Innovation in Packaging Technologies

Trends in Barrier Technologies for Safe Use of Crop Protection Products

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on behalf of CropLife International - Specification Expert Group


CropLife
INTERNATIONAL
PURPOSE
Advancing innovation in agriculture for a sustainable future.
VISION
CropLife International plays a leading role in enabling a sustainable food system.

Agenda

Packaging Materials
-
Need for Innovative Barrier Technologies

Development of New Plasma Treatment Technologies
-
Early Results

Packaging Innovation
-
How to Accelerate a Long Change Process

Packaging Materials
-
Need for Innovative Barrier Technologies

Packaging Materials

Standard Materials

Safe packaging of Crop Protection Products (CPPs) on the market is ensured by a broad range of available packaging materials.

- Typical sizes: approx. 50 mL to 1000 L
- Typical materials: pure or layered

Pure materials (examples):

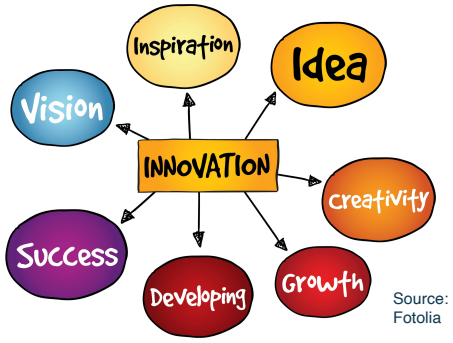
- High density polyethylene (HD-PE)
- Polyethyl terephthalate (PET)

Layer materials (examples):

- Ethylvinyl alcohol / High density polyethylene (COEX-EVOH)
- Polyamide / High density polyethylene (COEX-PA)
- Fluorinated High density polyethylene (f-HD-PE)

Packaging Materials

Even so Innovation is Needed



Source: Fotolia

Provide innovative solutions for optimum shelf life and innovative active ingredient concepts such as microbial products.

Further increase recycling of packaging materials including use of recycled plastic in circular economy.


Source: Fotolia


Source: Bayer

Contribute to regional targets worldwide by innovative sustainable solutions, e.g., related to EU Green Deal.

Packaging Materials

Barrier Technologies

Standard High-Density Polyethylene (HD-PE) is satisfactory for a broad range of formulation types, e.g., water-based or solid formulations.

Product Quality
Protect from degradation.

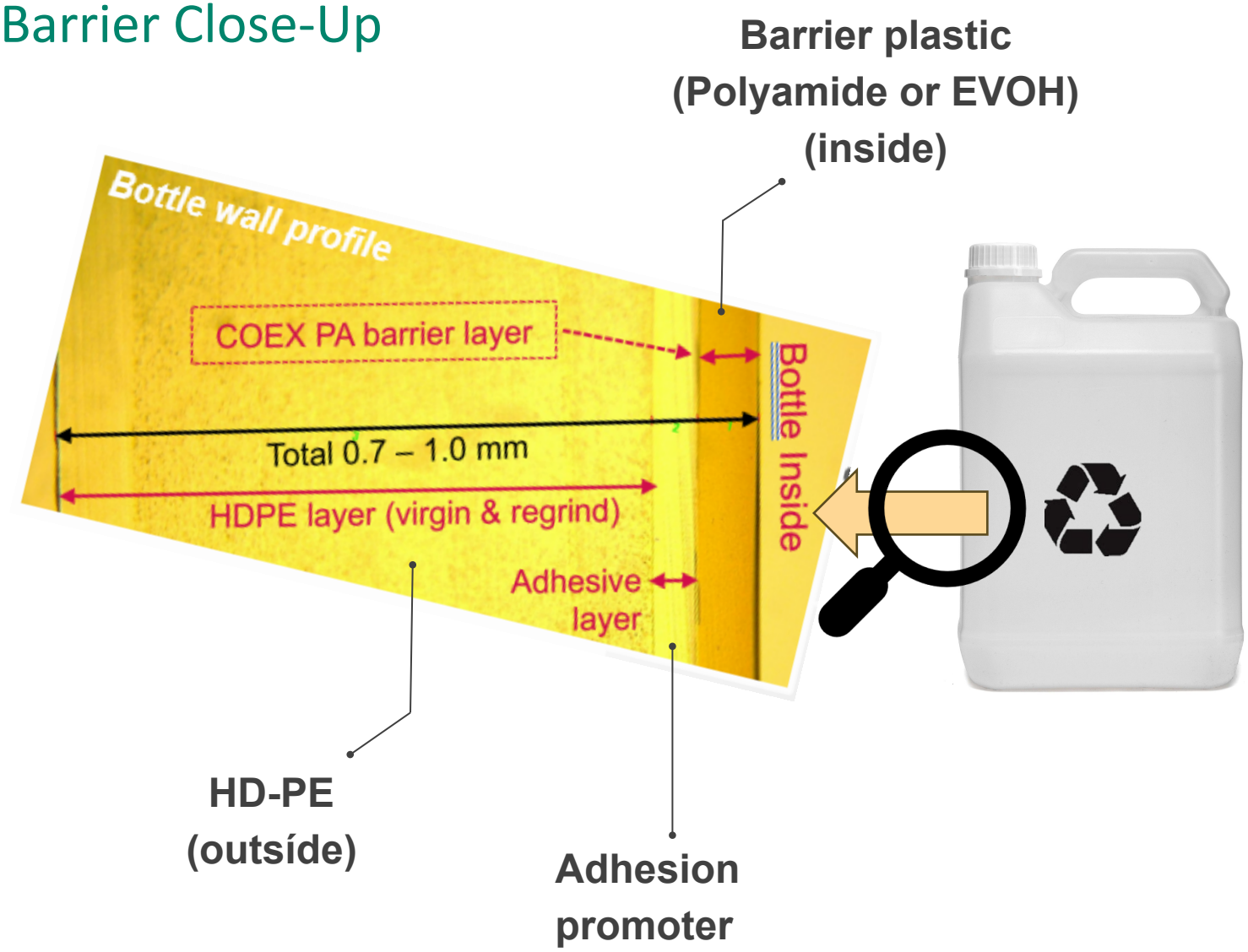
- **Environment**
  Ensure safe storage.
- **Operator**
  Ensure easy and safe handling.
- **Sustainability**
  Minimize footprint in production, transport & recycling.

Barrier Technologies are used e.g., when formulation components like solvents could penetrate standard HD-PE material, resulting in:

- Weight loss, product degradation, paneling or odor
- Swelling or weakening of container wall

Packaging Materials

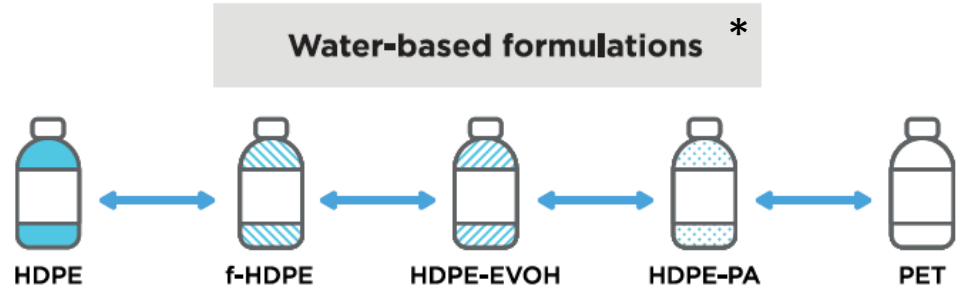
Barrier Close-Up

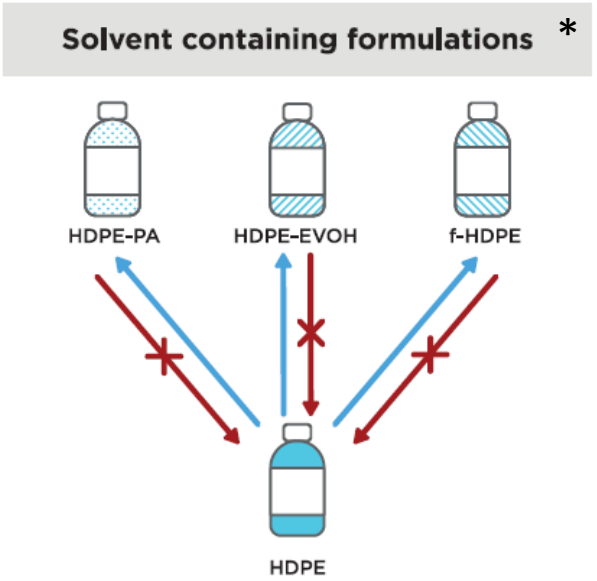


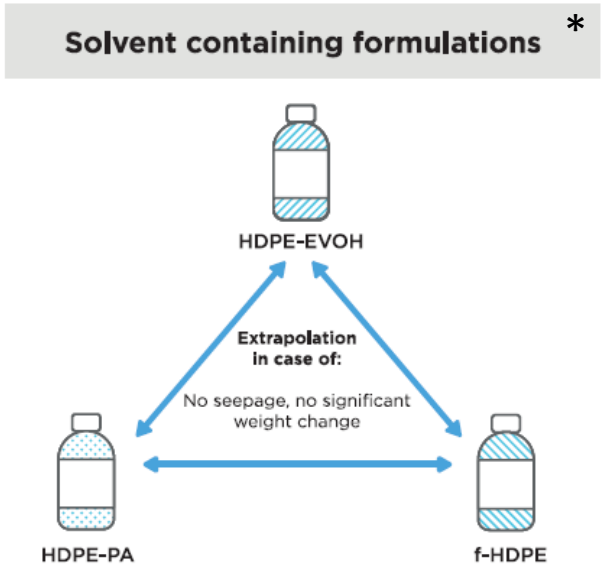
- good barrier depending on the product
- well established supply options in EMEA and LATAM
- not as easy to recycle as HD-PE

Packaging Materials

Extrapolation Concept for Established Materials







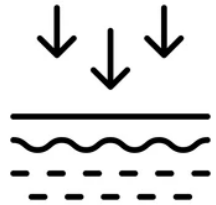
* from TM 17 (CLI, 2021)

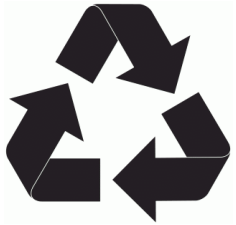
- Extrapolation is established for existing packaging materials, see:
  - SANCO 10473rev.5 or
  - Guidance by Belgium, UK, Australia (for CCPs), ECHA (for biocides).
- Extrapolation mostly relies on data for seepage / weight change (shelf-life studies over 2 years).
- There is no harmonized regulatory framework how to introduce new packging materials.

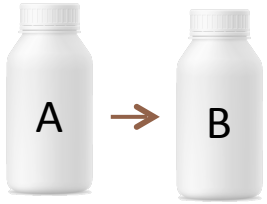
Packaging Materials

Characteristics

- Optimal
- Limited
- cbc (new)







	Water / Solvent Barrier	Recyclability	Extrapolation (seepage data)
HD-PE	Limited	Optimal	Limited
Coex-PA	Optimal	Limited	Optimal
Coex-EVOH	Optimal	Limited	Optimal
F-HD-PE	Optimal	Optimal	Optimal
Packaging Innovation	cbc (new)	cbc (new)	*Not yet established*

Case Study:
Development of New Plasma Treatment Technologies
-
Early Results with Innovative Barriers

Packaging Materials

Objective

- optimum barrier-properties
- 100% recyclable

Packaging Materials

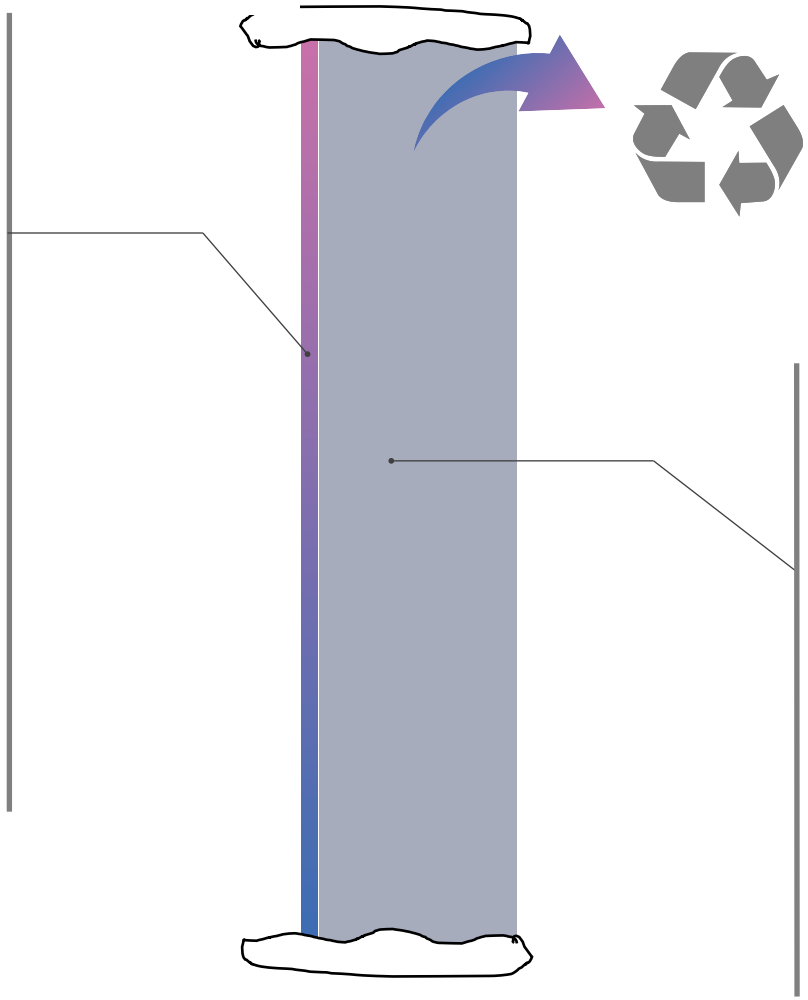
Innovative Plasma Treatment Technologies

Coating Properties

- Non-reactive & chemically inert
- Food-safe
- Super thin (sub-micron scale)
- Compatible with recycling

Functionalities

- Migration barrier (e.g., solvents, other substances)
- Corrosion protection (acid or alkaline substances)

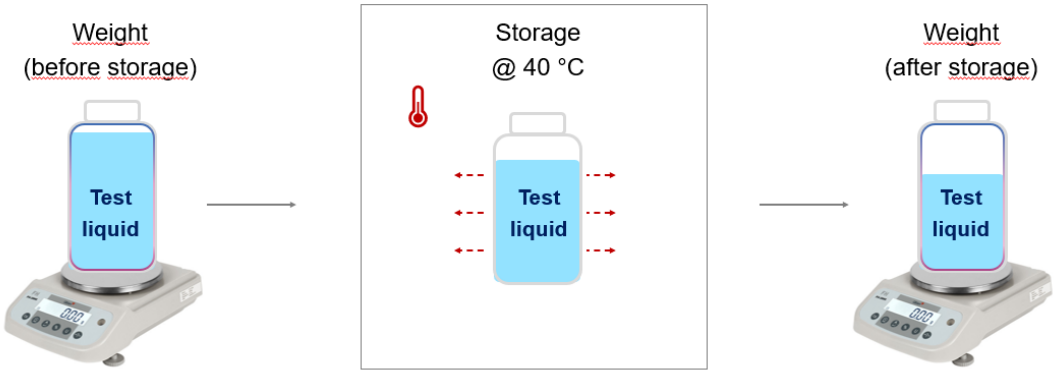


Plastic Substrate

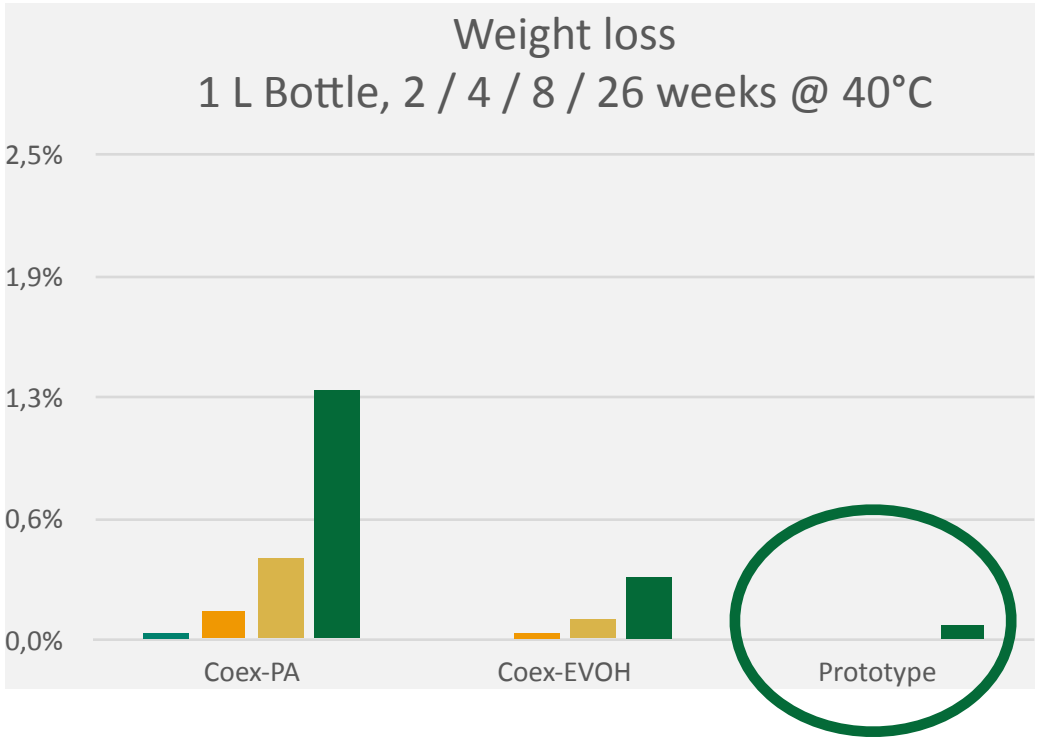
- High-density PE (HD-PE)
- Low-density PE (LD-PE)
- Polyethylene terephthalate (PET)
- Polypropylene (PP)
- Polyamide (PA)
- Post-Consumer Resin (PCR)
- others

Plasma Treatment Prototype

Penetration Test

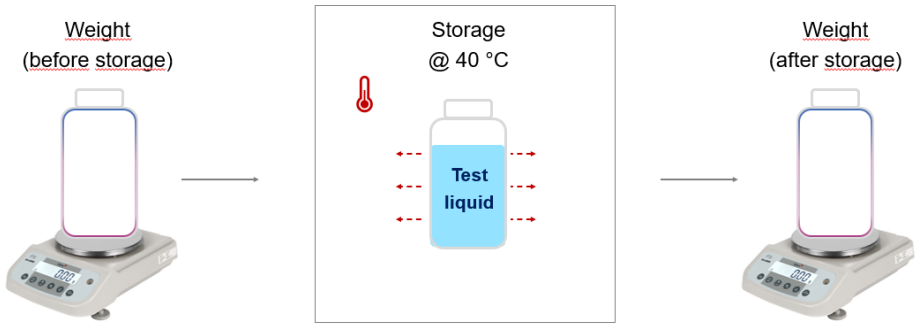


Packaging Prototype with Agrochemical Model Liquid

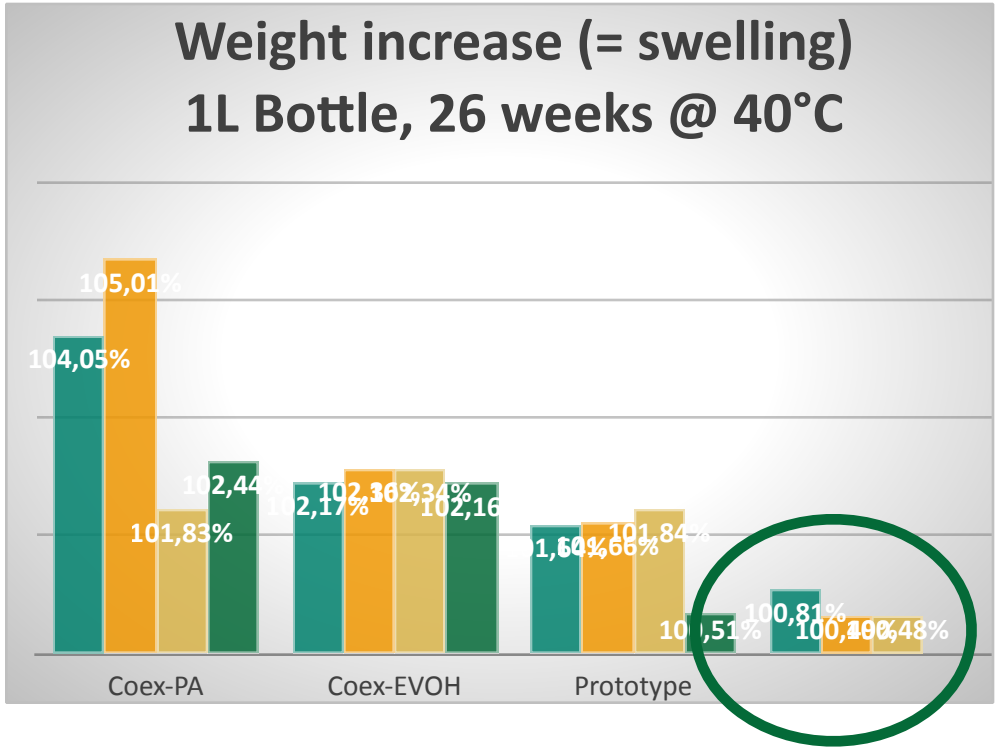


Plasma Treatment Prototype

Swelling Test

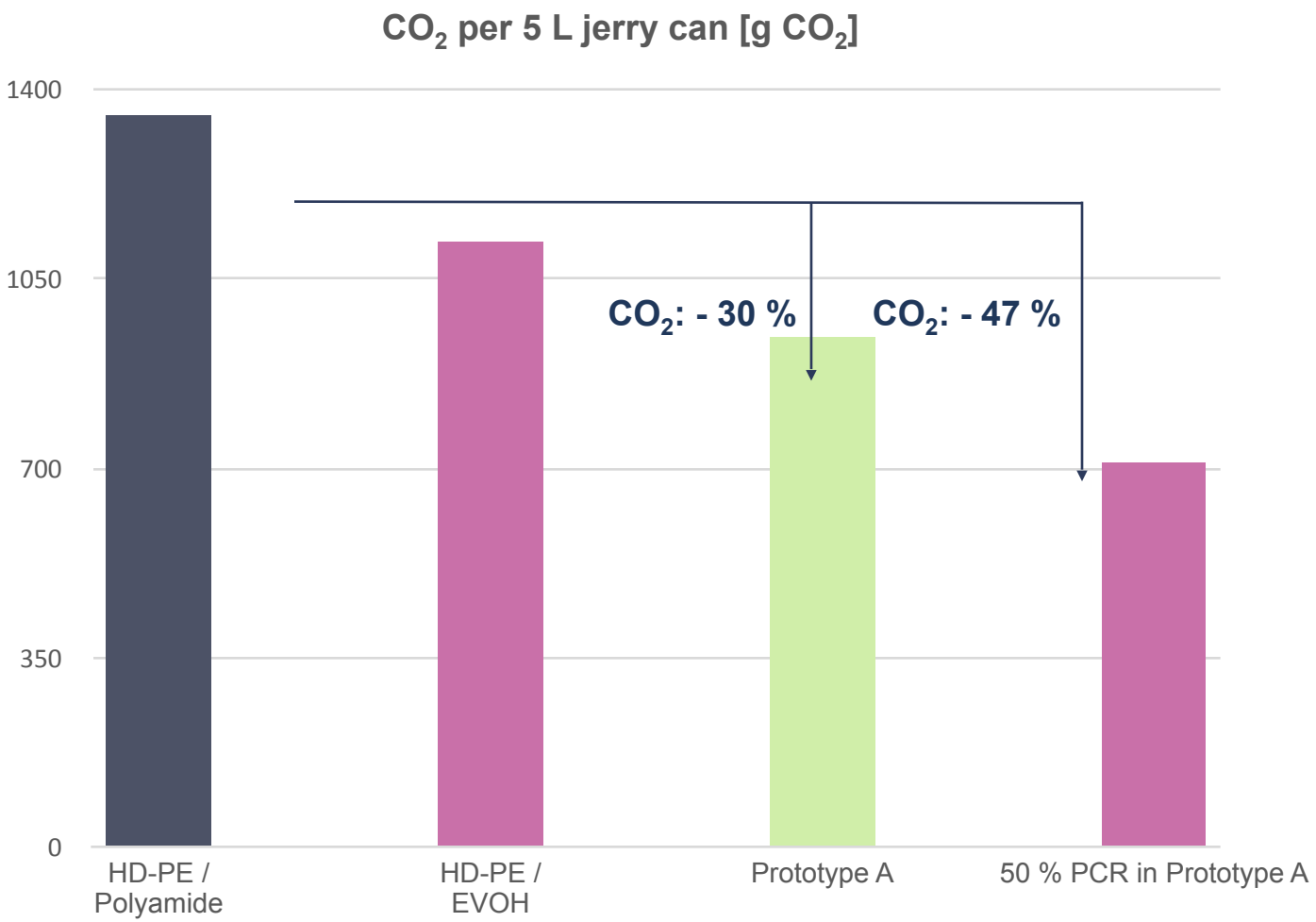


Packaging Prototype
with
Agrochemical Model
Liquid



Plasma Treatment Prototype

Carbon Footprint Reduction Potential (Preliminary Data)



Footprint - Included:

- Production of pure material
  - HD-PE
  - EVOH or PA
  - Tie Layer Polymer
- Blow Moulding Process
- Coating Process (Prototype)

Footprint - Excluded:

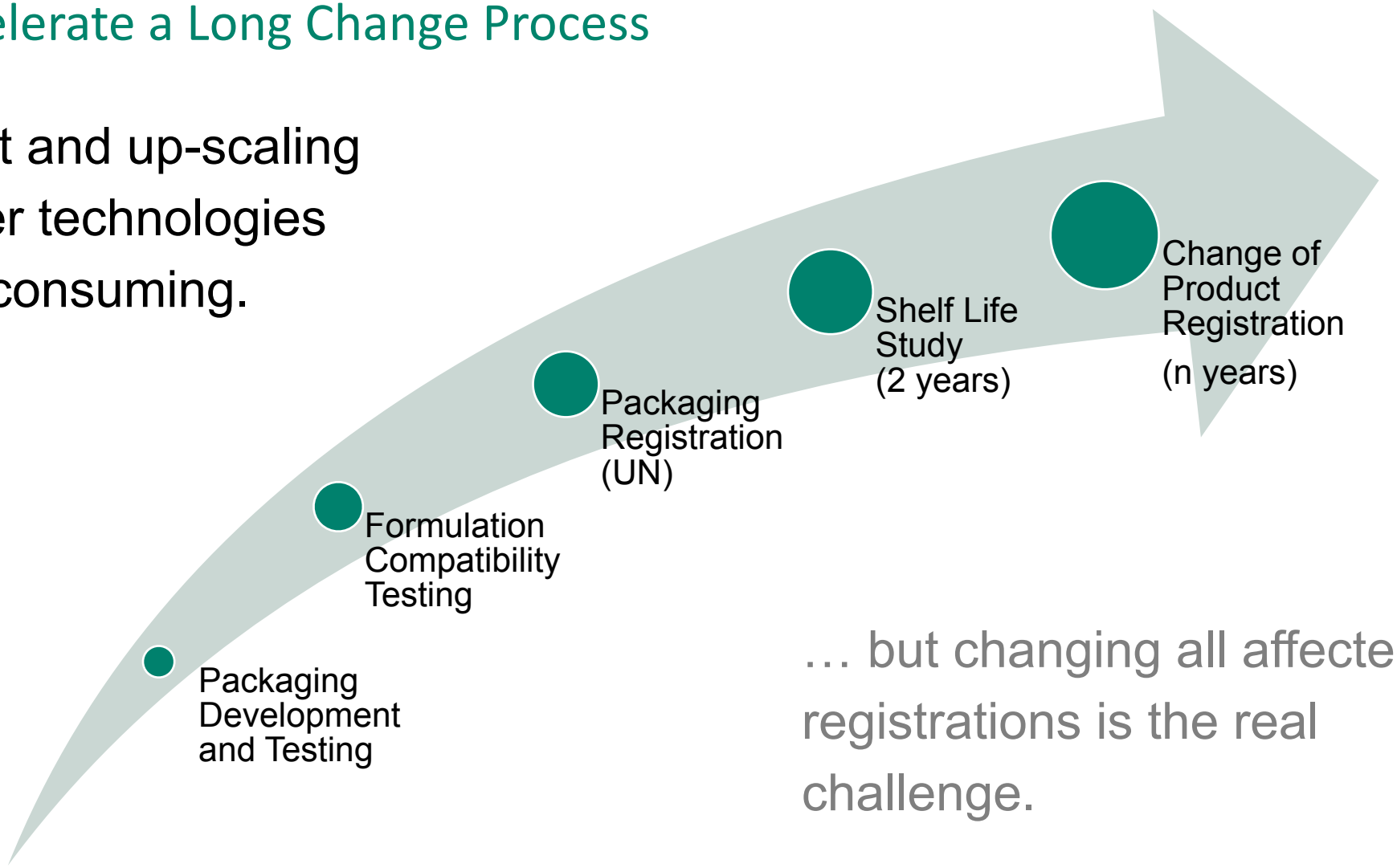
- Transport and filling
- End of life scenarios (Downcycling, Energetic Recycling)
- Material for Blow Mould or Coating Machinery

Packaging Innovation
-
How to Accelerate a Long Change Process

Packaging Innovation

How to Accelerate a Long Change Process

Development and up-scaling
of new barrier technologies
is very time-consuming.



… but changing all affected registrations is the real challenge.

Packaging Materials

Introduction

- Depending on a manufacturer's portfolio, individual packaging materials are used for up to hundred formulations or even more.

Portfolio A
(< 10 products)

Protfolio B
(10 – 100 products)

Protfolio C
(> 100 products)

- Switching to a new packaging material will impact all related product registrations.

Packaging Innovation

Registration of Innovative Packaging Materials

- Changing the packaging material for entire product portfolios has a huge impact on packaging suppliers, manufacturers of CCPs and regulatory bodies.
- Capacities and timelines of stakeholders will not allow to conduct (manufacturer) nor evaluate (authorities) new phys-chem data studies for every affected formulation within an acceptable timeframe.
- For established Packaging Materials, extrapolation is an established process. However, there is no easy-to-use regulatory process for changing a **portfolio of products** to a NEW Packaging Material.

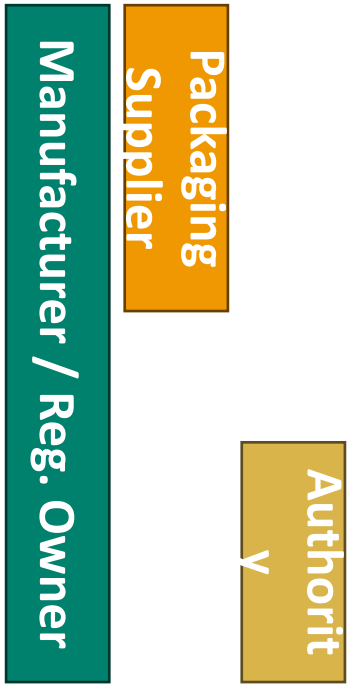
Outlook

Stakeholder involvement in Change Process

High level view on change process for introducing new packaging materials:

- Technical development & evaluation of material
- Testing on representative model formulations / liquids
- Up-scaling of packaging supply
- Creating of data for selected formulations – criteria to be defined
- Submission / evaluation of selected dossiers
- Approval for selected formulations

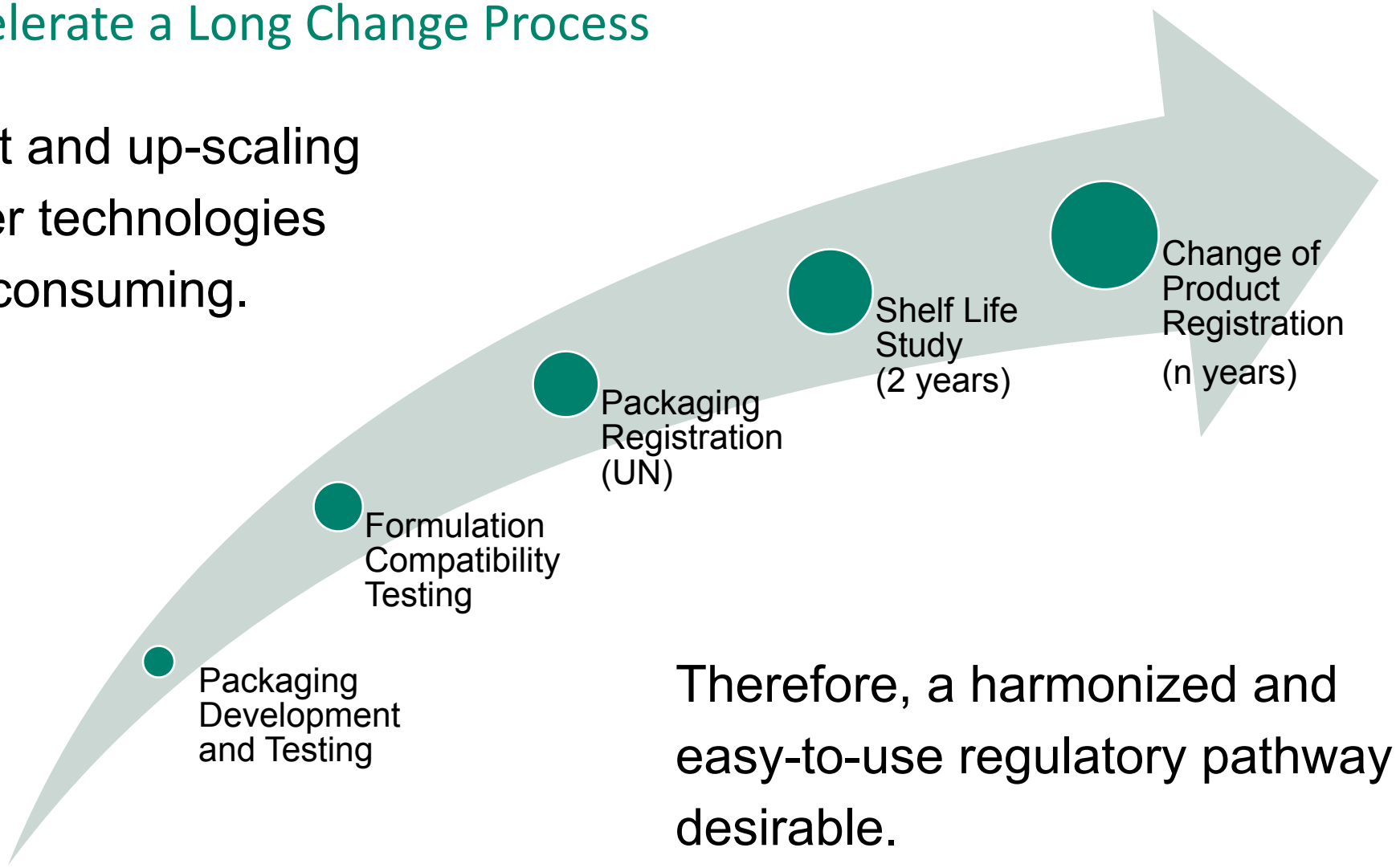
Extension to broader formulation portfolio – criteria need to be defined



Packaging Innovation

How to Accelerate a Long Change Process

Development and up-scaling of new barrier technologies is very time-consuming.



Therefore, a harmonized and easy-to-use regulatory pathway is desirable.


THANK YOU