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innovations and trends in

PACKAGING

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covid-19 impact on packaging

SAFETY * HYGIENE * BARRIER

One of the key trends in recent years has been the major shift in consumer sentiment in favour of environmentally friendly packaging solutions. While COVID-19 is unlikely to put a halt to this in the long run, there may be some impact on the speed of change in the short term as retailers' and customers' preferences seem to be shifting towards more pre-packaged items, such as fruit and vegetables, rather than buying them loose.

Essentially, the principles that packaging has long served – maintaining the **safety**, **hygiene**, and **integrity of goods** – come to the fore during the current crisis. While this may be a temporary trend, it does mean that the current consumer demand is likely to be for more, rather than less packaging.

The impact of a rise in eCommerce

Other sectors of the packaging industry will see stronger growth as buying habits evolve into longer-term behaviour change. With the closure of most physical retail stores during lockdown, online orders are booming as retailers attempt to keep sales going. Other retailers who may not have traditionally had a strong online presence have also been forced to shift their business model to eCommerce to ensure survival.

The requirement for eCommerce specific packaging is strong as a result. The retail focus is now on getting products safely to consumers first time, so the importance of packaging that offers the protection of goods through resistance technology has never been more crucial. Retailers want to minimise the risk of product loss or damage to reduce the potential of financial losses and returns.

Return-ready packaging will also increase the likelihood that retailers can get returned product back more quickly and without damage, giving them the ability to place goods back into their stock pool faster when availability might be scarce.

ECommerce packaging specialists within this sector are reporting increased demand and this is likely to continue. While some consumers will return to physical retail, once normality resumes, for others we could see a longer-term change in shopping habits. This is likely to make such specialists attractive, as targets for larger companies or as platforms for future acquisitions themselves.

The current crisis is unique in that it involves the shutting down of so-called non-essential shops. Whilst the closure of stores will reduce the need for disposable instore packaging in the short term, demand may shift to alternative uses. Disposable takeaway packaging options, for example, are now in higher demand as consumption patterns shift to food delivery. As well as booming business for the new food delivery giants, individual local restaurant and food businesses are also now launching their own delivery or food takeaway services, adapting their business models to meet the new consumer need – all of which requires packaging to ensure the food that is delivered is safe, warm and appealing.

Impact on the supply chain

Packaging companies, like all others, will need to adapt to deal with the global pandemic and there will inevitably be disruption in the supply chain. This is forcing packaging companies to look for contingency plans and to better understand their supply chains and their vulnerabilities. This could accelerate existing trends such as preferring domestic suppliers to big overseas suppliers (Alibaba/Amazon).

Packaging in post-corona times?

The long-term vision, corona or not, is still about sustainability and better recyclable packaging. This is not only in line with the demand of the consumers but with the commitments of the packaging industry and with European legislation.

Single-use packaging seems clean and safe, but they are nothing more than a form of symptom control. If there is anything we can learn from viruses such as SARS, Ebola, Mers and Corona, it is that our lifestyles make the living environment of animals too small, and viruses transfer from animals to humans. If the pandemic proves anything, it is that the world of food needs to switch to sustainable systems as soon as possible.

PLASTIC AFTER LOCKDOWN

Things must therefore be done differently, and even today there are several locally based cases that prove the feasibility of a circular approach. For example, there is **Tiffin**[1], a network of around a hundred restaurants in Brussels that offer a 5% discount on takeaway food when customers show up with their reusable lunchbox. Or the Ghent lunch concept **Djar**[2], which requires a guarantee for the glass jars in which their aperitif box is served. And **Billiecup**[3] uses the concept of reusable cups, launched by the initiative **Mei Plasticvrij**[4], that can be refilled with take-away coffee in hundreds of shops throughout Flanders.

Producers were already working on an innovation project to make sustainability even more central and will certainly continue to do so. However, yhe current trend continues to raise questions. After all, producers and supermarkets can only survive/grow by making consumers satisfied and are therefore invariably following their wishes. In recent years, for example, we have seen them willingly jump on the bandwagon of consumers asking for less or better packaging.

No one can say with certainty what will happen if mainly packaged products will continue to be sold. In any case, one thing is certain: every euro a consumer spends in the supermarket is a vote for a particular food system.

Sources: pack4food.be | KnackWeekend.be | packagingeurope.com

1 https://tiffin.be/
2 https://www.djar.fit/
3 https://billiecup.be/?lang=en
4 https://info.meiplasticvrij.be/

medical device packaging

SAFETY * SEALING * BARRIER * SHELF-LIFE

Medical device packaging is crucial to deliver the device to market safely and securely, with the sterile barrier intact. Poor packaging can cause safety issues to the medical device and their consumers. If a package holds a sterile medical device, it must arrive in hospitals and other medical facilities without any holes or broken seals, and it also has to survive or stand on a shelf for years without breaking.

Medical device packaging is regulated globally. The overall requirement is that the performances of the packaging must answer to what it has been designed for.

Sterile barrier systems (SBS) are intended to ensure the sterility of their contents until opened for use. They are also designed to permit aseptic presentation of their contents. The sterile barrier system provides protection for the sterile medical device but its ability to do so depends on how it is handled and stored. When the packaged and sterilized device undergoes repeated handling, additional protective packaging may need to be combined with the sterile barrier system to create an overall packaging system.

Medical device packaging has its own separate set of safety and security concerns, for good reason. Packaging not only protects a product from harm or tampering during transit but can display critical product information and brand marketing.

Applicable standards

EN ISO 11607 - Packaging for terminally sterilized medical devices - specifies the requirements for sterile barrier systems:

- ISO 11607-1 - Requirements for materials, sterile barrier systems and packaging - includes the validation of the packaging system design;
- ISO 11607-2 - Validation requirements for forming, sealing and assembly processes - covers packaging process validation.

The scopes of these standards apply wherever medical devices are packaged and sterilized. Therefore, they can be applicable to medical device manufacturer, a health care facility, or an organization that reprocesses medical devices.

EN 868 - Packaging materials and systems for medical devices which are to be sterilized

Medical packaging must meet 5 key requirements

Requirements	Features of a sterilization package	Testing
Biocompatibility & toxicological characteristics	Minimize risk for patient & user	Sensitization, irritation & cytotoxicity Control of conductivity & cleanliness as well as chemical properties & absence of pyrogens Guaranteed composition of the material
Compatibility with relevant sterilization processes	Enable effective sterilization	Sterilizer penetration test, porosity control Bioburden control Post-sterilization physical and chemical performance tests, monitoring of material composition.
Physical resistance and barrier	Provide physical protection & a bacterial barrier properties	Testing of physical performance & barrier performance to airborne fluids and particles Follow-up of his physical integrity Bacterial tests (BFE/Germproofness)
Demonstration of product shelf-life & sterility maintenance efficacy	Maintain sterility up to the specified date & point of use	Microbial aerosol challenge test Event related shelf life test Post-ageing tests of materials (accelerated & natural)
Compatibility with forming, sealing & assembly processes of the package	Allow aseptic opening	For films, drapability / folding & adhesive life tests surface tension control For pre-formed SBS, weldability, adhesive strength and peelability

Biocompatibility & toxicological characteristics

Biocompatibility is evaluated based on a risk assessment process according to standard EN ISO 10993-1.

For a medical device in contact with the surface of a lesion-free skin for a limited period of time (less than 24 hours), these tests should be considered: **EN ISO 10993-5:2009 - Biological evaluation of medical devices: Tests for in vitro cytotoxicity and ISO 10993-10 - Biological evaluation of medical devices: Tests for irritation and skin sensitization**

The chemicals released from device materials that contact the body may produce skin, mucosal, or eye irritation. In general terms, such irritation is a local tissue response characterized by the usual signs of inflammation—redness and swelling—and sometimes accompanied by heat and pain. Many chemicals can cause irritation, either immediate or delayed, and some of these may be present in materials as additives, processing or manufacturing aids, or inadvertent contaminants. For example, the organotin stabilizers used in nonmedical vinyl formulations are corrosive chemicals capable of causing irritation and necrosis when applied to mucosal surfaces; residual concentrations of ethylene oxide present in gas-sterilized devices can produce an irritant response if they are not reduced to acceptable levels before the device is used; and residues of such contaminants as chemical detergents in a particular batch of materials or devices can cause unexpected irritation responses in users or patients.

Toxicological & Patient/Healthcare Professional Safety can be verified by evaluating following properties:

- Conductivity test (BS 6524) / flammability test (CFR16 Part 1610)
- Measurement of pH (ISO 6588-2), sulphate (ISO 9198) & chloride (ISO 9197) content
- Material composition:
- Absence of recycled material to guarantee traceability
- Absence of optical brighteners (EN 868-2 Annex B)
- Free of phthalates, bisphenol A, natural latex, PVC, etc.
- Complies with the REACH directive, the Heavy Metals regulation according to RoHS, etc.

Compatibility with the relevant sterilisation processes

This compatibility can be verified using the following tests:

- Sterilizer penetration test
- Porosity control (ISO5636-3)
- Bioburden control (ISO11737)
- Post-sterilisation physical & chemical performance tests (EN868 series)
- Material composition monitoring (FTIR spectroscopy)
- Residue test EtO (ethylen oxide)

Physical resistance and barrier properties

The main physical resistance properties that should be evaluated are:

- Tearing resistance (EN21974)
- Bursting strength in dry (ISO 2758) or wet (ISO 3689) state
- Tensile strength in dry (ISO1924-2) or wet (ISO3781) state

The barrier performance to fluids, airborne particles or micro-organisms can be tested by:

- Water resistance (EN868-2 Annex D)
- Hydrostatic load test (EN20811)
- Mason Jar Test (EDANA 170-1-02)
- Resistance to low surface tension liquids (IST 80-8)
- Determination of the maximum pore diameter (EN868-2 Annex E)
- Thickness regularity (ISO534)
- BFE (Bacterial filtration efficiency) test (ASTM F2101)
- Germproofness" test with air passage (DIN 58953-6 § 4)
- Germproofness test in wet condition (DIN 58953-6 § 3)

Demonstration of product shelf-life & sterility maintenance efficacy

Following tests and procedures can be used to validate the finished packaging performance and stability:

Real-time or accelerated ageing test (ASTM F1980)

To demonstrate the shelf-life of the sterile packaging system all of the above mentioned property tests should be repeated after 5 years real-life or accelerated ageing.

Microbial aerosol challenge test

This test validates the finished packaging. The objective is to determine the effectiveness of the bacterial barrier of sterilised packs subjected to contamination illustrating maximised hospital storage conditions (Worst case scenario).

Event related shelf-life test

- The objective is to determine the effectiveness of the bacterial barrier of sterilised packs subjected to typical events of maximised hospital storage conditions during real-time storage (Worst case scenario).

Compatibility with packaging forming, sealing & assembly processes

The compatibility with respect to forming, sealing and assembly processes can be evaluated by the following tests:

Tests for sterilization films

- Drapability / folding tests (ISO9073-9 / ISO2493)
- Adhesive strength tests (surface tension control)

Tests for pre-formed sterile barrier systems

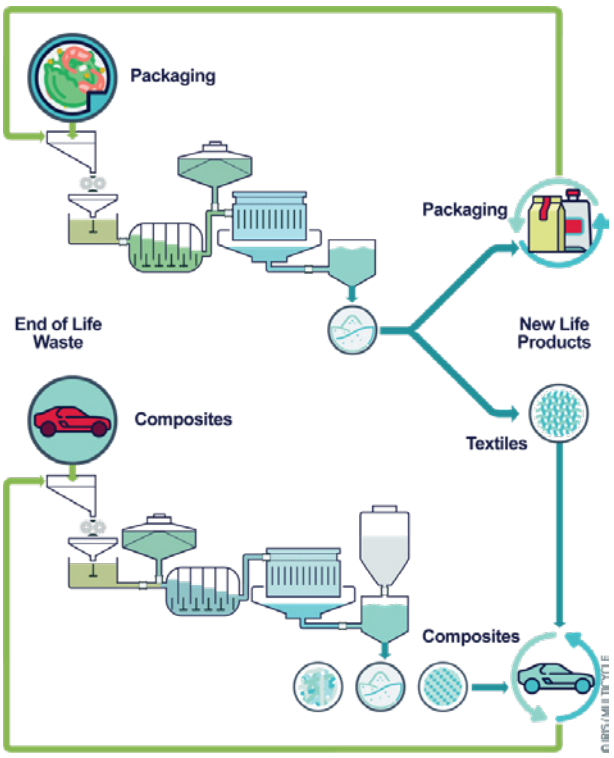
- Ability to be welded or bonded (EN868-5 Annex D / EN868-4 Annex C)
- Peel test EN 868-5 / ASTM-F88

MULTICYCLE

ADVANCED & SUSTAINABLE
RECYCLING FOR PLASTIC-BASED MULTI-MATERIALS

In line with the Plastic Strategy for Europe, the MultiCycle project helps realising a Circular Model in the plastic sector. Launched in November last year, this three-year EC Horizon 2020 Innovation Action is based on the Fraunhofer IVV patented CreaSolv® Process[1]. The main goal is to deliver an industrial recycling pilot plant for fossil and bio-based thermoplastic multilayer packaging and fibre reinforced composites. CreaSolv® is a selective, solvent-based extraction process which allows the recovery of pure plastics and fibres from mixed wastes without downgrading.

MultiCycle will optimize subsequent processing and formulation of the recovered materials to create valuable products and evaluate the environmental, social and economic sustainability and techno-economic-environmental feasibility of the proposed developments. In addition to recommendations for future upscaling, we will draft policy recommendations promoting waste management and resource efficiency improvements for the target packaging and automotive applications.



Centexbel-VKC is in charge of the characterization of recovered materials and the development of reprocessing procedures on a pilot scale. In a first stage, we characterized glass and carbon fibres recovered from thermoplastic composites. The residual amount of sizing as well as the presence of polymer matrix could be tuned by the CreaSolv® process which can be beneficial for the fibre-matrix adhesion in case of reprocessing in composites.

The recovered fibres were generally quite short, which is partly due to the type of input material and the pre-treatment step, where the thermoplastic composites are shredded to smaller pieces.

During the Creasolv® process itself, only minor physical stresses are generated without significant impacts on the fibre length. AIMPLAS is now investigating whether these fibres are suited to be applied as reinforcing filler for plastics.

The thermoplastic polymers recovered from reinforced car parts and multilayer flexible packaging have been thoroughly characterized in view of their reprocessing via film extrusion and melt spinning. In terms of composition, Fraunhofer IVV succeeded in obtaining mono-polymers of high purity.

1 CreaSolv® is a registered trademark of CreaCycle GmbH

From waste…

…to new materials

In terms of reprocessing, the properties of the recovered PP (r-PP) were in the same range as virgin PP grades for injection moulding applications. Indeed, preliminary injection moulding trials at AIMPLAS have shown that the mechanical properties of injection moulded samples containing r-PP materials are largely in line with the reference PP grade. Moreover, the obtained r-PE has properties which are similar to typical (blown) film extrusion grades.

AIMPLAS has also successfully produced blown films from recovered PE with mechanical performance in the same range of virgin PE, depending on the r-PE content (for some properties going up to 70% r-PE). Nevertheless, the r-PA6 and r-PET material properties indicated that the recovery processes needed further optimization.

Therefore, Fraunhofer IVV has been optimizing the recycling procedures for these polymers and **Centexbel-VKC** is currently performing lab scale filament and film extrusion trials with the new and improved r-PA6 an r-PET polymers

To be continued!

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http://multicycle-project.eu/

Sustainable Process Industry through Resource and Energy Efficiency

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 820695.

Interreg
North-West Europe

CurCol

BIO-BASED * SUSTAINABLE * COLORANT

Over the last ten years, many efforts were made to introduce more bioplastics in the packaging sector. In most cases they are reducing CO_2 emissions as well as our dependency on limited fossil resources while raising awareness among consumers. We can also observe a rising trend in the use of compostable packaging for articles that are not suitable for recycling, for example when they are heavely contaminated with food spills. These trends can only be encouraged. However we still have to find a solution for the additives including dyes and colorants that are widely used in packaging materials. These additives frequently contain heavy metals that may end up in waste water (and hence in the environement) via recycling processes.

This doesn't fit the greener packaging approach. In this perspective, **CurCol**, a new project was launched, in which Centexbel is one of the partners. In this Interreg project (part of the NWE program), we will study the production, introduction and processing of natural colorants for the packaging industry, with a focus on **curcumin**, a natural yellow colorant extracted from the plant **Curcuma longa**.

Curcumin (or Curcuma) is widely known as a yellow-coloring spice, adding a soft, bitter, typically warm and oriental taste to food. Furthermore, many health benefits have also been ascribed to it, such as an anti-inflammotary effect, detoxing capacity, the ability to decrease rheumatic pain, etc.

Regardless of curcumin's culinary and health benefits, Curcol will explore its environmental advantages to create greener packaging materials, as explained above.

To this end, an approach involving the complete value chain will be followed, starting with the growth and production of curcumin. Within this context, the following topics will be studied:

1 - The cultivation of curcuma. To this end, hydroponic and soil-bound cultivation systems will be compared and optimized. As a result, the first curcumin greenhouse will be established in Belgium. Based on the lessons learned during this experience, growing and harvesting guidelines will be created for other interested growers.

The cultivation and harvesting of the curcumin roots will be performed by PCG

2 - The extraction of curcumin.

After harvesting the roots, the curcumin extraction process will be investigated and optimized.

3 - The modification of curcumin.

Curcumin will be chemically modified to provide different colors, but also to improve the UV- and thermal stability of the obtained colorants. Three new colorants will be optimized and validated for optimal UV- and thermal stability.

The obtained curcumin will then be evaluated with respect to its color stability as well as its applicability in biopolymers, paper applications and in ink formulations.

Since curcumin is very sensitive to heat and UV, a further stabilization of the colorant will probably be required. Therefore, alternative additives are now being screened. In the context of creating 'green' packagings, it will also be primordial to focus on bio-based or even biodegradable additives.

As a result, **optimized plastic masterbatches and ink formulations** will be obtained, and their **applicability** will be demonstrated in **final packaging products**, including colored packaging films, reusable shopping bags (fabricated via tape extrusion), packaging trays (fabricated via thermoforming), bottles (via injection blow molding) and hard products (via injection molding).

A broad range of **plastic processing techniques** will thus be screened for their compatibility with the created masterbatches. In addition to plastic products, the colorants will be evaluated for their use in paper and biodegradable printing ink formulations.

The project will also include **LCA** (Life cycle assessment) and **TEA** (techno-economic assesment) evaluations to support the technical data and demonstrate the benefits of the products in selected business cases.

Finally, it will be evaluated whether the results are transferrable to other sectors, such as the textile sector.

Before you know it, you want curcu**MIN(E)** to become curcu**YOURS**!

Watch the CurCol video!

https://www.youtube.com/watch?v=OyOz7S2lsRk&feature=youtu.be

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https://www.centexbel.be/en/projects/curcol

Interreg North-West Europe CurCol

EUROPEAN UNION

European Regional Development Fund

AGENTSCHAP INNOVEREN & ONDERNEMEN

Vlaanderen is ondernemen

multi2recycle

RECYCLABILITY OF RIGID AND FLEXIBLE FOOD PACKAGING

Centexbel and partners have submitted a new project proposal for the Evaluation of the recyclability of flexible and rigid food packaging materials in function of their composition and the resulting shelf-life of food products.

Context

Plastic packaging materials are omnipresent. They preserve and protect the quality of the product and extend the shelf-life of packaged goods. Seemingly 'simple' foils and trays for the packaging of a broad range of food products often consist of multiple layers of different polymers, each contributing their own functionality to the overall packaging.

The food and packaging industry is being challenged by Europe and Belgium to prove the recyclability of their packaging materials. The European legislation imposes that 55% of all plastic packaging needs to be recycled by 2030 (EU Directive 2018/852). The Belgian Food Industry (FEVIA) states that 65% of plastic food packaging should be recycled by 2023.

In addtion, there is a strong consumer incentive due to the multitude of recent images of the environmental impact of plastic pollution on all media platforms.

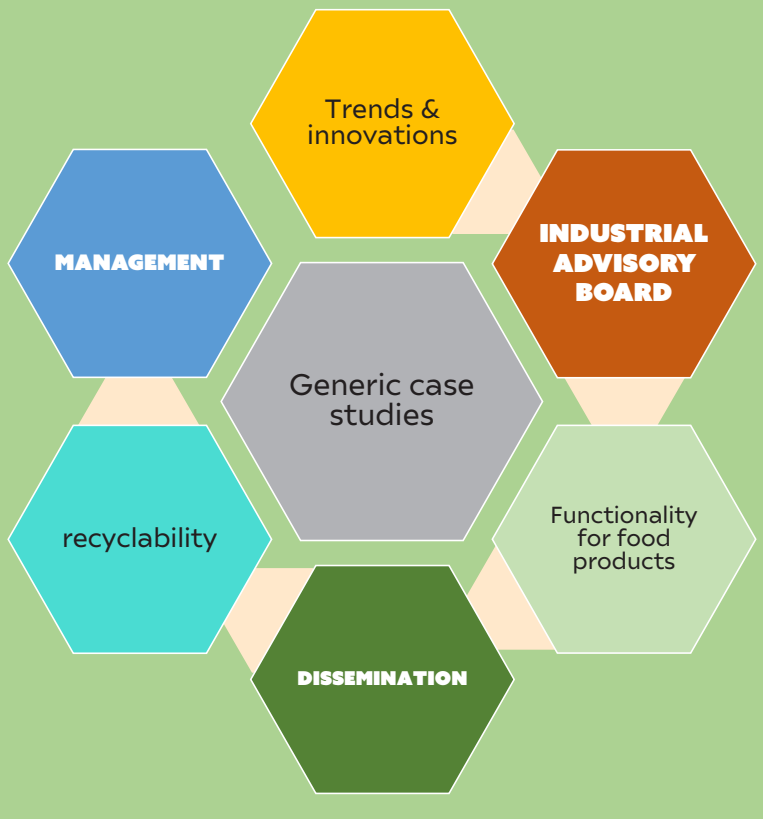
A transition to less complex packaging materials - without compromising the food safety and quality - can facilitate their recycling. Despite the many efforts and research activities, such as the work delivered in OPTIBARRIER, ReFOIL, CIRCOPACK, etc., there are still many questions and issues to tackle. In this context, we need to further develop our knowledge during the upcoming years.

Objectives

To replace non-recyclable multilayer packaging materials, the industry is currently using different coatings (e.g. AlOx, SiOx and PVDC and other barrier materials (e.g. EVOH) in combination with monolayer plastics (e.g. PP) to guarantee the shelf-life of food products. However, little is known however about their recyclability.

Therefore, to contribute to the above-mentioned knowledge acquisition, the Coock project 'Multi-2-Recycle' will pursue 3 goals:

1. Overview of the latest trends and innovations in the packaging industry, as well as in the sorting/recycling industry, relevant to enhance the circularity of food packages
2. Evaluation of the impact of the packaging composition (e.g. type and thickness of barrier materials on the mechanical recyclability of the packaging. In this context, recycling limits will be defined such as the tolerance level of EVOH for efficient recycling.
3. Based on these recycling limits, model packages will be produced and fully characterized, and the shelf-life of selected food products will be evaluated



Target group

The project addresses the needs of packaging producers, plastic converters, food processing companies, and the recycling companies.

What is a COOCK project?

COOCK stands for Collective Research and Development and Collective Knowledge Transfer. A COOCK project focuses on groups of companies (~ collective), with the aim of valorizing (basic) research results by accelerating the introduction of technology and/or knowledge (~ knowledge transfer).

A COOCK project consists of 2 parts:

PART A	PART B
The project partners, in close collaboration with the participating companies, will select generic packaging systems, determine their recycling limits and link this to the shelf-life of food products	The companies will transfer the knowledge aquired in part A to their specific application Company-specific implementation projects may include the analysis of: • the recyclability of a company specific packaging by the procedure demonstrated in part A • a new technology (e.g. based on the identified new trends) at the company's or partners' facilities • a new packaging composition for the company to determine if at least a similar shelf-life of the food can be obtained
DURATION	
3 years	5 years Starts together with part A and will run for another 2 years after the end of part A

Fingers crossed! By the end of this year we will know whether this project is approved!

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CREATE

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SOLVE