

# **“Biodegradability as end of life option in a circular economy: value and path forward”**

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Renewable materials conference –  
Biodegradation session

Siegburg, Germany, 24th of September 2025

# Agenda: “Biodegradability as end of life option in a circular economy: value and path forward”

## 1 Introduction

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## 2 Functional biodegradable materials

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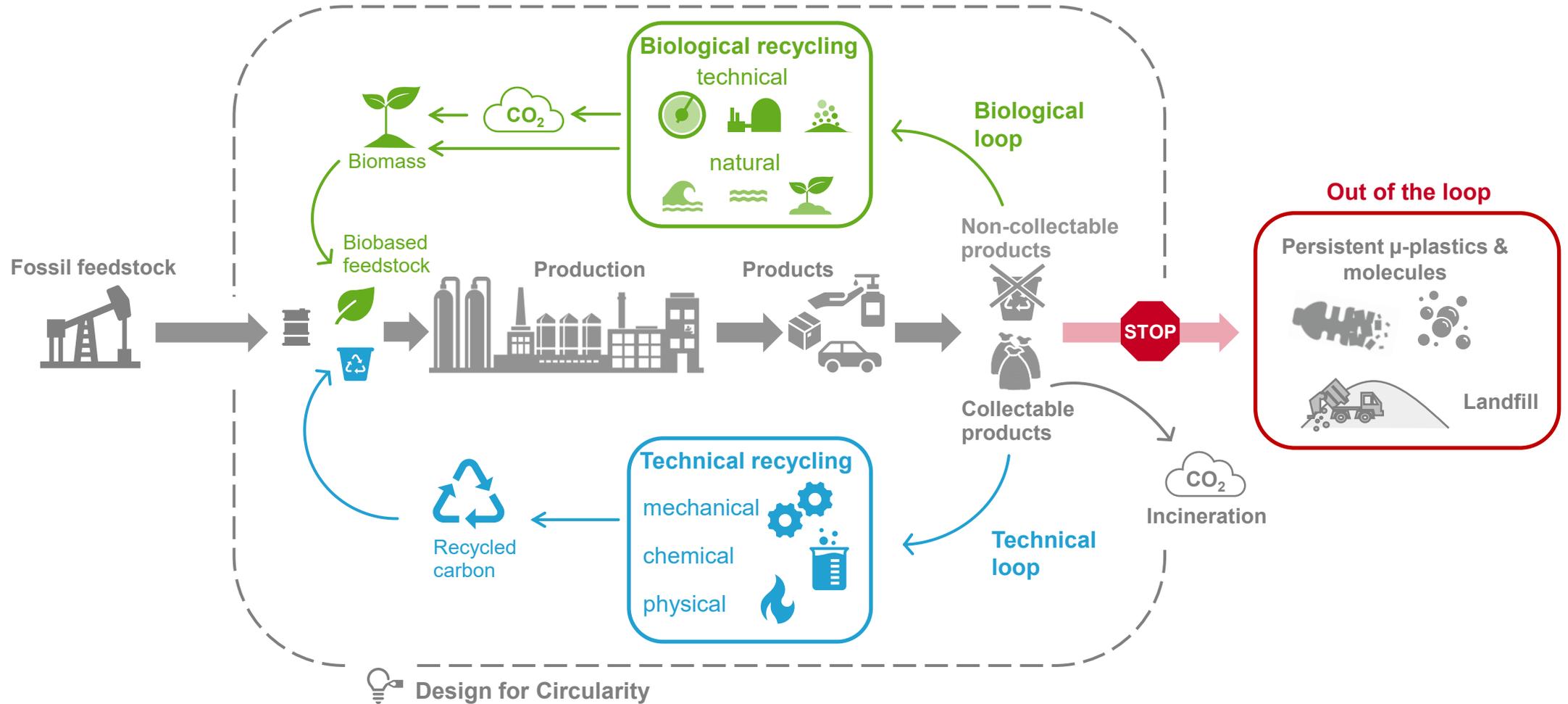
## 3 Structural biodegradable materials

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## 4 Path forward

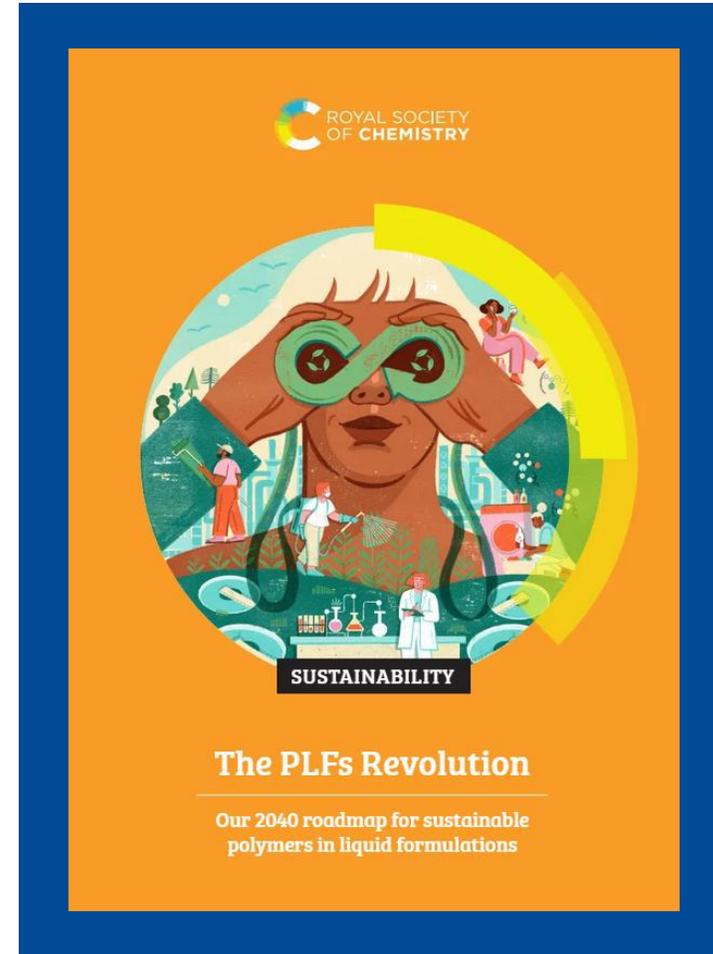
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# The role of biological and technical recycling in a circular economy



At the end of life there are 2 intended scenarios: biological and technical recycling loop

# Biodegradability understanding Where biodegradability makes sense and where not?



Agreed circular economy concepts towards biodegradable materials are essential

# Biodegradability understanding Chemistry and applications

## Development of new tailor-made certified biodegradable products

Small molecules (chemicals)

Functional polymers

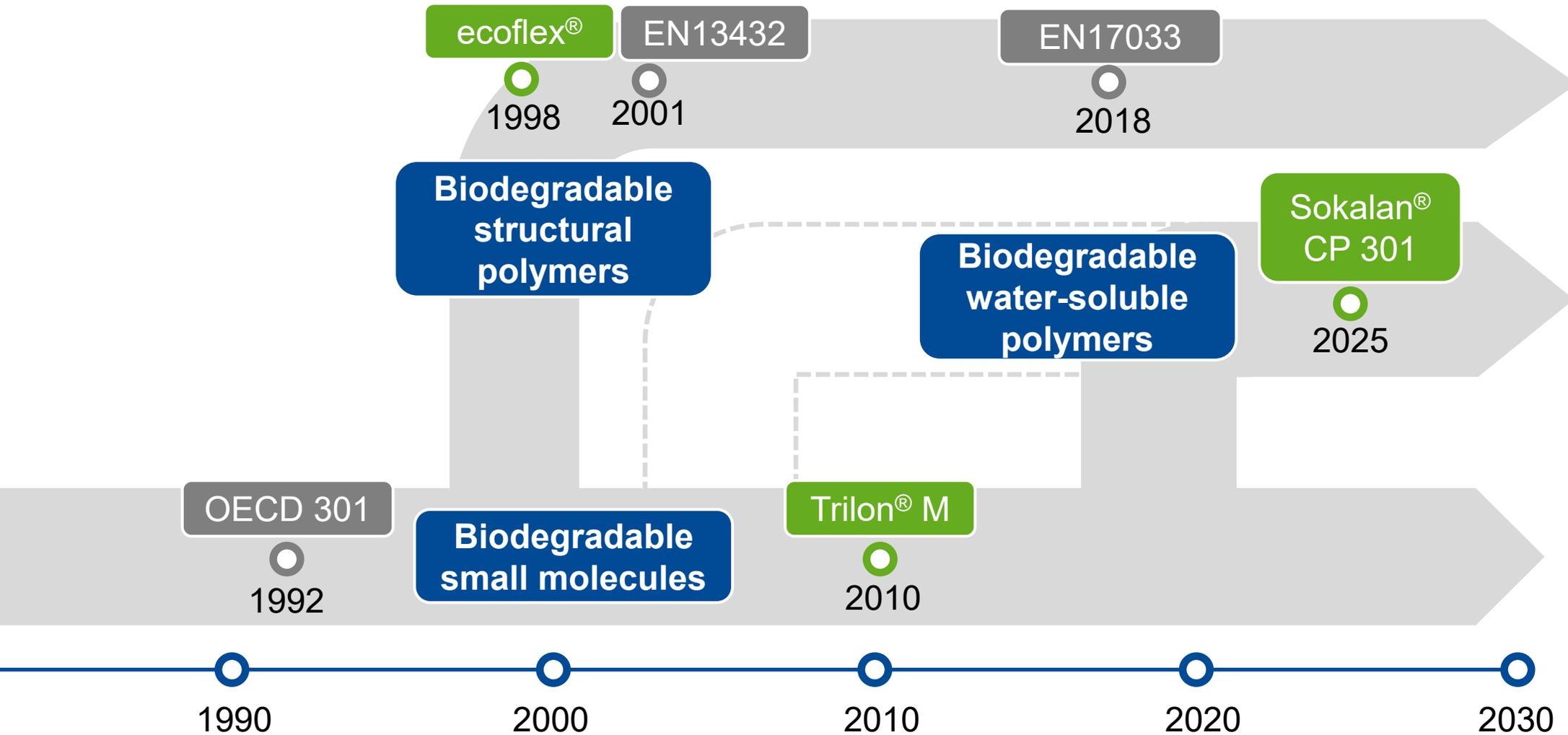
Structural polymers



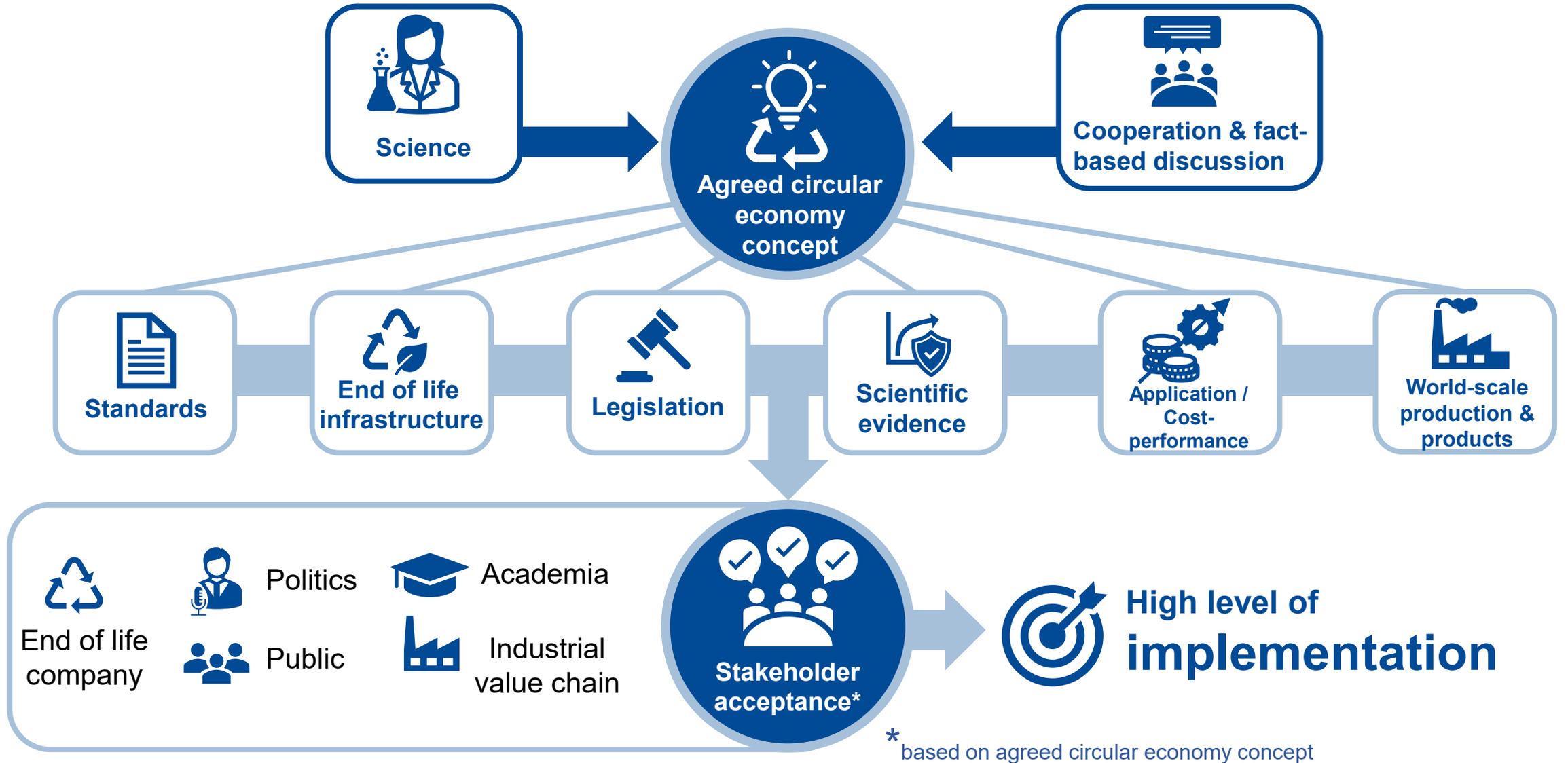
Align different chemistries with different applications

# Biodegradability understanding

## Biodegradable small molecules, structural- and water-soluble polymers



# Certified biodegradable materials: requirements for implementation



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# Case study 1: Biodegradable functional materials (small molecules)

## Trilon<sup>®</sup> M – replacing phosphate with a high performing biodegradable material



Phosphate



Trilon<sup>®</sup> M

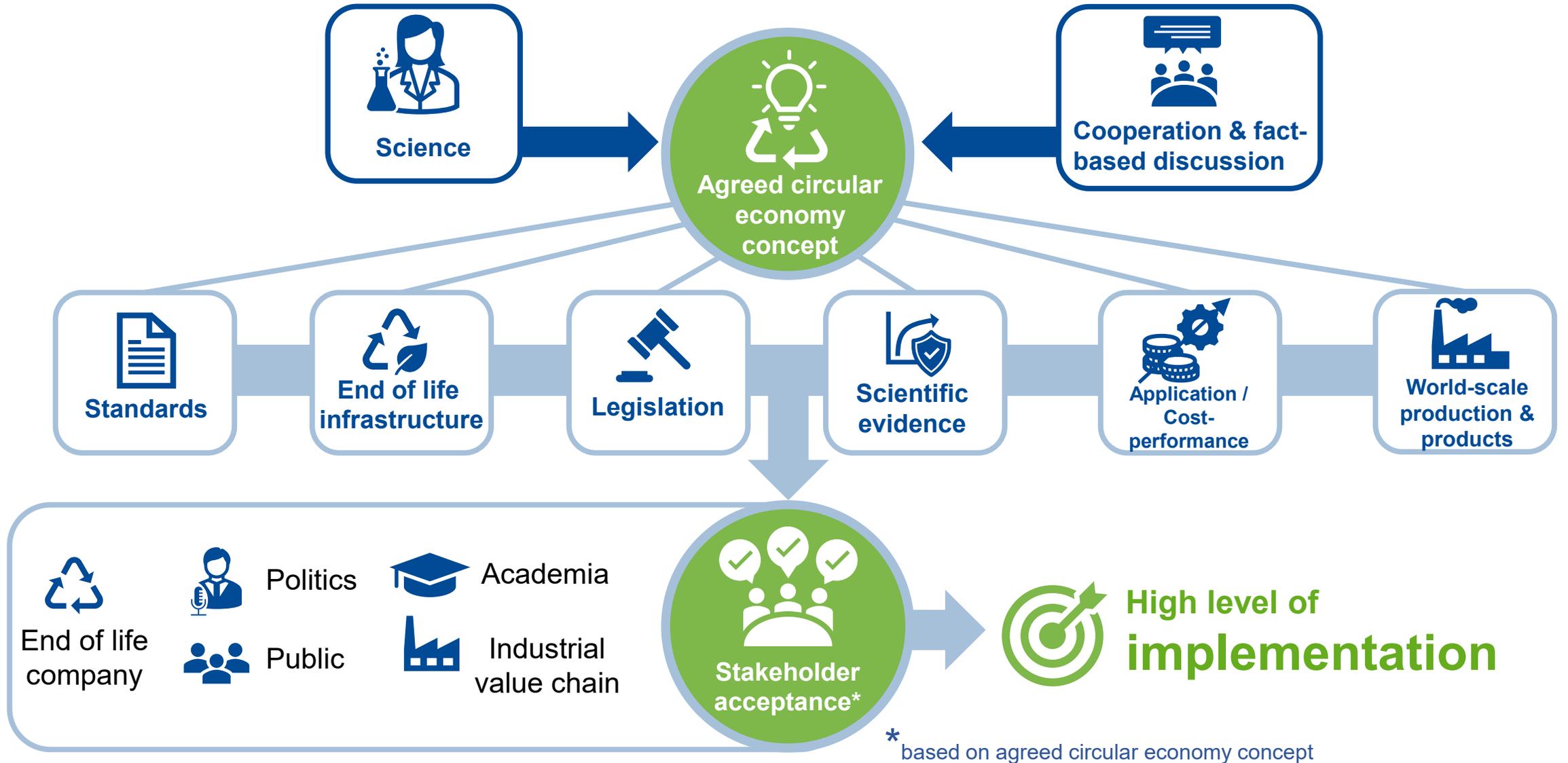


Replacement of phosphate with high performing biodegradable alternative (readily biodegradable OECD 301) in automatic dishwashing with significant environmental benefit

- achieved
- good progress
- to be improved

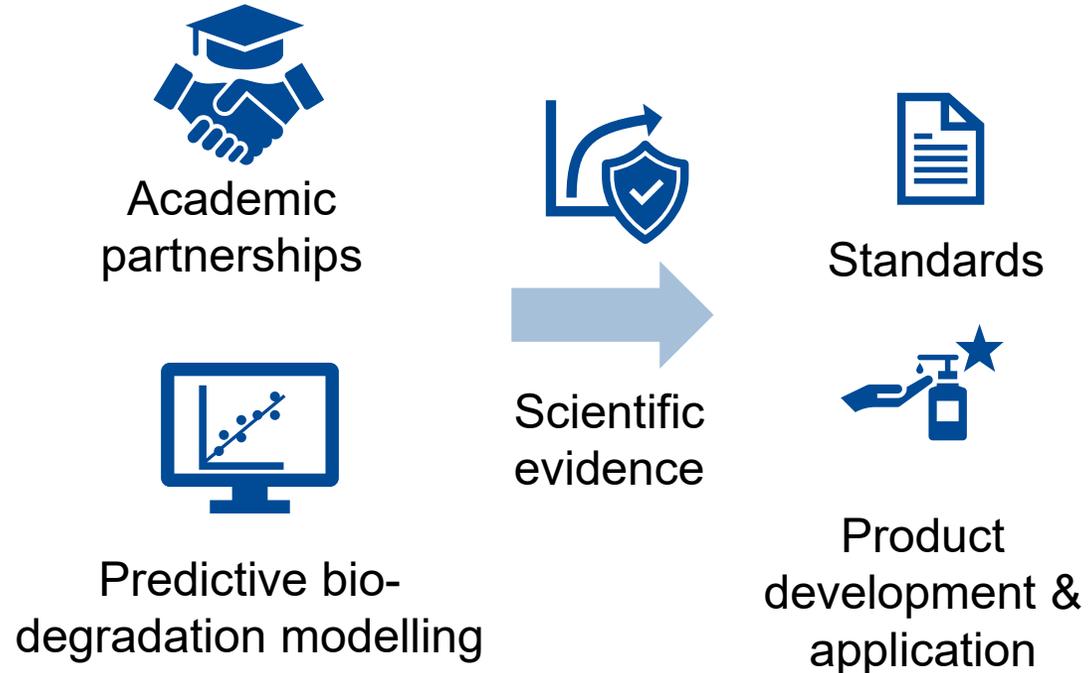
# Case study 1: Biodegradable functional materials (small molecules)

## Certified biodegradable materials: requirements for implementation



# Case study 2: Biodegradable functional materials (polymers) Sokalan® CP 301- readily biodegradable dispersant for agro

Sokalan® CP301



Readily (OECD 301) and soil biodegradable (ISO 17556) dispersant with performance for a broad range of active ingredients – launch 2025



- achieved
- good progress
- to be improved

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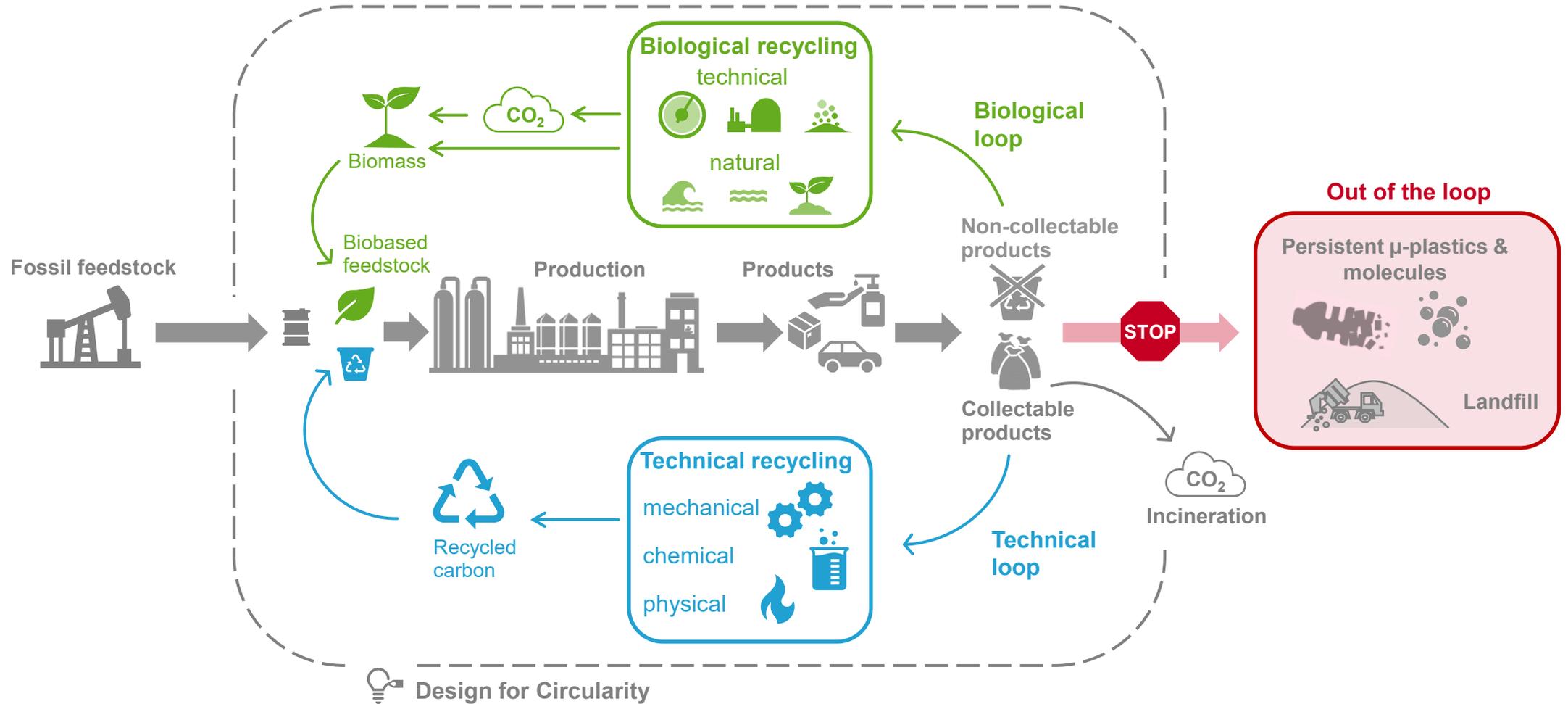
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# The role of biological and technical recycling in a circular economy



Despite increase in technical recycling, measuring the % of products “out of the loop” is crucial to track circular economy efficiency and to take meaningful actions

## Case study 3: Biodegradable structural materials

# Compostable bags: “Biosackerl” in Austria



Common target:  
**Prevent persistent  $\mu$ -plastics in compost**



### Germany

- Biowaste legislation allows use of compostable bags
- But: use of compostable bags in many areas restricted (to prevent PE-bag contamination of biowaste)
- Recommendation: Use newspaper and paper bags (compost certification not required)
- Compost time 4-6 weeks for majority of plants (shorter and longer times possible)



### Austria



bündnis  
mikroplastik  
frei

- Legislation in place
- Consequent use of „Biosackerl“ (compostable F&V bags) – ban of PE bags
- Enable hygienic collection of biowaste
- Increase amount of biowaste (5-50 % still in black bin)
- Compost time > 8 weeks

Question: Which way is more promising to solve the persistent  $\mu$ -plastic problem in compost?

## Case study 3: Biodegradable structural materials

# Compostable bags: proposal for comparison of countries

	Standards	End of life infrastructure	Legislation	Scientific evidence	Application / Cost-performance	World-scale production & products	Stakeholder acceptance*	Level of implementation
Austria								
Italy								
Germany								

\*based on agreed circular economy concept and acceptance of scientific evidence

very good level achieved    
 good progress    
 clear improvement needed

Solution approach for the same persistent  $\mu$ -plastic problem differs in Germany vs. Austria & Italy. Austria & Italy with aligned circular economy view including certified compostable bags.

# Case study 4: Biodegradable structural materials (agricultural mulch film)

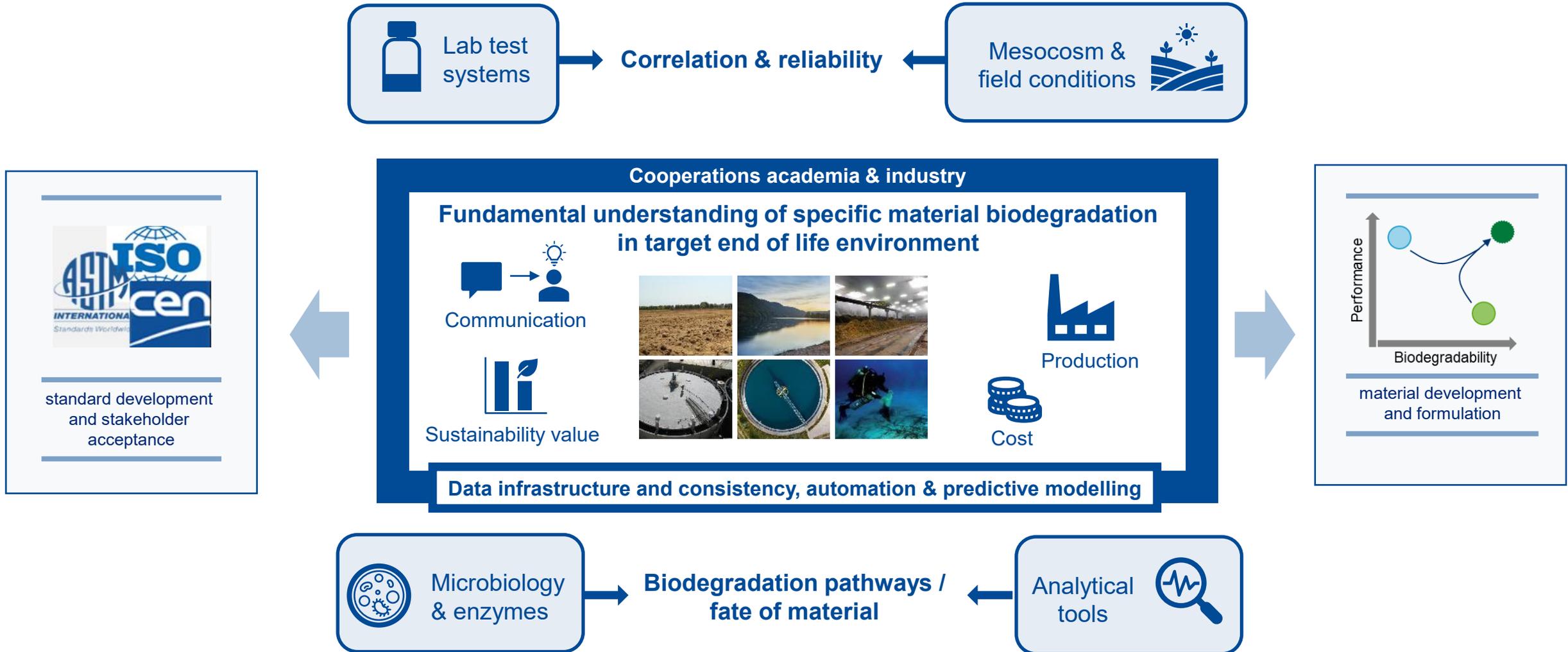
## Sustainability performance depends on material properties and application

Complete biodegradation in soil



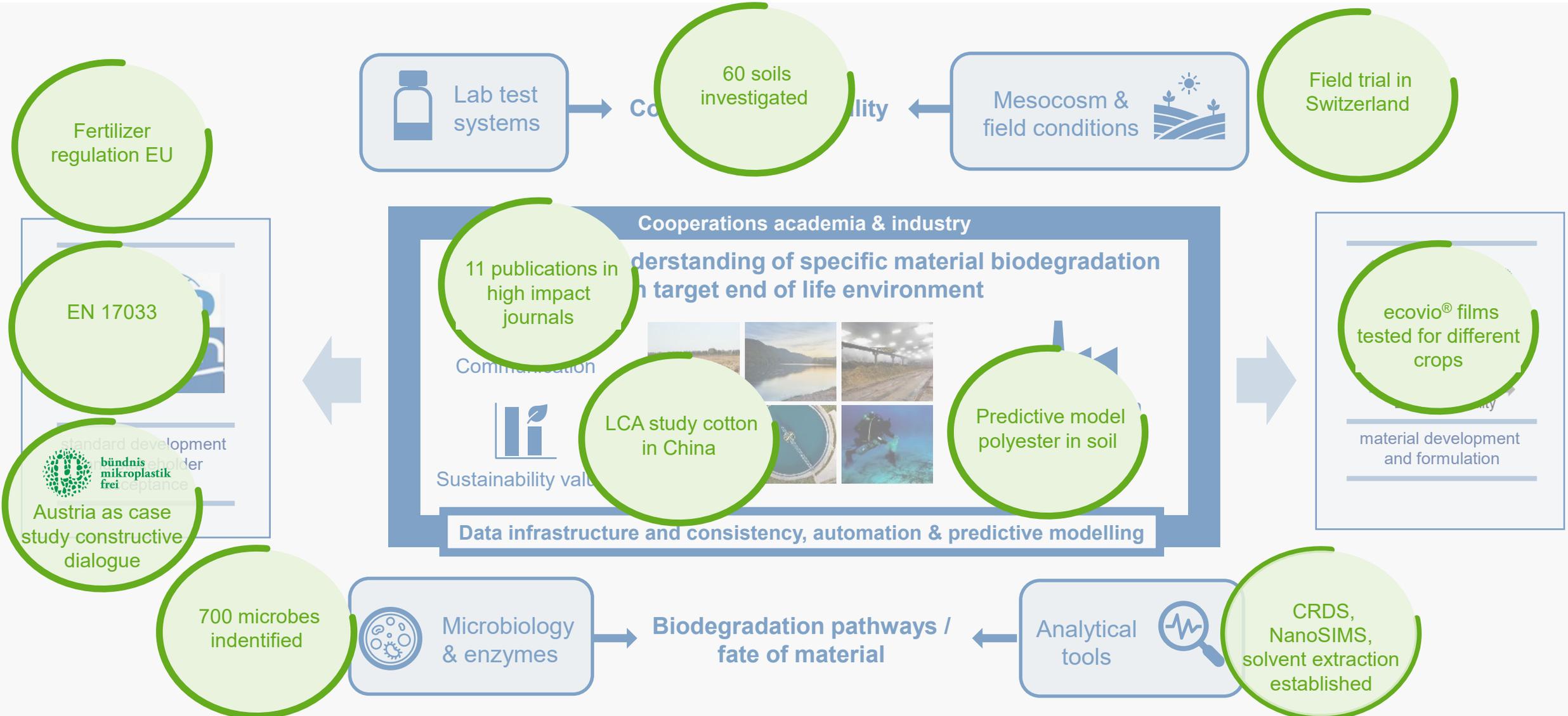
# Biodegradability 2.0

## Holistic approach for biodegradability with different technologies and partnerships



# Biodegradability 2.0

## Holistic approach for biodegradability with different technologies and partnerships



# Case study 4: Biodegradable structural materials (agricultural mulch film)

## The consequence of non-collection of PE films

In practice:  
Insufficient collection  
of PE mulch



Soil pollution

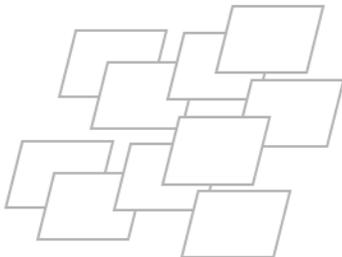
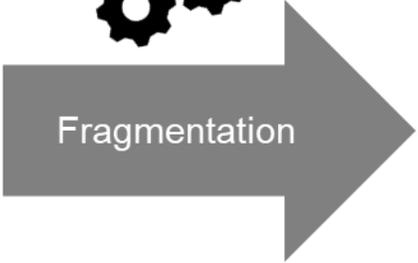


Reduced yield of crops

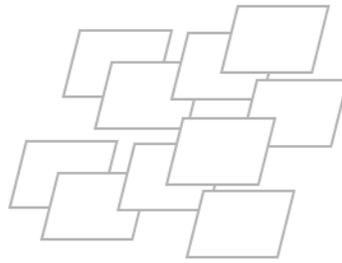


Generation of persistent  
 $\mu$ -plastic

### Conventional Plastics – e.g. LDPE



Fragments



Persistent microplastic

Fragmentation occurs via external processes such as mechanical treatment and creates persistent microplastic

# Case study 4: Biodegradable structural materials (agricultural mulch film)

## To achieve environmental performance thickness of PE film is defined by mechanical requirements for collection

- ➔ Biodegradable mulch film: ~12  $\mu\text{m}$  thickness
- ➔ Polyethylene mulch film:  **$\geq 25 \mu\text{m}$  thickness needed to ensure collection**



Microplastic reduction

# Austria as example for constructive discussion catalyzed by „Bündnis Mikroplastikfrei Österreich“ appointed by ministry for environment

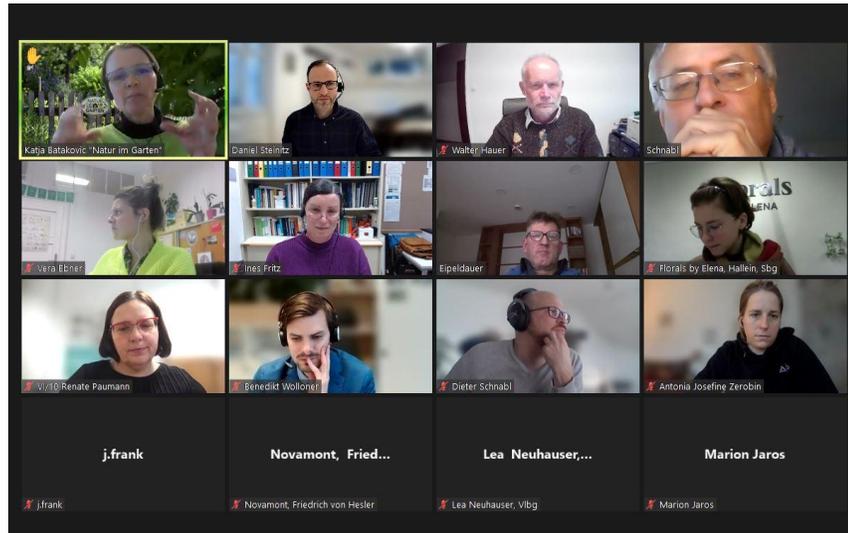
## Fact-based discussion

UBA Austria  $\mu$ -plastic event, Vienna 2022



## Dialogue

Dialogue with stakeholders, moderation „Bündnis Mikroplastikfrei“ (Daniel Steinitz)



## Concrete proposal

Walter Hauer (President Bündnis Mikroplastikfrei) and Leonore Gewessler (Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology)



Proposal: Mulch film  $<25\mu\text{m}$  = certified soil biodegradable mulch film (no recollection possible  $\rightarrow$  biological recycling);  $>25\mu\text{m}$  = PE mulch film (recollection  $\rightarrow$  technical recycling)

# Case study 4: Biodegradable structural materials (agricultural mulch film)

## Mulch film: proposal for comparison of countries

	Standards	End of life Infrastructure <sup>§</sup>	Legislation <sup>#</sup>	Scientific evidence	Application / Cost-performance	World-scale production & products	Stakeholder acceptance*	Level of implementation
								
 Japan								
 EU								
 China								

<sup>§</sup> refers to technical recycling

<sup>#</sup> allows use of certified biodegradable mulch film, e.g. EU fertilizer regulation

\*based on agreed circular economy concept and acceptance of scientific evidence

 very good level achieved     good progress     clear improvement needed

Significant improvement on aligned view towards and end of life. Solution path possible including both options. “Cost-performance” as major hurdle for certified soil biodegradable mulch film to solve.

## Case study 5: Biodegradable structural materials (packaging)

# Fruit and vegetable packaging – New approach proposed by „Bündnis Mikroplastikfrei Österreich“ to prevent generation of persistent $\mu$ -plastics

### Biological recycling

Prevent persistent  $\mu$ -plastics formation in compost\*



\*in case of „unintended“ path (often reality)

### Packaging

Trays, Foil, Net

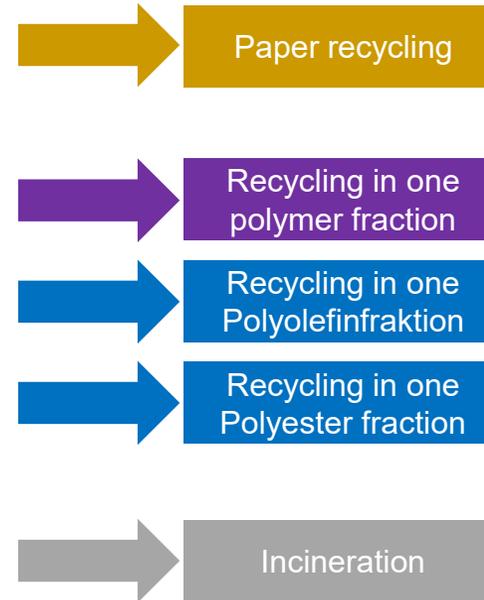
Today: PE, PP, PET, PS, paper

→ Change to compostable materials, paper



### Technical recycling

(intended path)



Prevention of persistent  $\mu$ -plastics in compost as priority target including acceptance of real situation leads to new approaches combining technical recycling with compostable property

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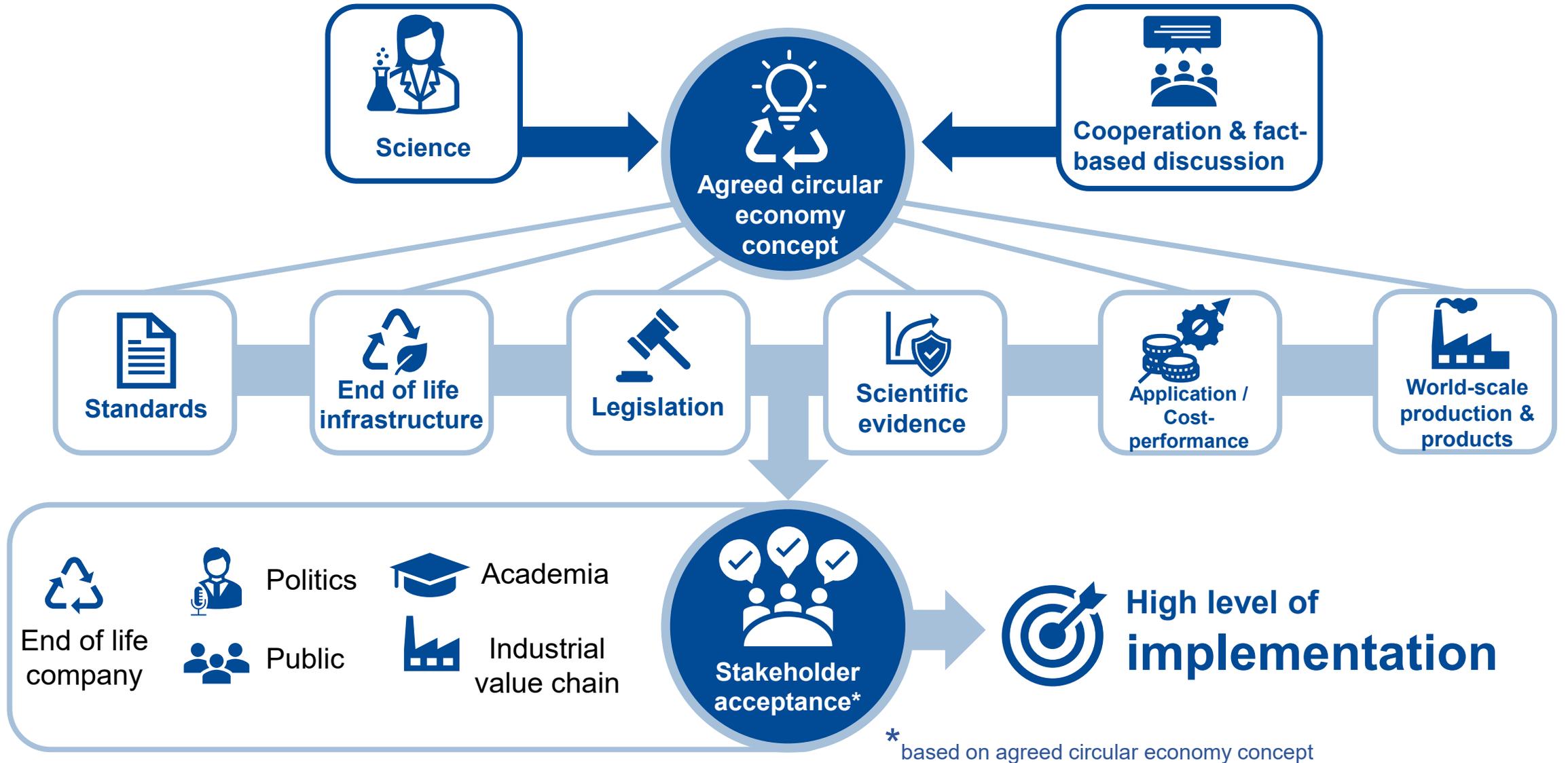
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# Certified biodegradable materials: requirements for implementation



# Recommendations & Learnings

**1** The logic of collectable and non-collectable gives clear guidance in which loop to go: **technical or biological loop**

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**2** Biodegradability is relevant for **small molecules, structural- and functional polymers**

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**3** Agreed circular economy concepts (“Makes sense!”) are essential. Open discussion about **implementation hurdles**

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**4** **End of life view** (need to prevent persistent  $\mu$ -plastic) needs to be **realistic, all options to be considered** and **results have to be measured in an appropriate way**

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**5** **Biodegradation as product property** offers **new opportunities** (e.g. connection of both cycles, enzymatic recycling)

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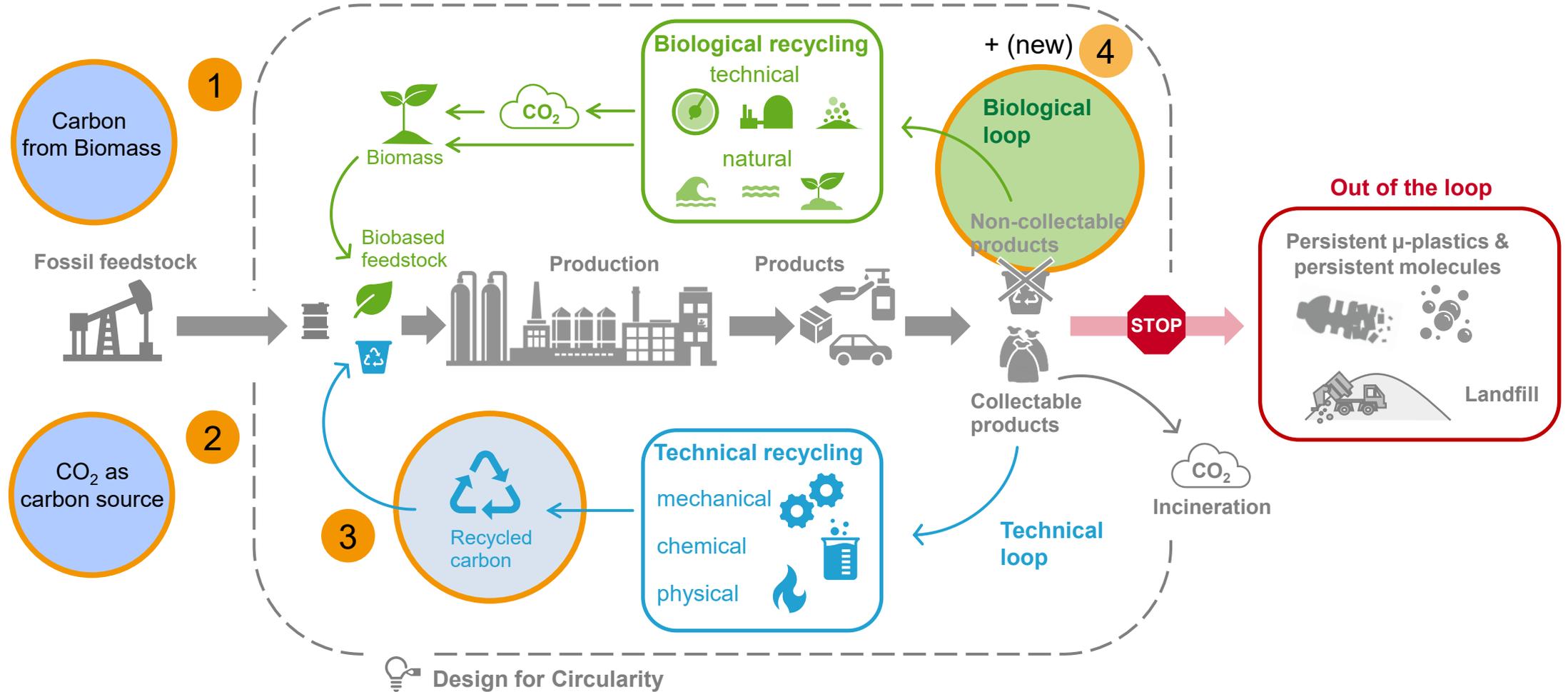
**6** **Biodegradation** for non-collectable materials as **4<sup>th</sup> pillar of a circular economy concept** (besides CO<sub>2</sub>, Carbon from biomass and recycled carbon)

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# Biodegradability understanding

## The role of biological and technical recycling in a circular economy



Technical loop and biological loop are essential parts of a complete circular economy concept



We create chemistry