would mean converting 10% of UK farmland to biopolymers. And consumers remain confused over what they really need to do at the shelf to help the environment.

‘For the future, some of these packaging technologies are likely to pursue various offshoot projects following the closure of Sustainpack; whilst other Sustainpack partners may try to patent some of their technology breakthroughs,’ explains Watts.

The project overall was extended from May to the end of September 2008. A report is expected to be published via the European Union, which is likely to discuss any offshoot projects and technology breakthroughs.
Like it or not, the letter of the law has the final say when it comes to biopackaging. *Biopackaging World* bids to make sense of some new trends and asks key players where it is all heading.

**Flying with the legal eagles**
European Bioplastics estimates that by 2011 worldwide annual bioplastic production will reach 1,500 kilotonnes. But what's going to make all this degradable plastic stick – changes in public perception, cost parity versus petroleum, positive steps by supermarkets, or higher product quality? Or will it be weighty documents handed down from Brussels or within member states' law that ultimately shine a torch for sustainability?

Legislation has done more than anything else to kick-start the green agenda in Europe. Some bemoan the lack of punitive measures hitting member states falling behind the pack or complain about indecipherable texts interpreted a thousand different ways. Overall, legal frameworks have given the continent as a whole a mighty shove in the right direction. But what's changing and what's coming next?

Firstly, a new packaging tax has hit the headlines in the Netherlands. With effect from 1 January 2008, all producers and importers of packaged products and point-of-sale packaging placing 15 tonnes of packaging or more on the Dutch market each year are liable to pay the packaging tax. That is between eight to 10 thousand companies paying tax on 95% of packaging in the country. This could generate €240 million in 2008 and €365 million in 2009. This is the first waste legislation working with greenhouse gas emissions to become effective in the EU. And the principle relies on the carbon footprint per kilogram of packaging material throughout the whole supply chain.

So what's the verdict? Some industry stakeholders reckon it could be a milestone in environmental legislation with significant impacts moving beyond the Netherlands. But others are more sceptical.

For bioplastics at least, the differentiation seems positive. Within the laws, they are recognised as a separate category of packaging material, distinguished by the acknowledgement of certification according to EN 13432. To make sure this works in practice, the use of the seedling logo is obligatory for packaging material classified as bioplastics. The charge for bioplastics material is €0.0641 per kilogram, which comes in at the same tariff as paper. Conventional plastics are charged at €0.3554 per kilogram.

Not crystal clear
The relative opportunities for cost to influence positive choice seem clear, but some disagree. The European Organisation for Packaging and the Environment (EUROPEN) wrote to the European Commission in May this year urging a hold on applying taxes to packaging, but why? We've already seen taxes on plastic bags in Ireland and pay-as-you throw schemes on kerbside packaging.

Julian Carroll, managing director at EUROPEN, defends his position: ‘In our opinion the science behind carbon calculations is very much open to interpretation. As yet there is no harmonised methodology agreed and the big question mark surrounds the source of energy which can be different from one production site to another.'
EUROPEN does not feel that this development is a positive environmental move either for the Netherlands or for the concept of so-called green taxation. In fact, it is disturbing that the Netherlands government has chosen to portray the tax as a “green tax” when in reality it is simply a fundraising measure.'

EUROPEN says that such rules actually act as ‘stealth taxes’ and rarely end up really going towards the environment, instead being siphoned off by other government coffers. It also claims that even before the resource savings from reduced damage and spoilage of packaging contents are taken into account, packaging is responsible for less than 1.8% of greenhouse gas emissions.

An EIPRO study found that, on average, packaging accounts for 8% of the total energy requirement of packaged products. It appears, therefore, that the carbon impact of packaging is far less significant than the carbon impact of packaged goods.

A study carried out for the Industry Council for Packaging and the Environment (INCPEN) came to a broadly similar conclusion, finding that the amount of energy locked up in the production of consumer goods is at least 10 times that used for the packaging.

Carroll has other concerns when it comes to free trade, one of the main battle grounds when it comes to any environmental regulation. The new tax applies equally to packaging produced in the Netherlands or packaging introduced into the Netherlands’ marketplace; so, from that point of view, there is no trade barrier. But EUROPEAN believes it does distort competition between packaging materials since the basis of apportioning different tax rates to different packaging materials is open to dispute.

‘There is a risk that the concept will be copied by other member states and industry should be concerned about that,’ emphasises Carroll. ‘We do not expect to see any amendment of the EU Packaging Directive which would aim to incorporate such a tax, since the competency of the EU to introduce taxes requires unanimous approval by all 27 member states, a very unlikely scenario.’

Harald Kaeb is chairman for European Bioplastics and he is excited by the logic behind the new rule. ‘It’s clear that this legislation is affecting bioplastics very heavily. The market share of bioplastics is growing and, as this increases, legislation will become increasingly important.’

He adds: ‘European Bioplastics has established an internal working group to deal with recovery and recycling issues. The goal is to develop specific recovery and recycling routes for bioplastics and to avoid any negative interference with traditional plastics recycling.’

The danger is that by getting mixed in with conventional plastic collections, PLA bottles
predicted increase in volumes should allow easier, more cost-efficient investment in sorting and recycling infrastructure for bioplastics. Until then PLA bottles must still sign up for the Green Dot system, prevalent in some form or another over many European countries excluding the UK. Cleverly, all other EN 13432 certified compostable plastic packaging is exempt from the Green Dot obligations in Germany, as a legal incentive to develop the market and push composting. PLA bottles are now collected in the Green Dot system. When volumes grow, PLA recycling can be established independently whether starting from the deposit or the Green Dot recovery system.

In other recent changes, from 2009 German companies can print the Green Dot on their packaging without having to use associated Green Dot collection and recycling systems. Divorcing the two could help consumers improve recycling quality, as the dot is widely recognised by the German public.

Kaeb believe there’s a big field for future action to pave the way for the recycling of bioplastic, adding that legislation can help guide the way there to avoid conflict and allow bioplastics to become a bigger part of the market.

‘Right now systems are running well, legislation can help to organise various streams in the best possible way,’ he says. ‘We’re building up the right working groups and talking to all stakeholders. The legislation in the Netherlands on CO$_2$-related packaging tax is really interesting; the tax is lower for bioplastics than for conventional plastic packaging products.’

The logic of the German system makes good sense to those in other countries. Chris Dow is managing director for Closed Loop Recycling in the UK and his primary focus is on food grade PET/HDPE recycling, specifically for milk bottles. ‘I am focused on the PET industry and believe that, while bioplastics have a place in packaging, I would like to see them refrain as they are very difficult to deal with in the recycling industry.’

It’s a reasonable viewpoint, as in the UK the infrastructure to separate out PLA from PET is even less advanced than on the continent. Dow himself is affected by other recent EU
law. From 27 March 2008, (EC) 282/2008 redefined requirements for recycled plastics used in food contact materials, setting up authorisation procedures for recycling processes used in the manufacture of recycled plastics for food contact use. Plus requirements exist for materials that can be recycled and efficiency of recycling processes to reduce contamination, with regulation by the European Food Safety Authority.

**Safe plastic recycling**
The laws hope to ensure plastic recycling remains safe given rising recycling rates, a rare example of legislation reacting to increases in recycling, as opposed to attempting to generate them.

Dow is happy with the news. ‘I see the changes as positive as they will bring certainty in regard to quality. We need to ensure that local UK governments are encouraged to introduce plastic recycling at the kerbside.’

Perhaps the granddaddy of all packaging legislation remains the Packaging Directive. Even now, it raises contention, as the argument swings between non-governmental organisations demanding higher targets and industries seeking consolidation of what has already been achieved. ‘The Packaging Directive is a positive move to ensure that companies are able to follow specification quality and not be allowed to interpret quality issues independently,’ says Dow.

This may well be true but if more examples like the Netherlands come into play, would this much desired uniformity be endangered, distancing companies which feel their products are being unfairly penalised?

Potential revisions to the Directive have to be guided by a deft hand. ‘Presently the Packaging Directive is the key law,’ Kaeb points out. ‘This is up for revision next year. There’s not much in there for bioplastics specifically right now, but there is organic recycling mentioned referring to the EN 13432 standard; we see this as part of the top level legislation.’

He believes that the first step to remove the market hurdles for bioplastics is to work out a basic position paper to be published around the end of the year. ‘We are in dialogue with most of the relevant industry associations to find best solutions in the future when bioplastics will reach bigger volumes.’

With the right discourse between all stakeholders, it’s to be hoped legislation can play the right role in tomorrow’s ever-changing climate.