



The European voice of the **adhesive and sealant industry**

FEICA WEBINAR

Adhesives in the context of paper and board recycling - state of play

30 March 2023

10:00 - 11:00 Brussels CET

Proceedings

- Please be advised that this webinar will be recorded. By joining, you are consenting to the recording
- Note that you will be muted and your camera will be turned off automatically upon entry
- During the Q&A session following the presentations, you will be able to use the chat box to ask questions
- In case we don't have sufficient time during the Q&A session to address your question, please feel free to send your question to info@feica.eu
- The presentation slides and recording will be sent to all webinar registrants

Speakers - Moderators



Jana Cohrs

Executive Director Regulatory Affairs, FEICA



Elizabeth Staab

Global Packaging Sustainability Manager, HB Fuller and Chair, FEICA Task Force on Sustainability & Recycling of Adhesives in P&P Applications



Arne Jost

Senior Manager Circularity Assessment & Validation, Henkel and Member of the FEICA Task Force on Sustainability & Recycling of Adhesives in P&P Applications

Agenda

- 10:00** **Welcome by Jana Cohrs**
- 10:05 Overview of adhesives in paper and packaging by Elizabeth Staab
- 10:15 Recycling process and test methods by Arne Jost
- 10:40 Recommendations and look to the future by Elizabeth Staab
- 10:50 Q&A moderated by Jana Cohrs
- 11:00 Close of the webinar



Jana Cohrs

Executive Director Regulatory Affairs, FEICA

Welcome



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16 National Associations
representing 17 Countries
450+ members



25 Direct Company Members



25 Affiliate Company Members



Contribution of the adhesives and sealants industry in Europe

17 billion euros contribution to the EU economy

800 adhesives and sealants manufacturers, of which **90% are SMEs**

5 million tonnes of adhesives and sealants used in everyday products

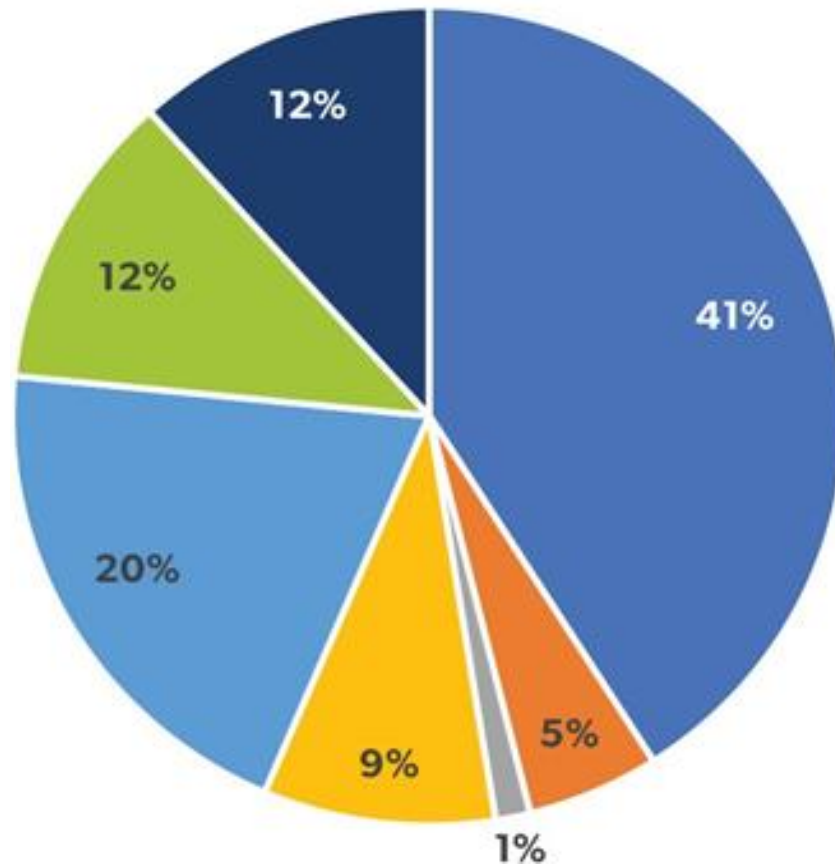
Investing **470 million euros in Research and Innovation**

Employing over **45,000 people**



European adhesives demand by market segment

ADHESIVES



- Paper, board & related products
- Transportation
- Footwear & leather
- Consumer/DIY
- Building, construction, civil engineering craftsmen
- Woodworking & joinery
- Assembly/other

FEICA expert group

Sustainability and Recycling of Adhesives Applications in Paper and Packaging

National Associations



Company Members



Printing Ink
Joint
industry TF

Food
Contact
Additives
Association

European
Food Contact
Legislation

X-sector
group



Campus
Wien

CEN TC
261

Packaging
Chain
Forum

European
Recovered
Paper
Council

European Packaging
and Packaging Waste
Regulation

CEFLEX

RecyClass

4evergreen

Cooperation and communication along the supply chain

- Adhesives in packaging are very complex. FEICA is supporting stakeholders with expertise
- Cooperation amongst different actors in the supply chain is key to further improving recycling
- More information on paper and packaging on our website: <https://www.feica.eu/our-projects/food-contact>
- For questions and comments after the webinar please contact us at info@feica.eu



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Elizabeth Staab

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FEICA Task Force on Sustainability & Recycling of Adhesives in
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Overview of adhesives in paper and packaging



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Chemistry and adhesive applications in fibre-based packaging

FEICA Webinar
March 30th, 2023

Elizabeth Staab
Global Sustainable Packaging
Manager

Agenda

- Adhesive Application & Functionality
- Hot Melt Adhesives
- Water-based Adhesives



Adhesive Application & Functionality

- Enable versatile packaging types
- Package integrity & food hygiene
- Labels for logistics, promotions etc.
- Wide range of applications
- Minor component of overall product packaging

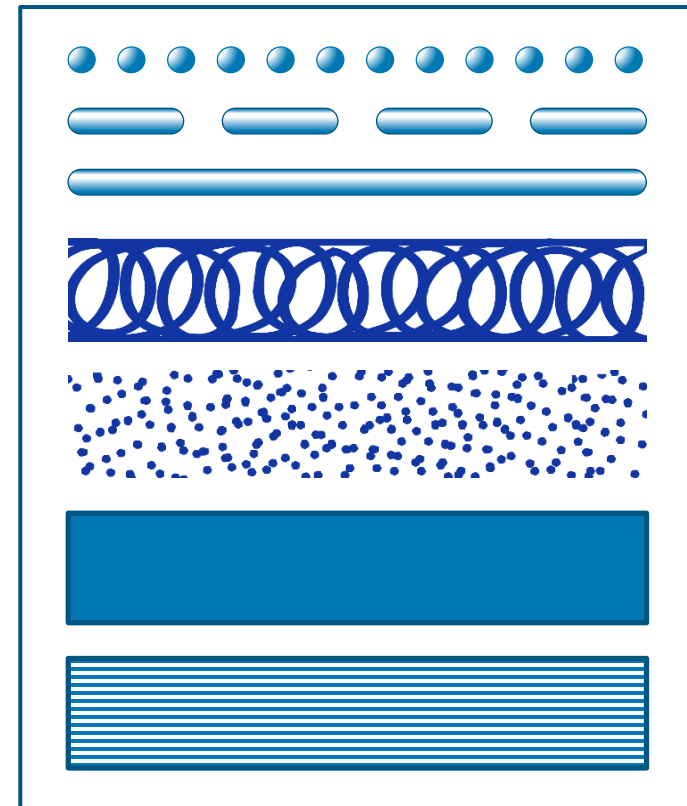


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How Adhesives are applied

Adhesive application techniques are as versatile as their packaging applications

- Application methods
 - Spray
 - Slot or Roll Coating
 - Roller (gravure, smooth)
 - Nozzles
 - Wheel / Disc
 - Other techniques
- Recyclability considerations



Adhesive application patterns

Contrasting demands on adhesives in paper products

APPLICATION

- Strong bond
- Often permanent (customer driven)
- Resistant to specific usage conditions

RECYCLING

- Easily detached from substrates
- Enables high quality paper recycling
- Compatible with paper recycling process

Hot Melt Adhesives

Typical Paper Applications - Standard Hot Melt Adhesives



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Hot Melt Adhesives

Typical Composition



Standard Hot Melt Adhesive

POLYMER

- EVA
- Rubber
- Polyolefin
- Metallocene Polyolefins
- Styrene block copolymer

RESIN

- Natural resin
- Aliphatic hydrocarbon
- Aromatic hydrocarbon

WAX

- Paraffin
- Micro-crystalline
- Synthetic

ADDITIVES

- Anti-oxidants
- Colour
- Other

Hot Melt Adhesives

Typical Applications of PSAs on Paper and Board



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Hot Melt Adhesives

Special Hot Melts – Pressure Sensitive Adhesives

- Form bond by application of light pressure
- Permanent or removable applications
- Typical raw materials
 - Styrene block copolymer
 - Tackifier Resins
 - Plasticizer
 - Additives





Hot Melt Adhesives

Behaviour in the paper recycling process

- Approach* for graphic papers often applied for fibre based packaging
- Adhesive application expected to be removable in paper recycling, if
 - Softening point is high enough
 - Application dimension appropriate and suitable for being removed in the process
- Valid for standard and PSA hot melts

Water-based Adhesives

Dispersions vs Solutions

Dispersions

- Distributed particles of a solid material dispersed in a continuous phase of a fluid medium
- Adhesive dispersions are typically mixtures of natural or synthetic solid polymer(s) in water



Water-based Adhesives

Dispersions vs Solutions

Aqueous Solution

- Polymer is dissolved in water
- No solid phase
- Transparent / translucent





Water-based Adhesives

Typical Composition

- Polymers
 - Synthetic : Vinyl Acetate Polymers (VAE, PVAc), acrylics, others
 - Natural: casein, dextrin, starch, natural rubber latex
- Other raw materials
 - Tackifiers, fillers, plasticizer
- Additives
 - Defoamer, preservatives, surfactants, UV-brightener

Water-based Adhesives

Typical Paper Applications

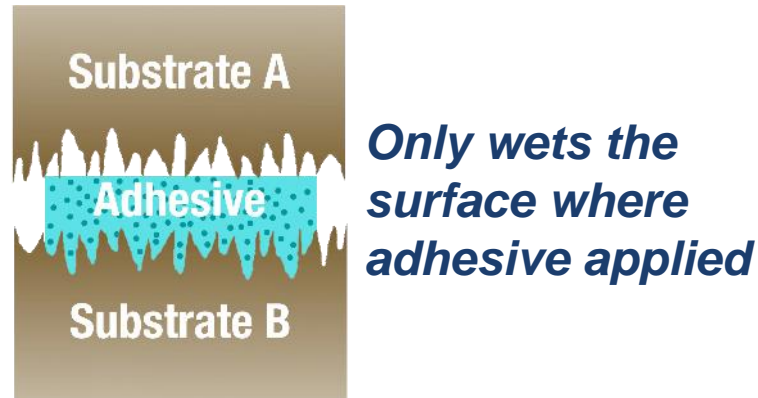
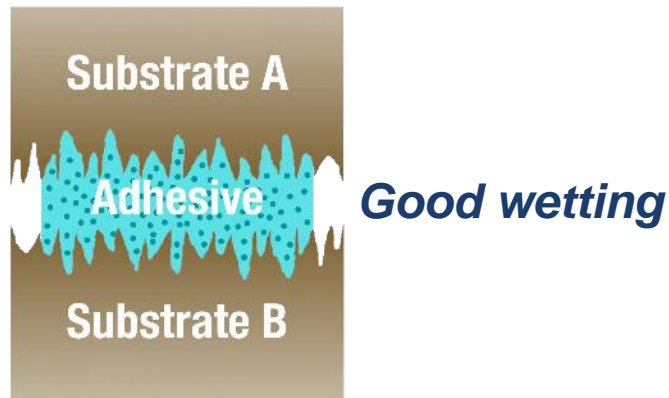


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Water-based Adhesives

Bond Formation by Wet Bonding

- Water acts as carrier
- At least one of the substrates is water absorbent
- Substrate wetting is key for performance
- Water evaporates / driven off by heat



Water-based Adhesives

Behaviour in Paper Recycling Processes

- No significant changes compared to recycled paper without adhesives
- Possible adhesive impacts
 - Adhesive partially detached and washed out; may remain in washing water
 - Adhesive partially remains in the fine reject
 - Adhesive slightly sticks to fibre and will be incorporated in the recycled paper
 - Various combinations of the above

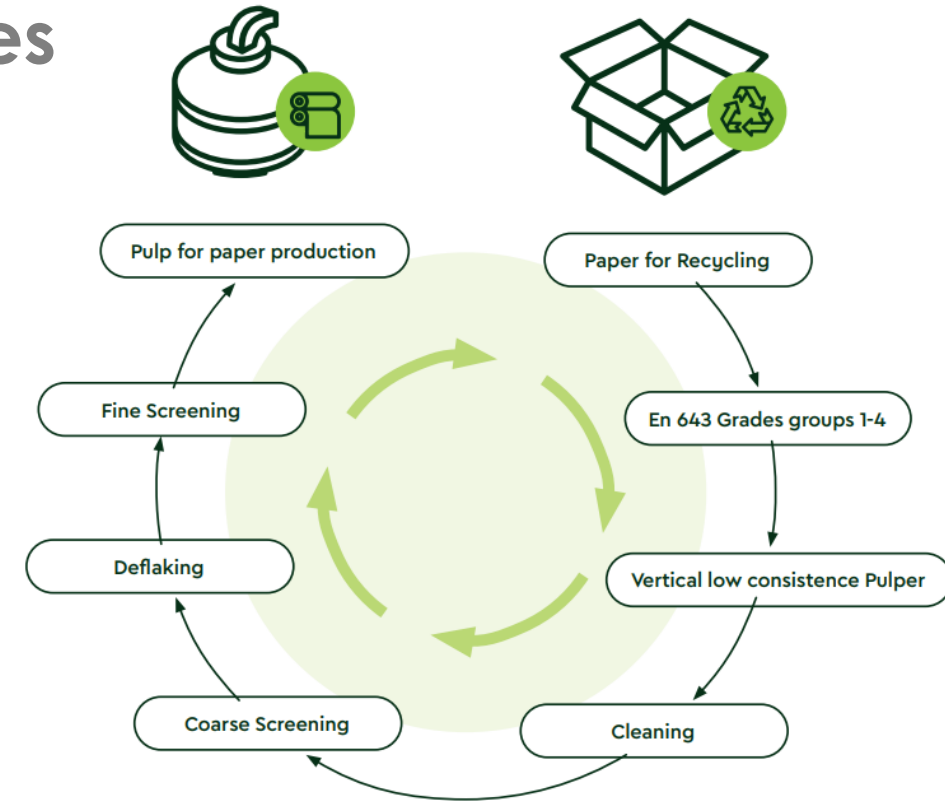


Figure 1. Recycling in standard paper mills

4evergreen-Circularity-by-Design-2.pdf

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Arne Jost

Senior Manager Circularity Assessment & Validation, Henkel and
Member of the FEICA Task Force on Sustainability & Recycling of
Adhesives in P&P Applications

Recycling process and test methods



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AGENDA

- 01 Adhesives in paper & board recycling
- 02 Adhesives in the recyclability test lab
- 03 Watch-outs in recyclability testing



Adhesives in paper & Cardboard recycling Overview (1/2)

- Adhesives are a **vital part** of fiber-based packaging
- Adhesives have been around for decades and are **well-managed** in paper mills.
- Still, next to **yield loss** and **visual impurities, stickiness** is a concern in paper mills.



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Adhesives are a well-established component in paper making.

Adhesives in paper & Cardboard recycling Overview (1/2)

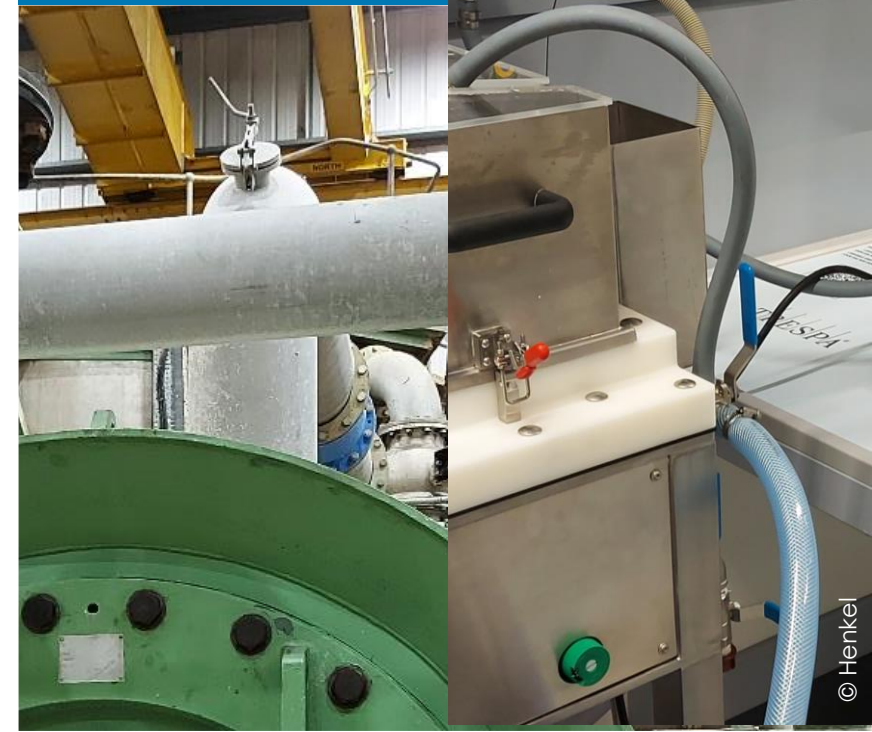
- **Adhesive applications** might cause challenges in paper/cardboard recycling due to their tackiness/stickiness:
 - Clogging/blocking of screens
 - Build-up on heated rollers
 - Runnability: tears, holes
 - Printability
 - Blocking of reels
- **Preventive measures:** screens, scrapers, neutralizing agents, cleaning of dryer fabric, flotation (de-inking)



**Paper mills are
equipped to deal
with stickiness.**

Differences between paper mills and recyclability test labs

- A lab process tries to **mimic** the **physical reality** of a paper mill. But each paper mill is different from one another!
- **Complexity** is reduced:
 - Not all real-life processes are considered.
 - Paper mills might receive waste from millions of households. The lab processes a well-defined dedicated sample.
- **Scale**
- The lab process is **standardized**.



A recyclability test lab is not a paper mill!

Adhesives in recyclability testing & evaluation overview

Adhesive applications are present at several testing steps:

Measure	CEPI/4evergreen
Yield (coarse & fine screening)	Mandatory
Evaporation residue	Indicative
Chemical oxygen demand	Optional
Sheet adhesion test AC-sheets	Indicative
Sheet adhesion test AF-sheets	Mandatory
Macro-sticky test	Optional
Reject quality	Not (yet) used

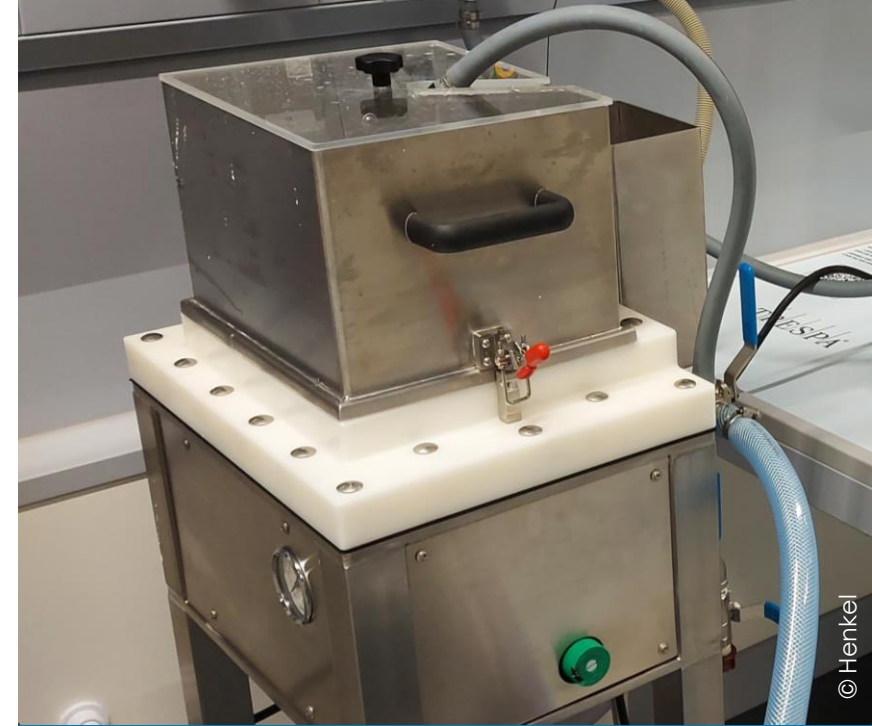


Adhesive applications are omnipresent in recyclability testing, but only yield and sheet adhesion are evaluated.

Adhesives in recyclability testing & evaluation

Focus: yield

- Various **materials** might impact yield (plastics, metals, etc.)
- **Adhesive applications**, at low quantities, will impact **yield**, as well:
 - Water solubles/colloidals → wastewater (-); final product (+)
 - Coarse screening → Reject (-)
 - Fine screening → Reject (-)
- **Fibers** may adhere to adhesive applications and become reject, as well.



© Henkel

Adhesive applications, at low quantities, impact on yield

Adhesives in recyclability testing & evaluation

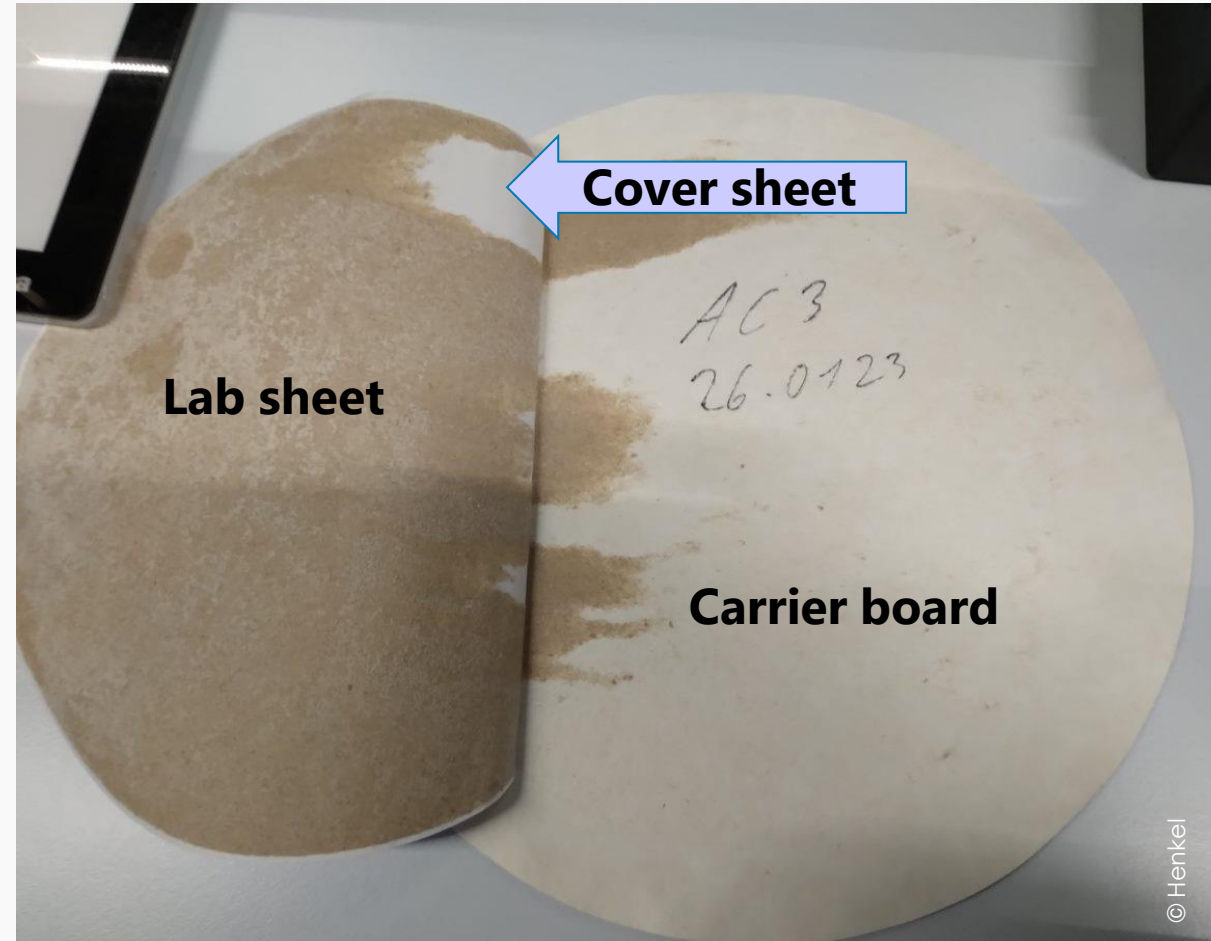
Focus: sheet adhesion test (1/2)

Objective:
stickiness/bonding between lab sheet and carrier board and/or cover sheet

Sheet former



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Adhesives in recyclability testing & evaluation

Focus: sheet adhesion test (2/2)

Challenges Capi test method



- Identical **cardboard support** (EN ISO 5269-2) vs. market reality
- **Peel angle & speed** not standardized
- Quality of recycled paper (**paper strength**)

Challenges 4evergreen Evaluation Scorecard



- **Evaluation Scorecard:**
tipping point
pass/knock-out unclear
and not reality-proven

Current Sheet Adhesion Test & Evaluation present challenges. 4evergreen WS1 works on improvements.

Adhesives in recyclability testing & evaluation

Focus: Macro-sticky Test

Objective: Determination of stickiness through particle size distribution and overall surface of sticky particles < 2 mm

Challenges Capi test method (optional)

- Test based on rejects
- Overlapping particles are miscounted
- Reflecting (but not sticky) particles such as metallized structures and plastics are counted



More work is needed on the macro-sticky test. 4evergreen WS1 and Aticelca (I) work on improvements.

Key take-aways

- **Adhesives** are a **vital part** of fiber-based packaging production and have been around for **decades**.
- Recyclability testing focuses on **yield** where adhesives play a minor role.
- Sticky-related **tests show challenges** which need to be addressed. **4evergreen WS1** works on improvements.



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Recommendations and look to the future





Adhesive Technology in Paper and Board

Market Trends

Elizabeth Staab
Global Packaging
Sustainability Manager

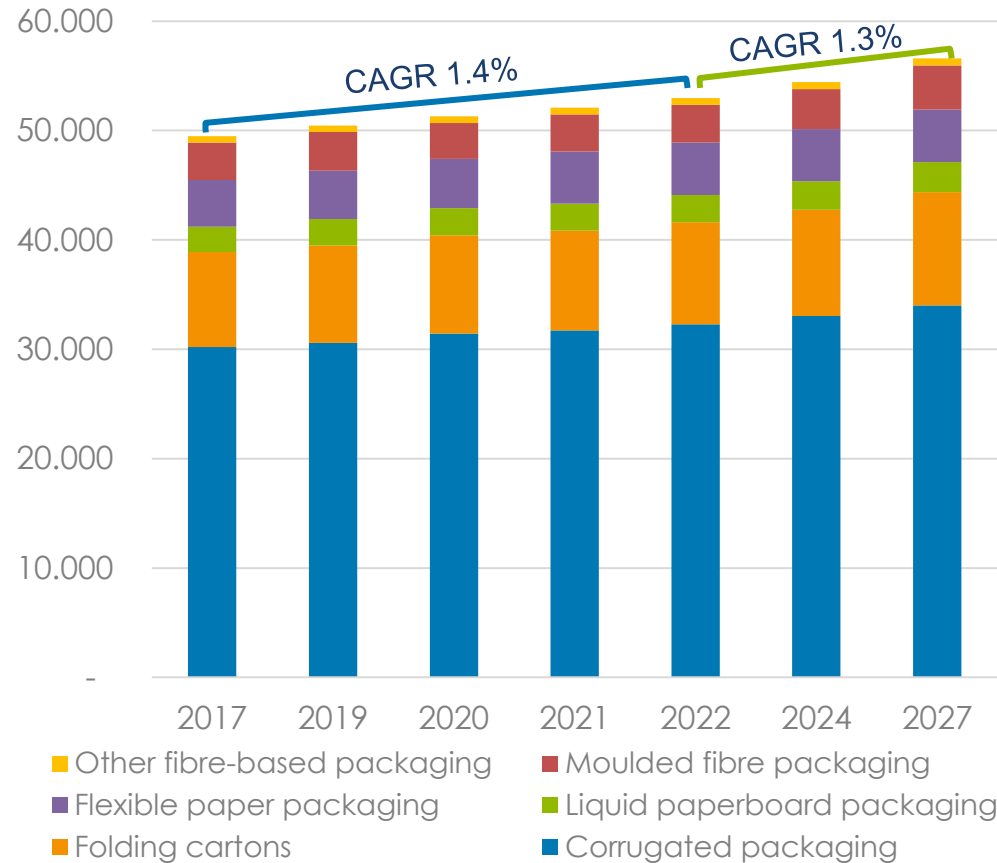
Topics



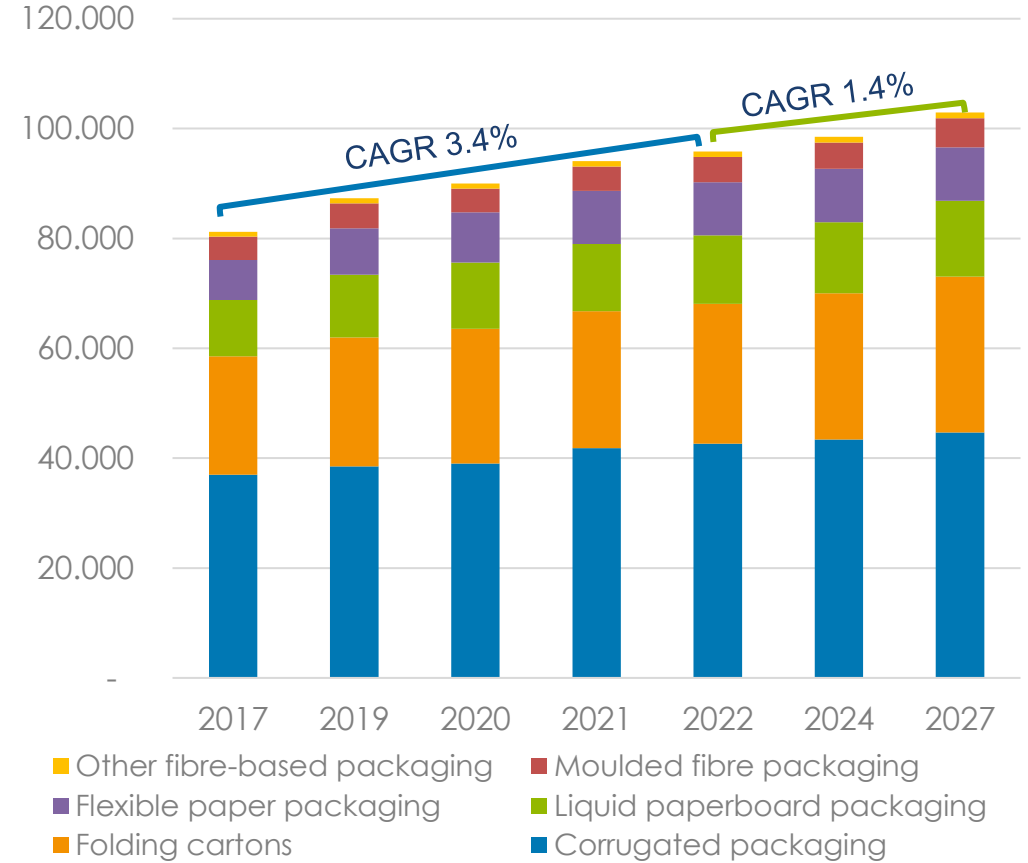
- Market growth data
- New packaging types and innovations
- Implications for fiber-based packaging industry
- Recyclability testing driving innovation

Growth in Fiber-based Packaging in Europe

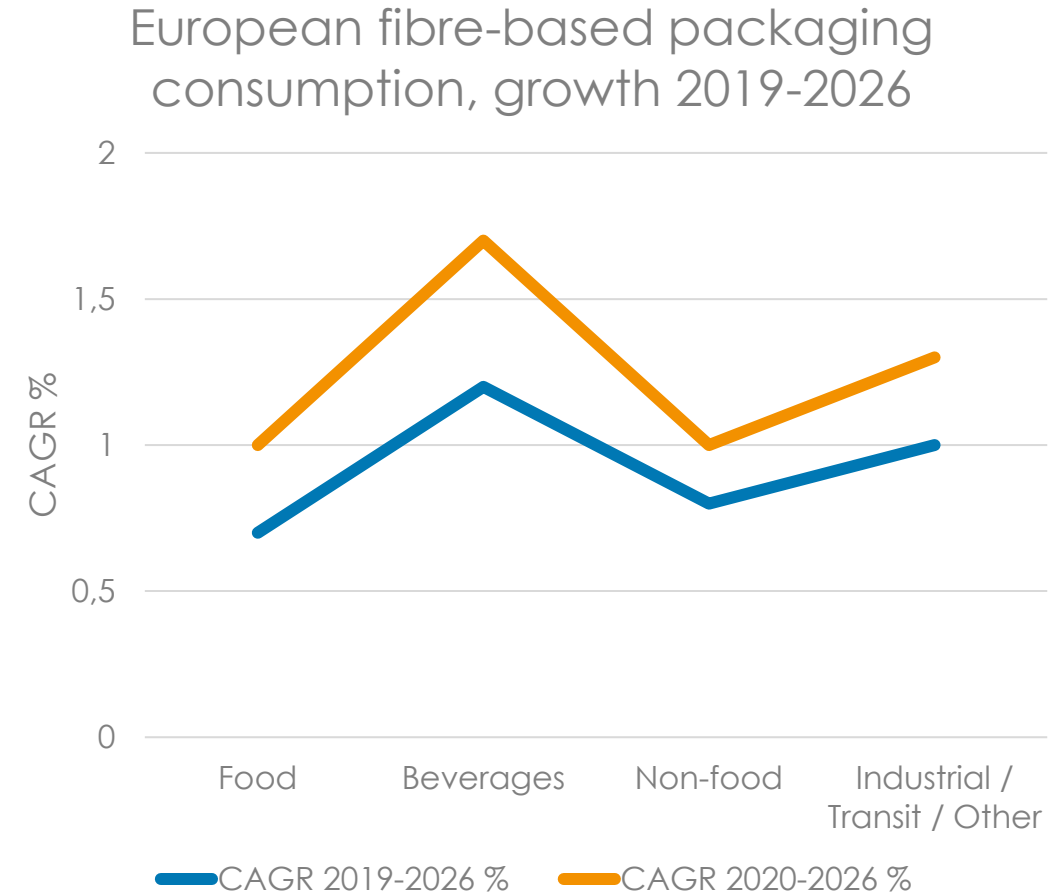
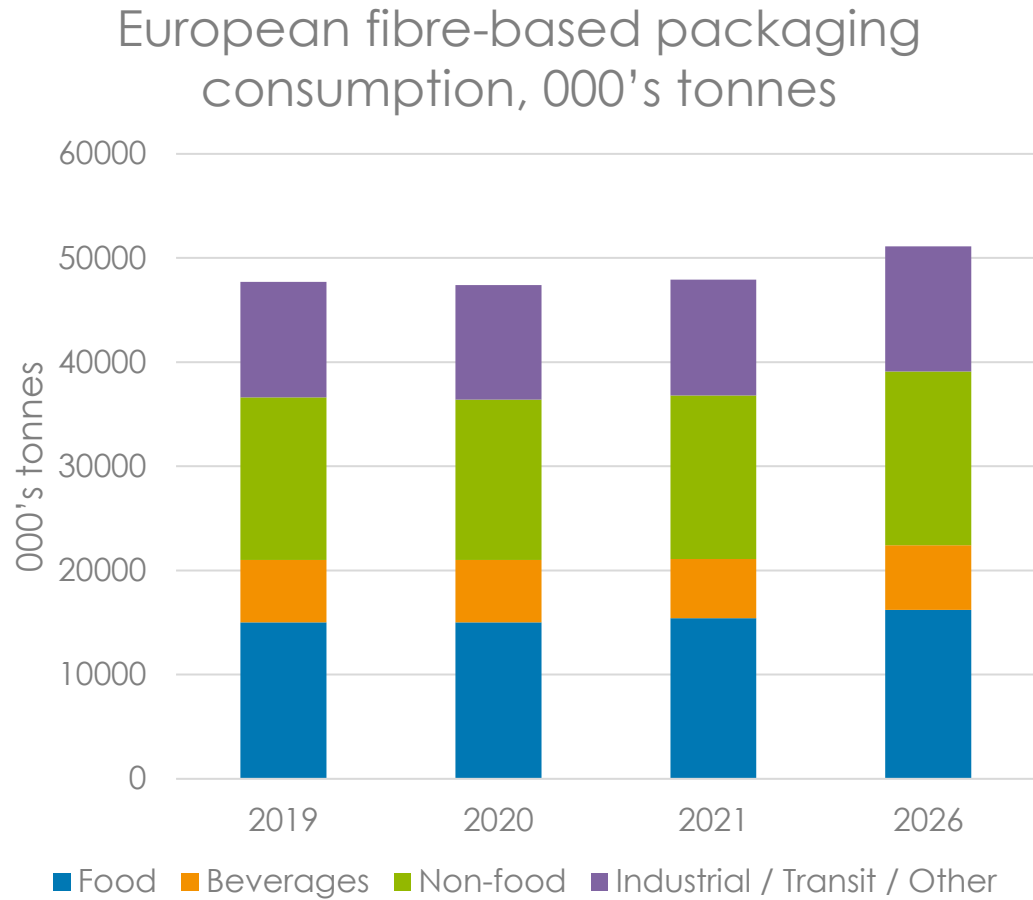
Total Europe: fiber-based packaging market volume by product type, 2017–27 ('000 tonnes)



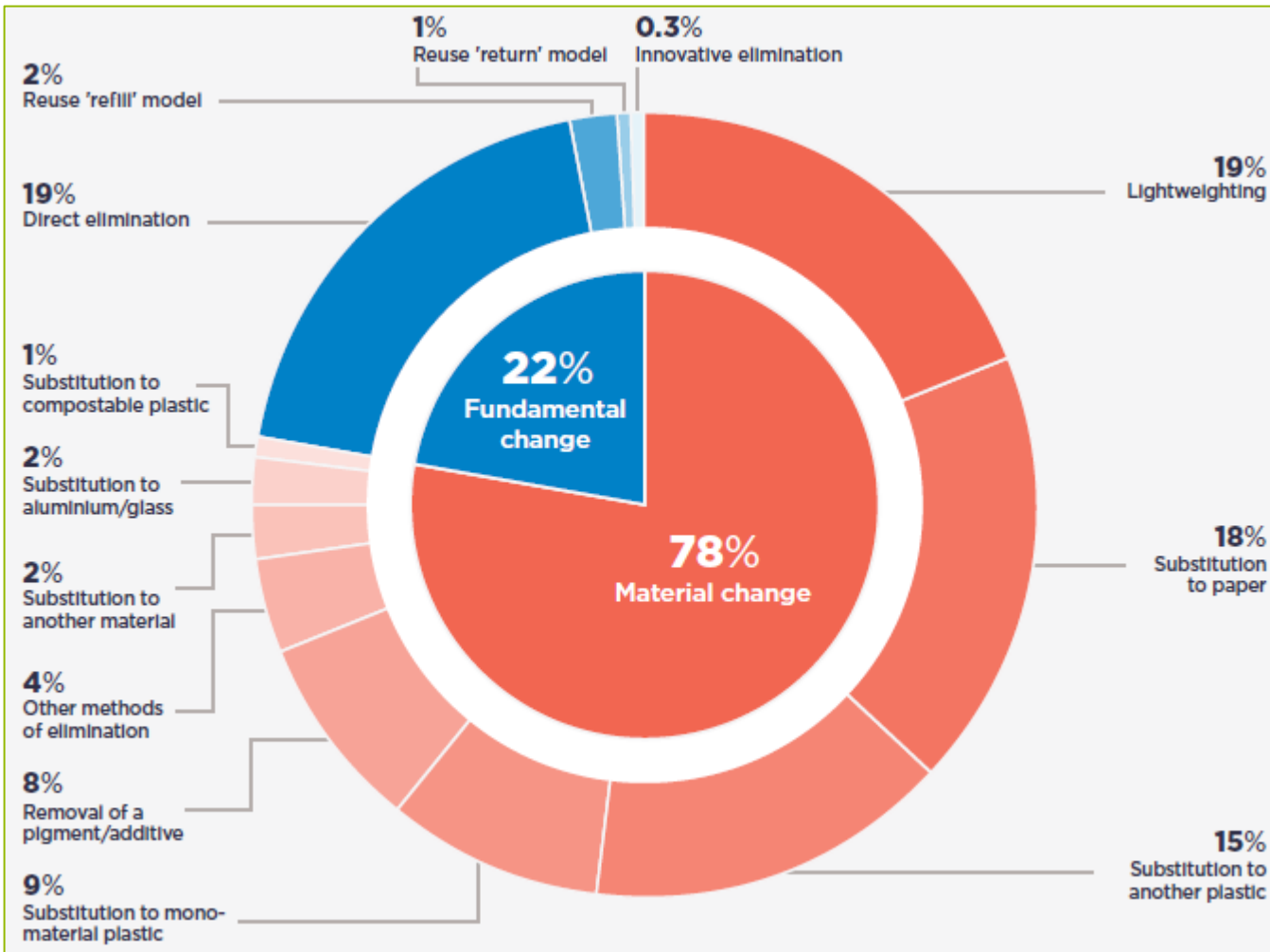
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Importance of Consumer Packaging



Strong Shift in Plastic Packaging Materials Used



- Material changes and light-weighting leading packaging transformation
- Adhesives enable many innovations and shift of materials
- 18% opt for substitution to paper

Fiber Alternatives Replace Plastic

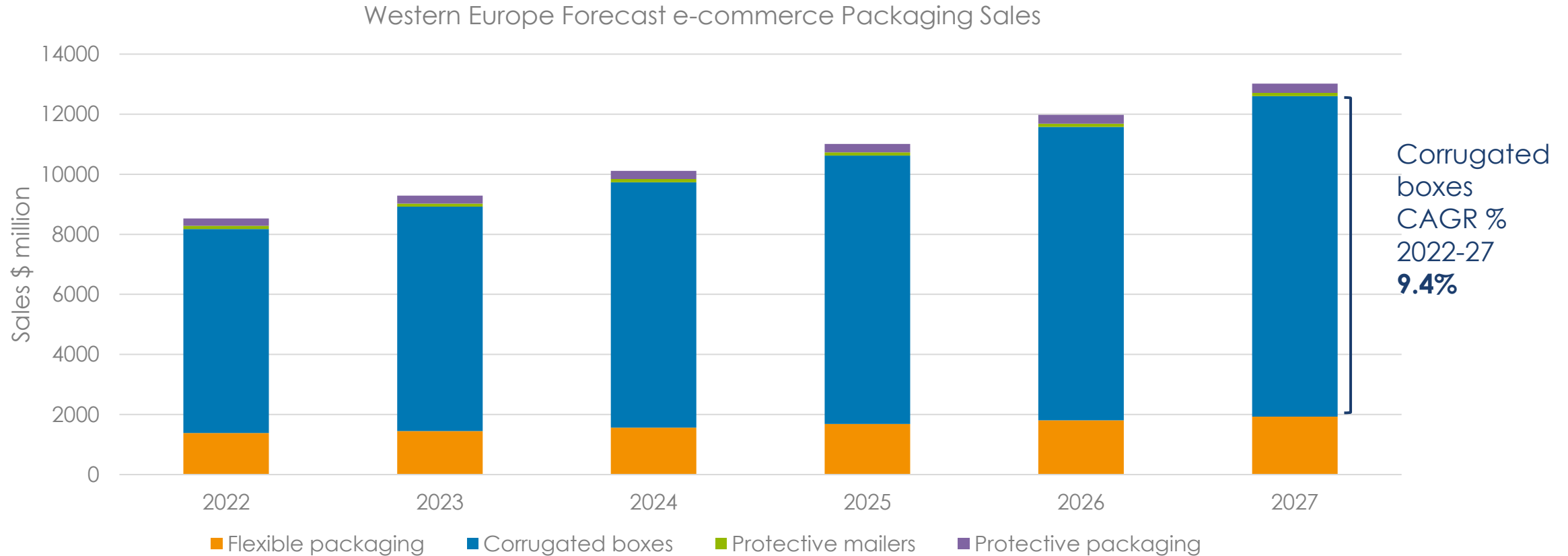
Packaging innovation enabled by adhesives and barriers

- Food paper bags
- Food laminated packaging
- Fast food & take-away packaging
- Paper cups



E-Commerce Packaging

Growing quantities corrugated in post consumer waste stream



Source: Smithers: The Future of E-commerce Packaging to 2027

E-Commerce Packaging Changes

More paper-based and reusable mailers

- E-commerce businesses seek to demonstrate their sustainable packaging credentials



Alternative Fiber-based Solutions

Pushing the boundaries for fiber-based packaging



Adhesive Recycling Aspects

Focus is shifting and more attention is being paid to adhesives throughout the entire process



Paper Recycling Mills have handled adhesives for decades



High consideration of package application performance



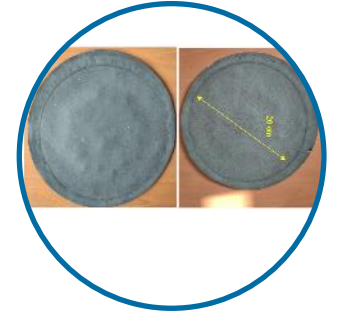
Low consideration of recycling performance



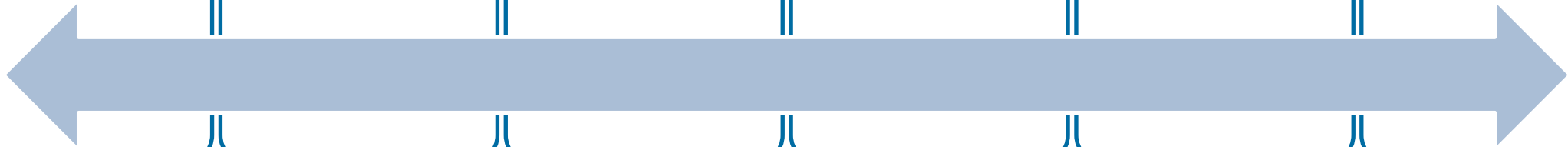
Not only adhesives influencing the recycling process



Available adhesives enable low impact on paper recycling quality



Current test method good industry tool but not fully reflective of paper mills



Final Comments

Adhesives are THE enablers of innovative fiber-based packaging for circular economy



**Increasingly
diverse solutions**



**Waste collection
and sorting
challenges**



**Recyclability criteria
enable growth in
innovative fiber-
based packaging**



**Reliable
recyclability
testing**

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Executive Director Regulatory Affairs, FEICA

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