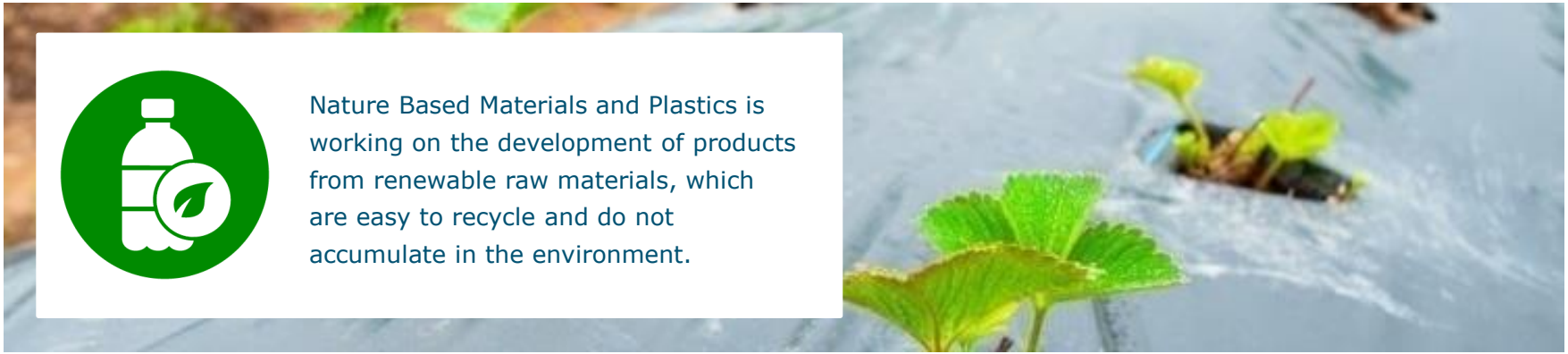
# Nature Based Materials and Plastics



Nature Based Materials and Plastics is working on the development of products from renewable raw materials, which are easy to recycle and do not accumulate in the environment.

A. Circular and non-accumulating biobased plastics

B. Fibre based materials for building, paper and textile

C. Strategies and policy development for biobased materials and chemicals


**Contact**

Karin Molenveld
+31 317 481 157
karin.molenveld@wur.nl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# A. Circular and non-accumulating biobased plastics

# Creating understanding of biodegradation and safety aspects

## Idea #1

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The societal acceptance of biodegradable products is notably affected by growing concerns on the amounts of microplastics found in the environment, their accumulation and their impact on ecosystems or human health. Biodegradable plastics typically fragment during use or at end-of-life, to be subsequently further metabolized and taken up in the biological carbon cycle.

This project will develop methods that provide insight into the environmental fate of disintegrated (intermediate) degradation products when we can no longer see them. Material producers, product developers and brand owners can use these methods to show whether their products potentially contribute to environmental safety aspects.

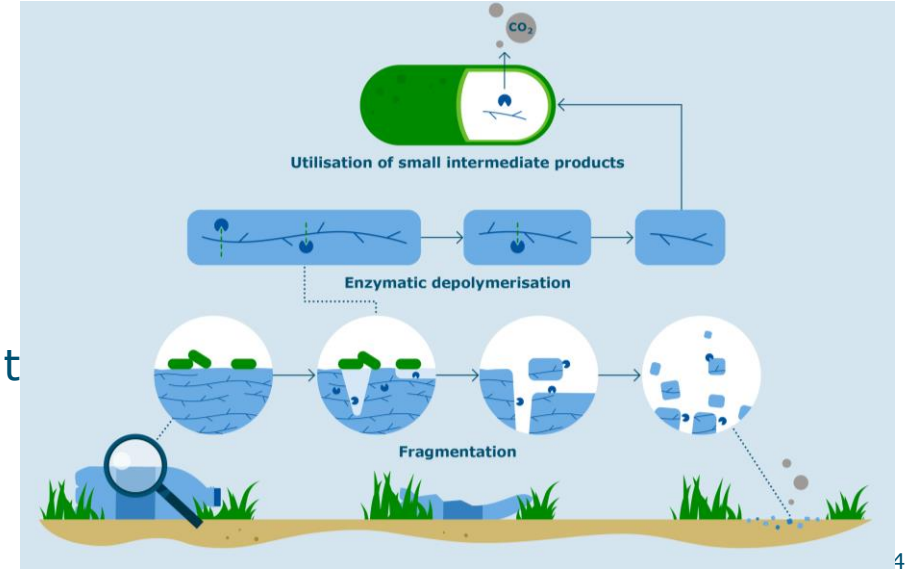
# Creating understanding of biodegradation and safety aspects

What happens to the fragments of biodegradable products (and other degradation products) in the environment when we no longer see them?

**Goal:** Develop methods that provide insight in the environmental fate of these degradation products, e.g.

- microplastic fragments
- released additives

**For:** Material producers, brand owners, product developers, to demonstrate that their products potentially contribute to environmental safer solutions

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# New circular products based on thermoplastic elastomers

## Idea #4

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Currently, most elastomers are derived from fossil feedstocks and very hard to recycle. They end up in the environment as microplastics due to their crosslinked nature. There is a specific need for new biobased, biodegradable thermoplastic elastomers (TPEs). By carefully tuning the polymer microstructure and architecture, such as the length of soft and hard blocks and hydrophilic / hydrophobic segments, specific properties can be targeted such as resilience, toughness and scratch resistance. The proposed TPEs, could be (re)processed using common melt processing techniques. Products that could benefit from these TPEs are used in the automotive industry, consumer goods or leisure products.

# New circular products based on thermoplastic elastomers

- Challenge:

Poor circularity of elastic materials due to cross-linked and/or origin from fossil feedstock. Materials end up in nature as microplastics

- Project aim:

Development of biobased biodegradable TPEs that can replace current elastomers

- Project approach:

Develop TPEs with specific microstructure; hard and soft blocks, hydrophilic and hydrophobic segments to target desired properties.

# Expanding the processing opportunities of PHA plastics

## Idea #5

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Looking at biobased plastics that do not accumulate in nature, PHA polymers remain the only polymers that ‘tick’ both boxes by default. However, their processing behavior hampers their application window, which makes that they are not a suitable option for many applications. The challenge of this project would be to expand the processing opportunities of PHA, thereby making these materials suitable for a wider range of applications.

Topics that will be covered in this project are:
i) improved process stability at higher temperatures;
ii) enhanced flow behavior for injection molding applications;
iii) improving PHA melt strength for film blowing applications.

# Expanding the processing opportunities of PHA plastics

**Challenge:** Biobased PHA polymers are highly promising due to their high biodegradability in many environments. Application window remains narrow due to challenges in processing.

**Project aim:** Develop new material formulations based on PHA polymers and show that these new formulations can be used to develop demonstration products that are currently not in reach for PHA polymers.

**Project approach:**

Investigate and improve the different limitations of PHA such as:

- Processing stability at higher temperatures
- Improving flow behavior during injection moulding
- Improving melt strength for film blowing

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# Safe biodegradable products for outdoor applications

## Idea #6

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This project will develop new strategies to program the biodegradation rate of plastic products that are being used in outdoor environments such as forestry, agriculture, lakes and oceans. These plastic products are often difficult to collect and recycle and even when they are, a high risk of leaving plastic residues in the environment remains.

This calls for new plastic materials that maintain their functionality during use while biodegrading as fast as possible during their end-of-life. Hence the project will develop new polymer formulations and processing routes towards products that maintain their intended performance while significantly reducing their pollution potential.

# Safe biodegradable products for outdoor applications

**Challenge:** To develop new strategies to program the biodegradation rate of plastic products that are being used in outdoor environments and are difficult to collect and recycle and have a high risk of emitting microplastics

**Project aim:** Develop new polymer formulations and processing routes towards products that maintain their intended performance while significantly reducing their pollution potential.

**Project approach:** Investigate the effect of a wide range of hydrolysis stabilizers on biobased polymer processing and functionality (both during use and end-of-life). New materials formulations will be scaled up product level in collaboration with participating parnters.

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# B. Fibre based materials for building, paper and textile

# Binder, done that

## Idea #10

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Thermoset resins are currently produced from extensive amounts of fossil-based, environmentally unfriendly and toxic binder chemicals. Lignocellulose can offer all the functionalities needed to produce fully biobased thermoset resin alternatives.

The ‘Binder, done that’ project will harness these functionalities, paying specific attention to the role of biobased aldehydes. New value-chains for lignocellulosic side streams will be explored, novel biobased resins will be developed and product properties will be tailored through synergistically combining biobased constituents.

# Binder, done that.

Thermoset resins are currently produced from extensive amounts of fossil-based, environmentally unfriendly and toxic binder chemicals. Lignocellulose can offer all the functionalities needed to produce fully biobased thermoset resin alternatives. The ‘Binder, done that’ project will harness these functionalities, paying specific attention to the role of biobased aldehydes.

**Development of fully biobased binders through synergistic combinations of lignocellulosic constituents.**

**Deliverables in the project:**

- Sourcing and characterization of lignocellulosic side-streams
- Study effect of various biobased aldehydes in resin synthesis
- Tailoring product properties through composition and processing
- Hot-spot assessment of techno-economic feasibility

Consortium partners:
- Side-stream owners (e.g. agriculture, food, forestry)
- Converters (e.g. furanics)
- Resin/binder producers (e.g. PF, UF)
- End-users (e.g. particle board, HPL)

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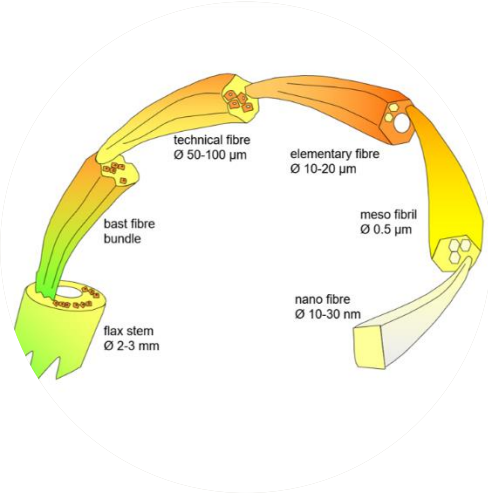
# Stronger biocomposites




This project aims to develop stronger natural fiber reinforced biocomposites and make them more competitive against glass fiber reinforced composites. Typically, the low strength of biocomposites is due to a very short fiber length that remains after the required harsh compounding conditions needed during production.

In this project methods will be developed to weaken the binding layer between plant cell fibers. This allows the use of a mild extrusion process to produce biocomposites, with an increased fiber length and up to 30% higher composite strength.

## Idea #11

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# Stronger Biocomposites

- Issue:
  - Biocomposite stiffness can compete with glass fibre composites. However, strength cannot.
  - This is due to short fibre length, the result of harsh extrusion compounding conditions required to refine the fibres to their strong plant cell fibre level.
  - Retaining longer fibre length, up to 30% higher composite strength expected, while retaining high composite stiffness.

- Solution
  - Weakening the binding layer between plant cell fibres, thus allowing
  - Milder extrusion compounding process to obtain longer yet strong plant cell level fibres.

# Stronger Biocomposites

- Deliverables
  1. Pretreatment process for flax and hemp fibres (and eventually woody biomass) to facilitate further 'refining';
  2. Milder extrusion compounding process to obtain composites with anticipated double fibre length compared to currently;
  3. Composites with up to 30% higher strength.
- Approach
  - Weakening of the binding layer between plant cell fibres of flax and/or hemp (& eventually woody biomass); effectiveness of a number of methods will be evaluated.
  - Compounding (mixing) of pretreated fibres with thermoplastics under mild conditions; the effect of pretreatment and compounding conditions on fibre length and composite strength will be optimised.
    - To be tested successively on a lab scale and pilot scale.

# Stronger Biocomposites

- Target
  - Biocomposites with up to 30% higher strength
    - Much improved competitiveness with glass fibre reinforced compounds
  - Application options: Injection moulding; 3D printing

# Biowaste to building Materials

## Idea #12

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Biobased materials, specially building materials are currently mainly promoted and developed from agricultural (side-) streams. The use of residues and/or waste streams for this purpose opens interesting opportunities. For once They are already readily available, in large volumes. Optimizing separation technologies and improving processing will open this large resource group. Impurities and components outside the normal lignocellulosic matrix may even be used to provide additional properties, e.g. bonding, water resistance or fire retardancy.

This project will add “bio-waste” to the list of raw materials used for building.

Fibre based materials

# From bio-waste to building materials

Opportunity

- Biobased building to reduce $CO_2$ is gaining momentum.
- Biobased materials, especially building materials are currently mainly promoted and developed from agricultural (side-) streams.

➢ The use of residues and/or waste streams for this purpose opens up interesting opportunities. (e.g. Pruning, Reed, Horticultural/Greenhouse residues, Food waste)

Fibre based materials

# From bio-waste to building materials

Opportunity

- Bio-waste is already readily available, in large volumes.
- Impurities and components outside the normal lignocellulosic matrix may even be used to provide additional properties, e.g. bonding, water resistance or fire retardancy.
- Most new biobased building materials rely on other materials to create the overall properties
    - Gypsum walls, Plastic bonding fibres etc.

Fibre based materials

# From bio-waste to building materials

Approach:

- Determine where bio-waste can replace agricultural crops in building materials
- Determine added value of impurities and non-lignocellulosic components
- Optimizing necessary separation technologies
- Adapt processing to achieve similar of better materials with bio-waste

Goal:

This project will add “bio-waste” to the list of raw materials used for building.

# C. Strategies and policy development for biobased materials and chemicals

# Decision support for future-proof products with sustainable material strategies

## Idea #15

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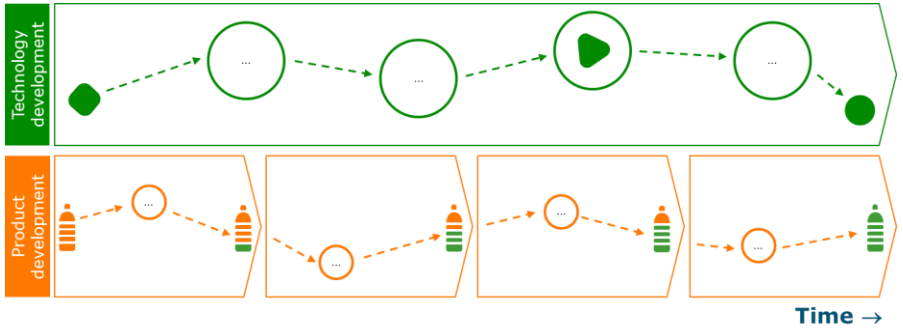
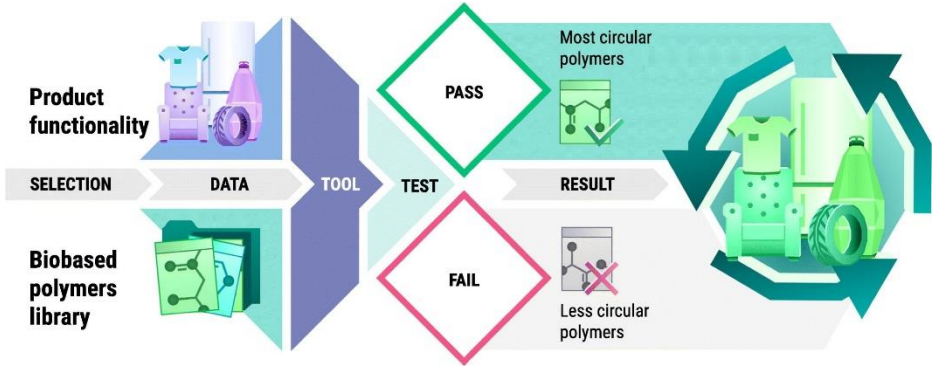
Producers in material development and product design face significant challenges when making decisions about which materials to apply for specific products, especially in terms of sustainability. The current systems are ill-prepared to accommodate novel polymers and sustainable innovations. As a result, many companies and entire sectors are resorting to sub-optimal choices, prioritizing short-term system compatibility over long-term sustainability.

This project will leverage a suite of innovative tools to address the challenges of sustainable material selection. By doing so, companies and sectors will be supported in making sustainable material choices for their current products and in developing an action plan for future product innovations.

# Decision Support for Future-Proof Products with Sustainable Material Strategies

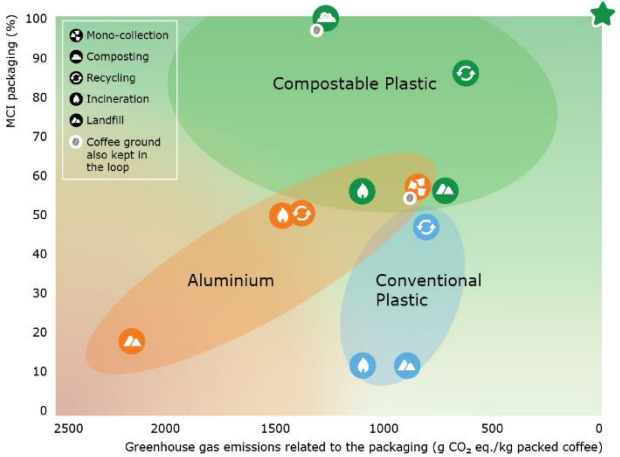
## Technology roadmapping




## Strategic polymer selection

## Multi-dimensional sustainability assessment




## & other tools …

# Safe and sustainable by design biobased chemicals and materials in NL

## Idea #16

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The 'safe and sustainable by design' (SSbD framework) of the European Commission is a voluntary approach to guide the innovation process for chemicals and materials. With the increasing emphasis towards transition to circular biobased economy, this framework can facilitate the shift to happen in a sustainable and safe manner. While this framework offers many opportunities and benefits, how can it be effectively applied by companies?

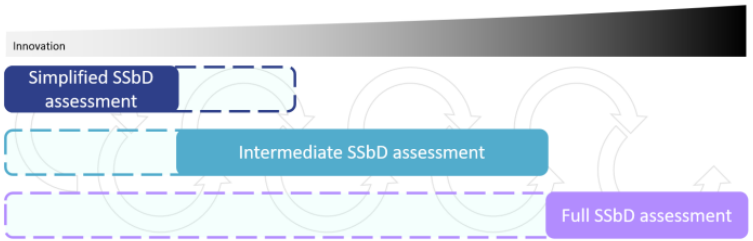
Therefore, the aim of this project is to support the uptake and utilization of the SSbD Framework in the Netherlands and facilitate its implementation.

# Safe and sustainable by design biobased chemicals and materials in NL

The 'safe and sustainable by design' (SSbD framework) of the EC guide the innovation process for chemicals and materials

Aim: To support the uptake and utilization of the SSbD Framework in the NL and facilitate its implementation by biobased producers

- Carry out assessment (simplified to full depending on the TRL of studied products), facilitate decision making & steer innovation in the most sustainable and safe direction
- Derive feedback from practical testing to improve the applicability of the framework to biobased chemicals and materials

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# Legislation and the impact on industries

## Idea #17

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New European regulations and directives have an increased impact on European industries. Examples are the Packaging and Packaging Waste Regulation (PPWR), SUP directive and fertilizer regulation. Although these policies aim to create a more sustainable future, they may result in various challenges, like for example:  difficult implementation and monitoring, increased costs, blocking of innovations and regrettable substitutions.

The aim of this project is to provide clear insights from an industry perspective that can be used to improve the implementation of new legal frameworks and shape future adjustments to make them more effective.

# Balancing carbon to soil and biobased applications

## Idea #18

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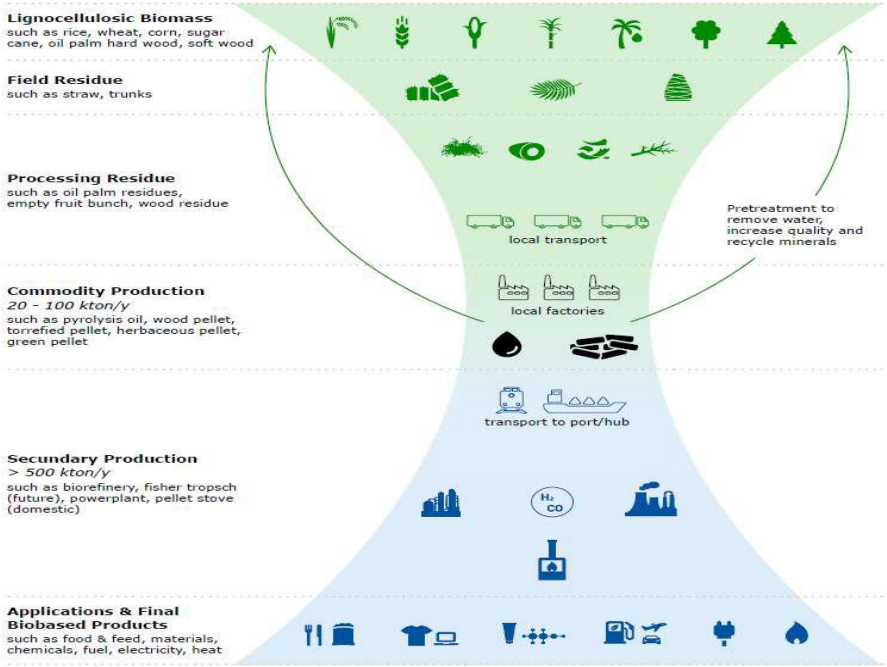
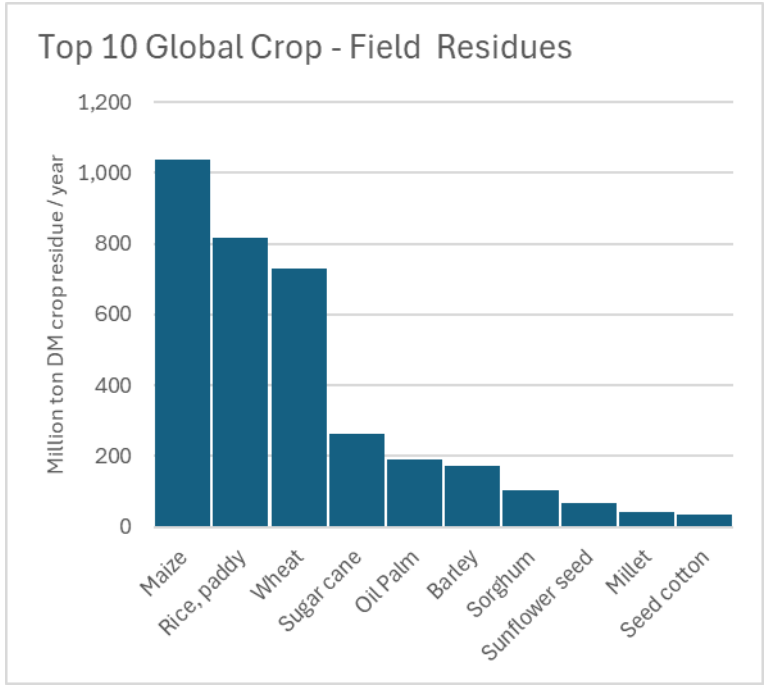
The biobased economy needs sustainable biomass for production of chemicals, SAF, and other material or energy uses. Residues or wastes are generally the most sustainable feedstock choice. A potential conflict emerges with soil quality maintenance which also requires biomass input.

Still, optimization strategies are possible and need to be tested and evaluated. As soils vary considerably in the need for inputs and the timing of the input the topic is complex, and case specific solutions are required.

# Balancing carbon to soil and biobased applications

## The biobased economy needs sustainable biomass

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# Balancing carbon to soil and biobased applications

## Balance between utilizing available biomass and maximizing soil quality

Optimization strategies are possible - but need to be tested and evaluated. As soils vary considerably in the need for inputs and the timing of the input the topic is complex, and case specific solutions are required.

Possible approaches:

- Harvesting straw only once every 2-3 years
- Planting a green manure crop after harvest
- Increase crop yields
- Use stems, leaves for the soil (2/3 nutrients left in the field + 1/3 of organic matter)
- Apply other organic fertilizers: digestate, manure, etc.
- Returning ash from straw burning to the field
- Requiring balanced fertilization from farmers

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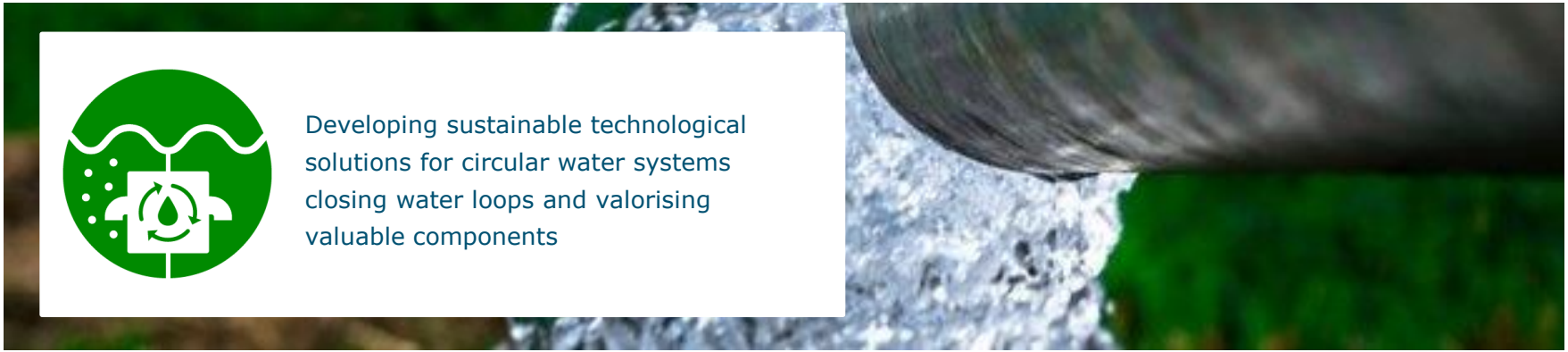
# Circular Water Technologies



Developing sustainable technological solutions for circular water systems closing water loops and valorising valuable components

D. Water treatment for circularity


**Contact**

Irma Steemers-Rijkse
+31 317 487 530
irma.steemers-rijkse@wur.nl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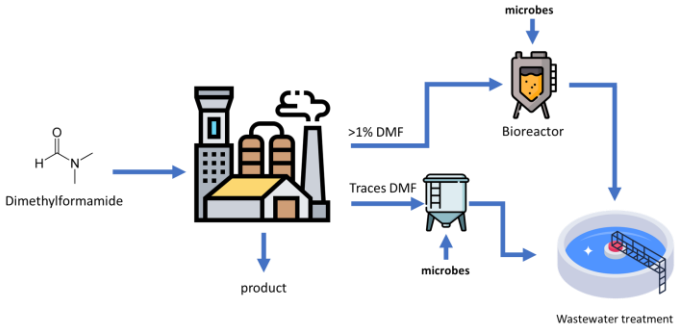
# D. Water treatment for circularity

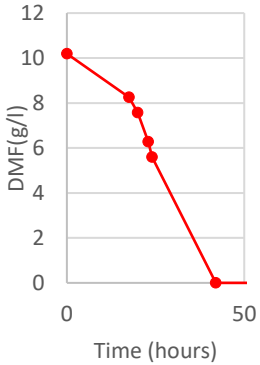
# Tailor made microbial degradation processes for wastewater treatment

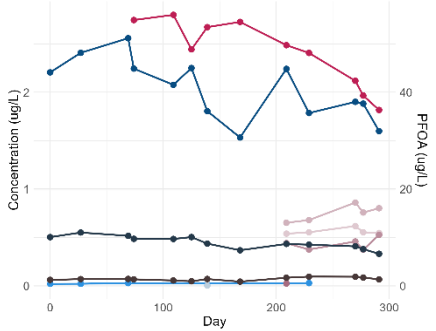
**Microbially driven cleanup of environmentally hazardous compounds has a great potential to improve surface water quality while being cost effective compared to physicochemical methods.**

- We were able to remove dimethyl formamide (DMF) from waste streams that originated from pharmaceutical manufacturing facilities using specialized bacterial species.

- We performed microbial enrichment experiments to select for species that might degrade PFAS and explore bioremediation potential

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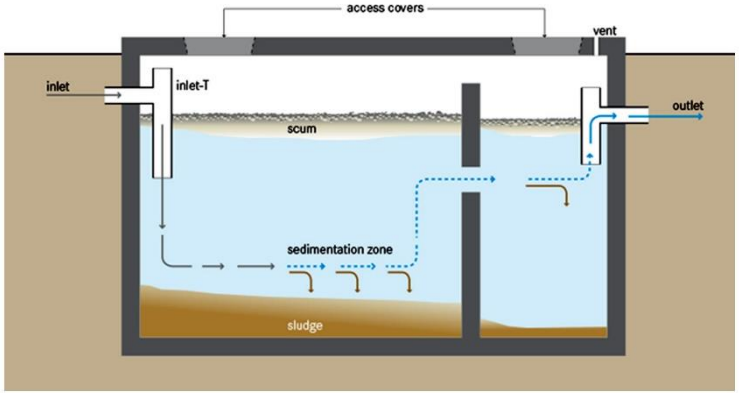
# Idea #19: SepticTankUpgrade

Septic tanks are known to be suboptimal for the removal of excreted medicines, hormones and other pharmaceutical compounds. Yet, even in the EU a large fraction of sewage in rural areas is treated in on-site septic tanks.

**Our aim is to develop bacterial cultures specifically to enhance removal of pharmaceutical residues from sewage.**




**Deliverables in the project:**

- Identify and characterize the bacterial species that can degrade these compounds efficiently,
- Investigate if they can proliferate in current conventional septic tank systems and
- Produce spray-dried culture that could be part of septic tank formulation.

Consortium partners:

- Bacterial culture producers
- Septic Tank industry
- Pharmaceutical companies
- Waterschappen
- Others

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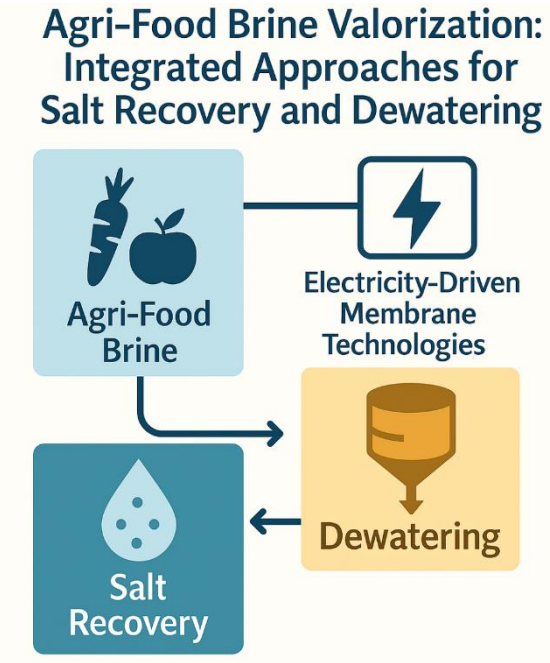
# Idea #20: Agri-Food Brine Valorization: Integrated Approaches for Product Recovery & Dewatering

**Challenge**: loss of valuable compounds in residual brine streams from agri-food sector (salts, proteins, lipids, organic acids, sugars, flavors)

**Solution: Develop non-thermal hybrid (electro) membrane processes for dewatering & selective product recovery**

Activities:

- Assessment of valuable compounds assessment
- Screening of hybrid technologies & feasibility for operational integration
- Evaluation through lab-scale testing
- Demonstration of most feasible process on location
- Economic & environmental impact analysis

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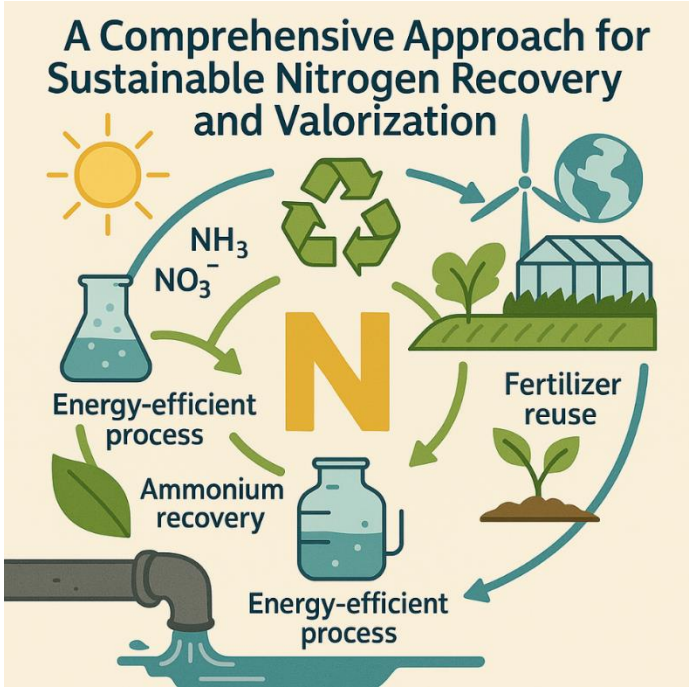
# Idea #21: a Comprehensive Approach for Sustainable Nitrogen Recovery and Valorization

**Challenge**: nitrogen and potassium are lost in aqueous waste streams, while fertilizer production relies on energy- and resource-intensive processes.

**Solution: develop new integrated electro-membrane separation and conversion process for selective nitrogen recovery and conversion**



# Idea #21: a Comprehensive Approach for Sustainable Nitrogen Recovery and Valorization

Activities:

- Mapping of nitrogen in residual streams
- Development of selective separation & conversion process
- Lab- and pilot-scale validation
- Production of marketable nitrogen-based products
- Assessment of agricultural impact & circularity
- Assessment of valuable compounds assessment
- Screening of hybrid technologies & feasibility for operational integration
- Evaluation through lab-scale testing
- Demonstration of most feasible process on location
- Economic & environmental impact analysis

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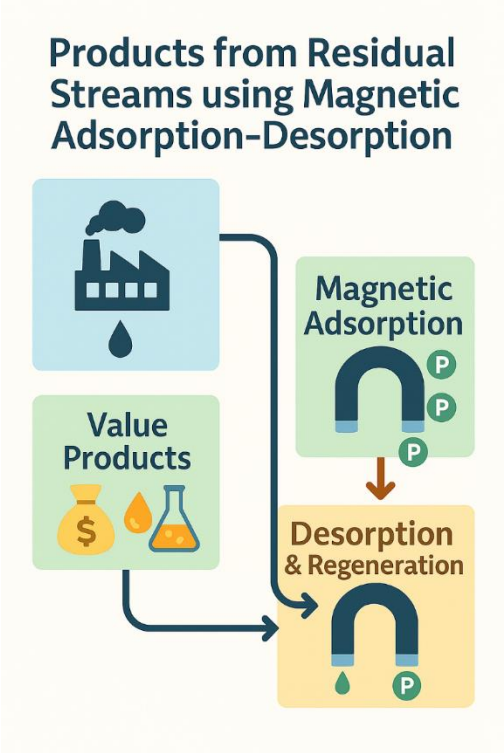
# Idea #21: recovery of Valuable Products such as Phosphorus with Magnetic Adsorption-Desorption

**Challenge**: Loss of phosphorus and other valuable compounds from wastewater; conventional recovery methods are chemical-intensive and not-selective.

**Solution: Apply Magnetic Adsorption-Desorption (MAD) using regenerable magnetite particles for selective recovery of phosphorus and other valuable components.**

Activities:

- Identification of valuable compounds in wastewater
- Development & functionalization of magnetic adsorbents
- Lab-scale testing of adsorption, desorption & recovery
- Pilot-scale validation on real streams
- Techno-economic & environmental assessment

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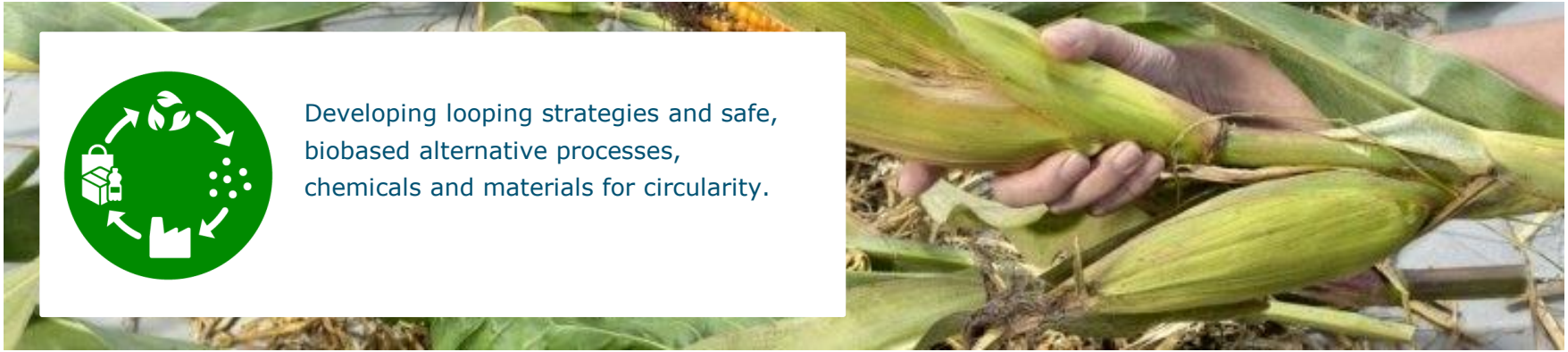
# Safe and Circular biobased Products



Developing looping strategies and safe, biobased alternative processes, chemicals and materials for circularity.

E. Value creation from biomass

F. Circular design of coating and composites

G. Safe and circular (food) packaging materials

H. Biodegradable alternatives to products that end up in sewage water

**Contact**

Jacco van Haveren
+31 317 487 530
jacco.vanhaveren@wur.nl

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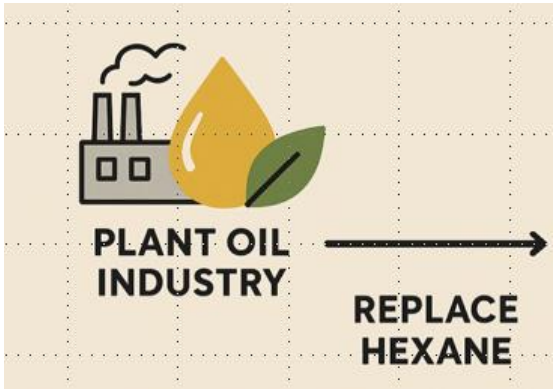
# E. Value creation from biomass

# Idea #23: “Hexane-Free”, scCO2 opens new markets for oilseed proteins




SUPERCRITICAL CARBON DIOXIDE

**Project aims:**

**-Validation both oil and protein**

**-Improved functionality and use of protein from oil seeds (feed food)** →

**-Economic feasibility, improved sustainability**

## Incentive for replacing hexane: EFSA report

Technical Report

efsa SUPPORTING PUBLICATIONS

APPROVED: 4 September 2024

doi: 10.2903/sp.efsa.2024.EN-9001

Technical Report on the need for re-evaluation of the safety of hexane used as an extraction solvent in the production of foodstuffs and food ingredients

European Food Safety Authority (EFSA),
Daniele Comandella, Margherita Bignami, Peter Fürst, Konrad Grob, Marcel Mengelers, Claudia Cascio, Kyriaki Xiftou, Cristina Croera and Claude Lambré

- **Toxicity**
- **Sustainability**

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# Idea #24: LactoMax: Delactosed permeate valorisation

Delactosed permeate (DLP) is a side-stream of dairy processing, currently applied in animal feed with little added value. WFBR developed a cost-effective partial demineralization technique for DLP and combined this with a fermentation, to produce microbial biomass. This biomass can be used as ingredient for pet-food or feed, with similar properties compared to yeast extract.

**Final goal is to create a healthy feed or pet food ingredient from DLP**

**Deliverables in the project:**

- Optimize pretreatment, fermentation and downstream processing
- Study effect of various DLP sources
- Application trials in feed and pet-food (health, uptake, conversion, palatability)
- Assess microbial oil production possibilities
- Derisking and scale-up of the process

Consortium partners:
- Side-stream owners (dairy companies)
- Feed (ingredient) companies
- Pet-food (ingredient) companies

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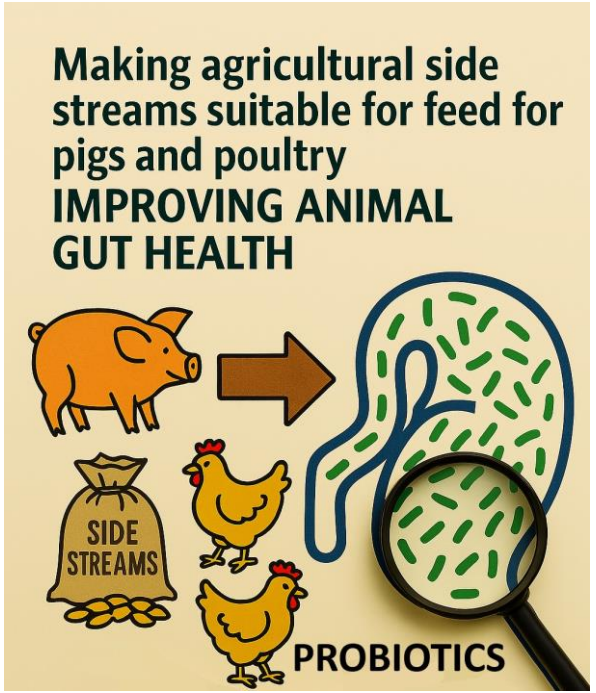
# Idea #25: “PAWS”, Probiotics for Animal Well-being and Sustainability

Project aims at (partly) substitution of soy and maize with agricultural side streams:

- make suitable for feed for pigs and poultry
- Improved feed uptake  and digestibility
- Improved animal health and gut bacteria

Tools: fermentation and probiotics

pretreatments, down stream processing

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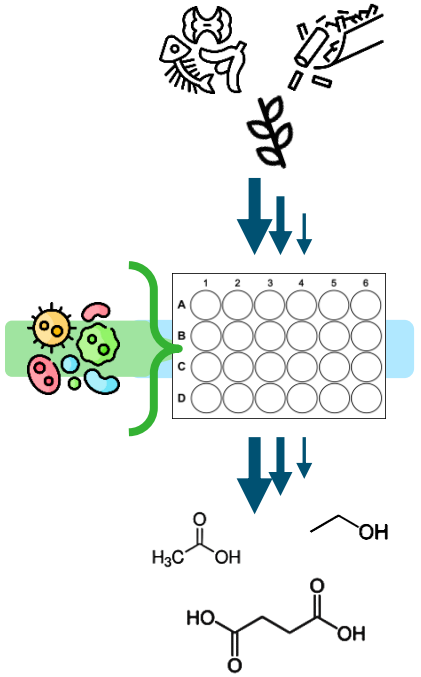
# Idea #26: Alternative host identification

Biobased production of chemicals and building blocks for polymers from waste streams through fermentation requires robust microbial production hosts. Finding the optimal microorganism is far from trivial. This initiative intends to make it easier to find promising solutions for valorization of waste streams and providing biobased building blocks for chemicals and polymers.

**We will create a 'mix-and-match' database to find suitable microbial platforms for biobased chemical production and waste stream valorization**




**Deliverables in the project:**

- High throughput screening methodology to assess performance of microorganisms on waste streams
- Establishing protocols for minimal feedstock pre-treatment
- Expert advice on possible product spectra and metabolic engineering potential of promising microbial hosts

Consortium partners:

- Side-stream owners
- Fermentation companies
- DSP companies
- Producers/end-users of biobased building blocks

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# Idea #36: Electrocatalytic conversion of CO2 to di(m)ethyl carbonate

- Electrochemical $CO_2$ valorization is a promising technology for the generation of products with a reduced ecological footprint.
- The ECODIME project will pursue the electrochemical synthesis of di(m)ethyl carbonate.
  Dimethyl carbonate or DMC is used in variety of applications such as solvents in lithium batteries, building block in the synthesis of polycarbonates and as reagent to modify polysaccharides.
- The ECODIME project will address the current limitations and will pursue the electrochemical synthesis of DMC at more industrial relevant conditions.

Potential industrial partners:

-$CO_2$ suppliers
-Equipment manufacturers
-Producers of DMC
-(End) user of DMC

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# F. Circular design of coating and composites

# Idea #27: Gluecose: sugar-based resins

In this project, fully biobased and safe resins for wood-panels will be developed from carbohydrate-rich agricultural and food side-streams. More specifically, the production of furanics as biobased building block will be targeted. Hemicellulose-rich side-streams could offer a great opportunity as pool of saccharides for conversion to furanics.

**Development of sugar-based thermoset resins from hemicellulosic side-streams**

**Deliverables in the project:**

- Mapping and characterization of hemicellulose-rich side-streams
- Improvement sustainable production of furanics
- Development sugar-based thermoset resins
- Resin application trials in selected products
- Hot-spot assessment of techno-economic feasibility

Adobe Firefly

Consortium partners:
- Side-stream owners (agriculture, food, forestry)
- Converters (enzyme suppliers, furanics producers)
- Resin producers/end-users

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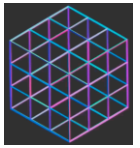
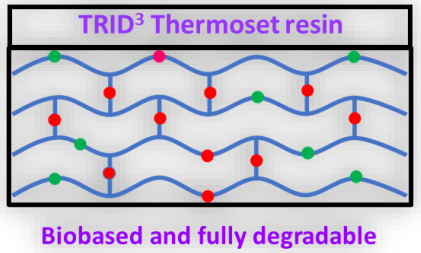
# Idea #28: Thermoset Resins: Innovatively Designed for Degradation on Demand - TRID3



- Conventional epoxy thermosets constitute a significant portion of high-performance polymers resulting into outstanding thermal and mechanical properties.
- Nearly 90% of the epoxy thermosets use diglycidyl ether of bisphenol A (DGEBA). Due to its endocrine disrupting effects, the use of BPA will be restricted or phased out in many applications.
- Alternatives to BPA are needed with comparable or superior performance, while not being endocrine disruptive.

**TRID$^3$ aims to develop thermoset resins that is innovatively designed for degradation on demand**




- Development of non-toxic and non-disruptive platform chemicals with enhanced functionality from renewable feedstock.
- Biobased monomers with unique degradable & cross-linkable bonds
- Formulation of thermoset resins using new monomers & evaluation of their mechanical properties
- Validation of the degradation by triggering the degradable linkages to recover chemical components

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# Idea #28: Thermoset Resins: Innovatively Designed for Degradation on Demand - TRID3

**STYR-FREE: Biobased styrene-free thermoset**

Global styrene market is enormous and expected to double by 2032. But styrene has demonstrated environmental and health problems, such as odour, air pollution, volatility and carcinogenicity. It is necessary to replace styrene with sustainable monomers for development of thermosets and composites. Several biobased monomers are available to that aim. However, more systematic efforts are needed to realize commercial value that will enable them more competitive. STYR-FRIEED project will select the most promising molecules that can replace styrene and bring them closer to the industry by evaluating the types of biomass feedstock, synthesis ease, curing conditions and efficiency and resulting resin properties.

**Final goal is to build a toolbox of biobased non-toxic styrene-replacement monomers to meet resin properties requirements over a broad range of rubbers, coatings and composites applications.**

**Deliverables in the project:**

- Evaluate the most promising biobased feedstock
- Synthesize a range of new biobased monomers
- Validate the application of the developed monomers in rubbers & resins
- Test the toxicity and thermo-mechanical properties of the resins

Consortium partners:

- Side-stream owners (agricultural)
- Styrene producing companies
- Resin producing companies
- Rubber (SBR), composites & coatings producing companies
- Products manufacturers (cars, tyres, asphalt, shoes, furniture, etc)

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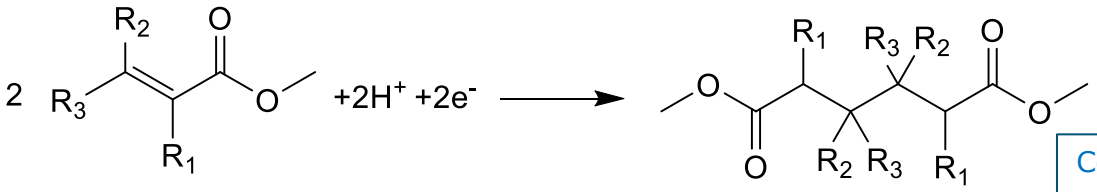
# Idea #29: Valorization of di-and tricarboxylates

- In order to reduce GHG emissions, next to using biomass, also the use renewable energy in the synthesis of products needs to be increased. Electro–organic synthesis is uniquely suitable to derive di-and tetracarboxylates from unsaturated biobased intermediates.
- This project will build on previous work in which a proof of principle has been established. The produced hydrocoupling products can be used as building blocks for biobased coatings, adhesives, sealants, elastomers, providing flexibility and hydrolytic stability to the envisaged products




Consortium partners:
- Equipment manufacturers
- Biomass/intermediate suppliers
- CASE industries

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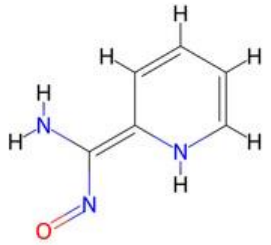
# G. Safe and circular (food) packaging materials

# Idea #30: The role of metal ions in generating NIAS

Non-intentionally added substances (NIAS) are found in recycled plastics. Some of these are substances of concern and are formed in the last stages of the recycling process. Transition metal ions (Cr, Co, Fe, Ti, etc.) accumulate in recycled plastics from shredders, sieves, impurities in washing liquids, pigments, etc. These metals are suggested to catalyze the conversion of innocuous contaminants (inks, tie-layers, etc.) into substances of concern. This project aims to study these complicated reaction paths and to find solutions.

**Final goal is to understand NIAS formation and to develop mitigation strategies**




**Deliverables in the project:**

- Study the role of transition metals in the formation of NIAS in recycled plastics
- Effective mitigation strategies to avoid NIAS formation in recycled plastics

Consortium partners:
- Recycling companies
- Food industries using food-grade recycled plastics

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# Idea #31: Methodologies for microplastic detection in food/feed

- With microplastics accumulating in human and animal tissue, it is only a matter of time before legal limits may be established. Exposure may occur through food and drinks, while health risks are still unclear. Detection of microplastics was already a subject of attention for the European Commission (Decision 2024/1441), but for food and feed matrices, method development and standardization is necessary.
- The project aims at developing increased insight in microplastic incidence in food and feed products helping companies to better address this issue of major public concern. Besides analytical quantification and qualification, a 'root-cause analysis' approach could identify possible origin sources and enabling risk mitigation strategies.

*In cooperation with Wageningen Food Safety Research*

Potential industrial partners:

-Food/feed companies
-Packaging companies
-End users, brand owners, retailers

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# H. Biodegradable alternatives to products that end up in sewage water

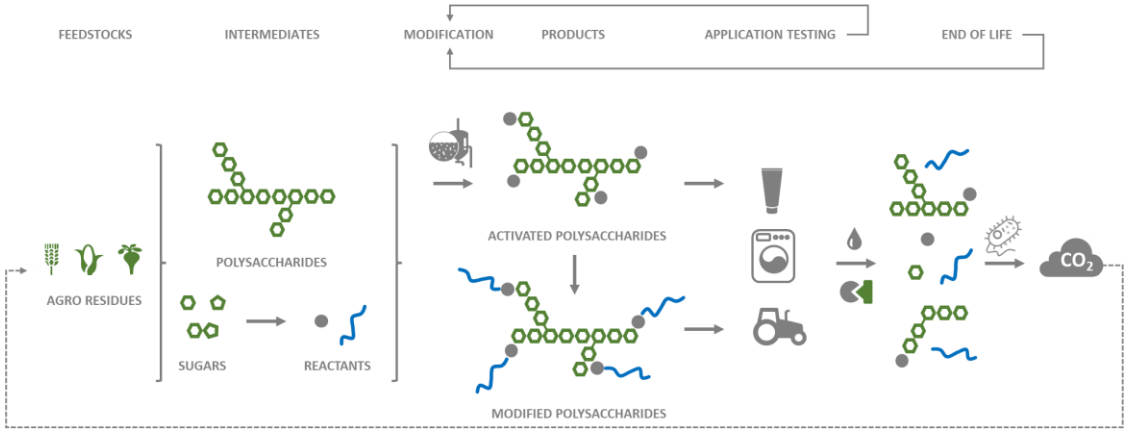
# Idea #32: Waterdispersable polysaccharides

## Motivation

There is a need for new, **biodegradable**, **multifunctional water borne components** for Home & Personal Care as well as agro-chemical formulations. There are conflicting demands wrt stability/shelf life, technical performance, GHG emissions and fast degradability

## Proposed solution

Use **residual polysaccharides** as polymer backbone en develop **new linker technology** to tether various modifiers (e.g. amines, protein hydrolysates) onto the backbone, while retaining **biodegradability**

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# Idea #34: Enzymatic modification polysaccharides: unlocking tailored functionality for industry

Industry demands sustainable high-performance polysaccharides for food and other applications.

**Development of (improved) enzymatic modification of polysaccharides such as guar and pectin for enhanced properties:**

- Biobased, clean-label & biodegradable
- Compliance with green chemistry regulations
- Anionic & non-ionic polysaccharides
- Remodelling & functionalization

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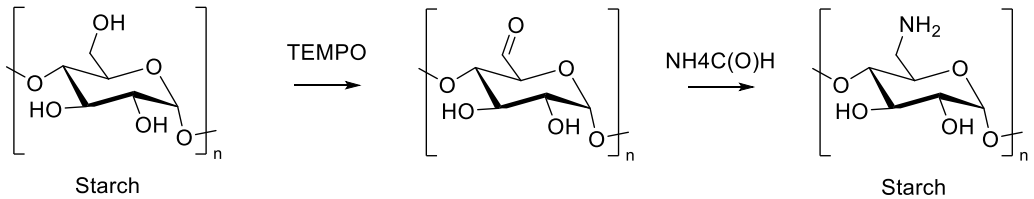
# Idea #35: "Leuckart-Enhanced Amino Functionalized" polysaccharides

- In Home & Personal Care products, as well as in applications like paper sizing & flocculants, *cationic polymers* are highly desired.
- The LEAF (Leuckart-Enhanced Amino Functionalized) project will develop *amino-functionalized polysaccharides*, via catalytic and green conversion technology.
- Polysaccharides will be catalytically oxidized to aldehydes, followed by reductive elimination of green ammonium formate (Leuckart reaction)




Starch Starch

Potential industrial partners:

-Feedstock suppliers
-Converters
-End users, brand owners

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