Andrés Sala

ainia

23/04/2026

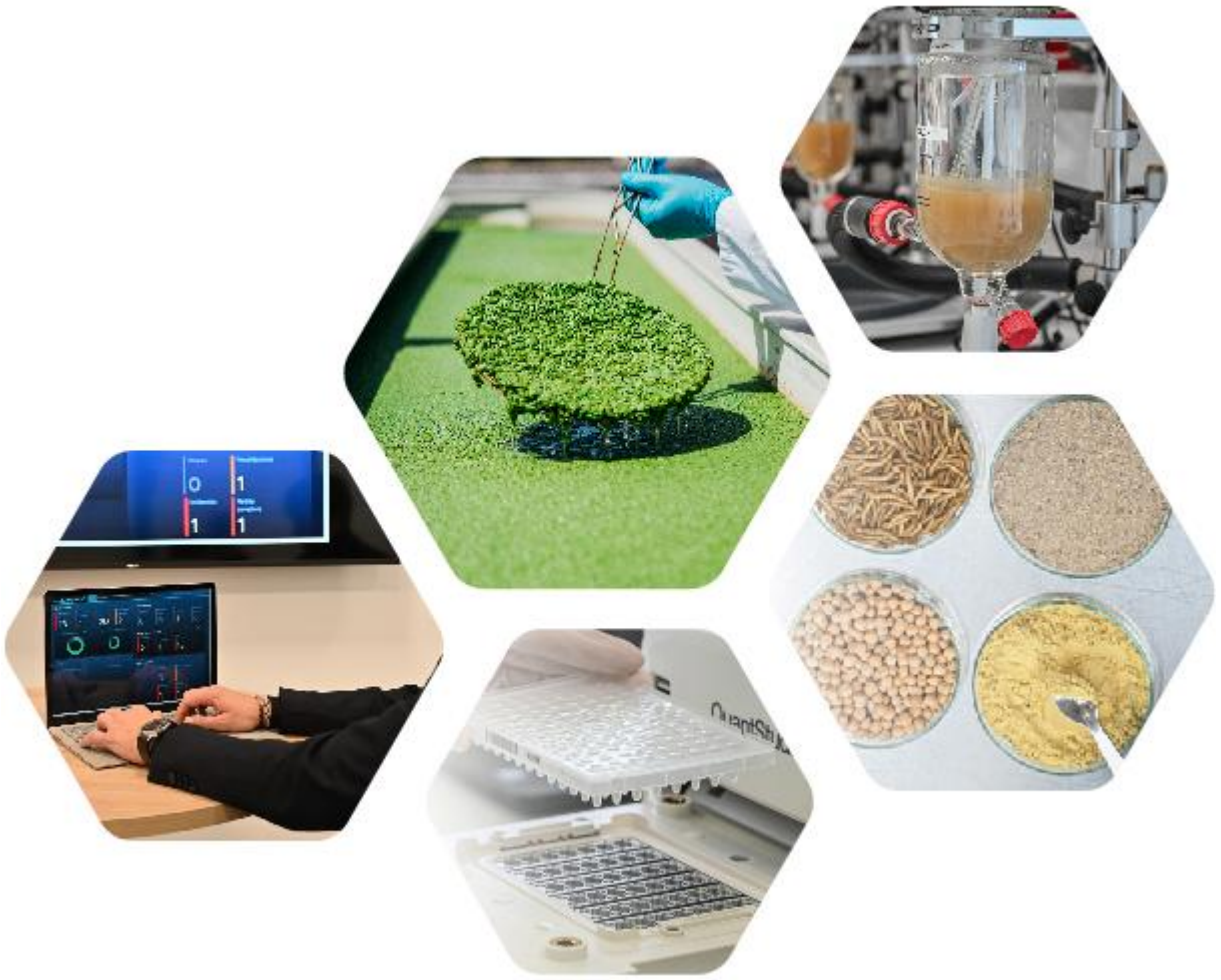
Grupo de Trabajo SSbD de SusChem

Reciclado químico y biológico de envases de PHA como alternativas de fin de vida a la compostabilidad para envases biobasados

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union, European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.

ainia



Trabajamos para resolver 5 retos de la sociedad y las empresas

Alimentación del futuro

Calidad y seguridad alimentaria

Transición verde

Salud y bienestar

Transformación digital

Sectores con los que trabajamos

Alimentación
Packaging
Cosmética
Farmacia
Química

ainia

LINEA DE ENVASES Y MATERIALES

MATERIALES

- Biopolímeros
- Valorización subproductos agroalimentarios
- Biorrefinería lignocelulósicos
- Reciclado químico
- Materiales carbonosos
- Surfactantes biobasados
- Downstream procesos biotecnológicos
- Modificaciones químicas y superficiales de materiales

ainia

SATIS PHA CTION

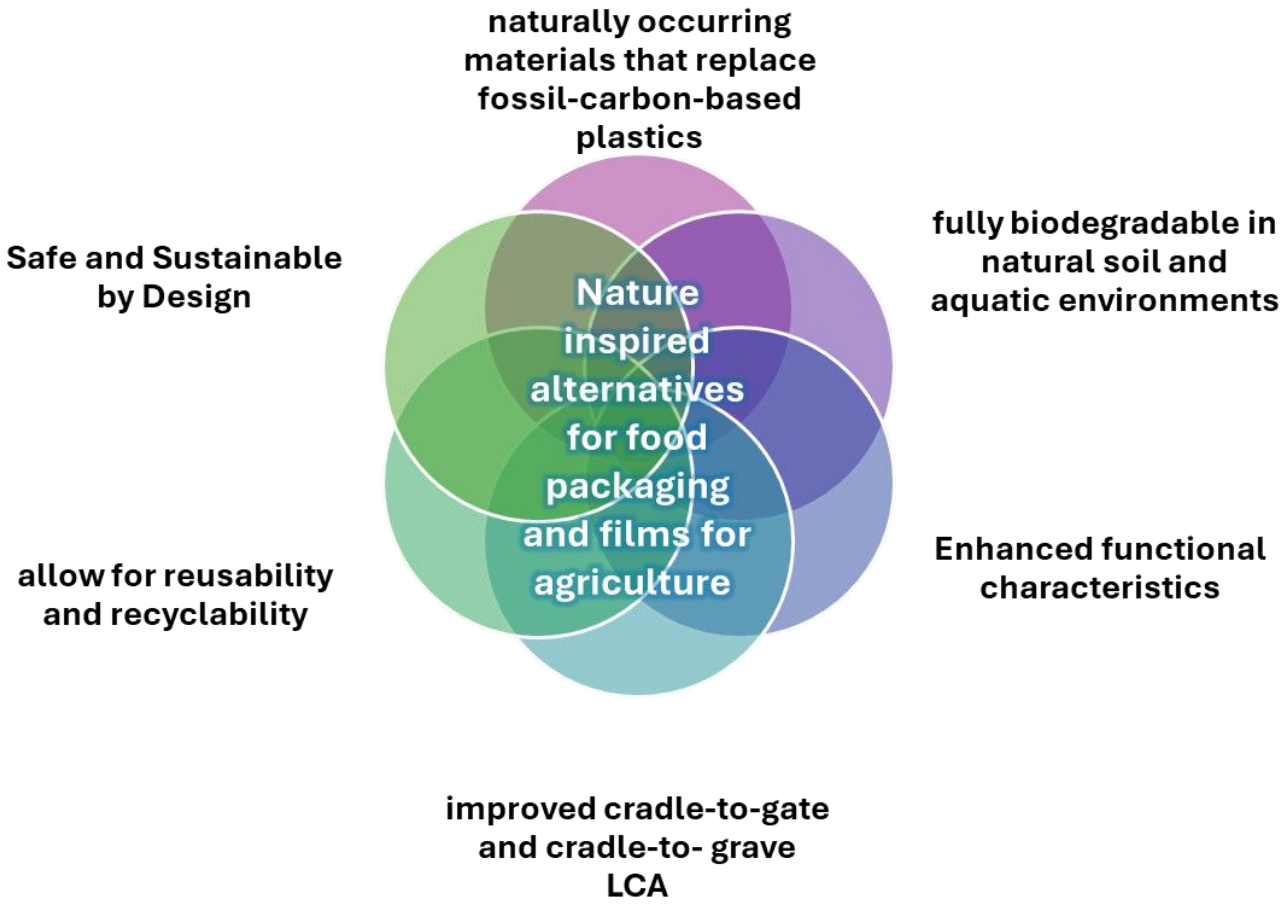
THE CHALLENGE

PATHFINDER

Deep tech projects
Taking forward breakthrough deep tech projects with a high degree of scientific and technological ambition and risk and potential to create a new market (TRL 1-4)

European Innovation Council

EIC PATHFINDER CHALLENGE Nature inspired alternatives for food packaging and films for agriculture



ainia

ABOUT THE PROJECT

Upcycling PHAs to innovative materials for fully sustainable food packaging

Duration:
4 years (1st Oct 2025 – 30th Sept 2029)
Call:
HORIZON-EIC-2024-PATHFINDERCHALLENGES
Budget:
3,7 million €

General objective

Development of groundbreaking chemical and enzymatic **PHA upcycling processes** that allow the full recovery of monomers and their subsequent repolymerisation **to enable the production of PHA polymers with enhanced properties**. Such polymer improvements will allow the preparation of PHA-based formulations less reliant on additivation and blending to meet the processability requirements.

Specific objectives:

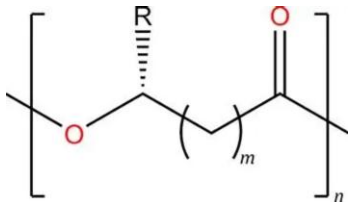
- Develop innovative depolymerisation processes for PHA packaging waste
- Demonstrate the cost-efficient fabrication of PHA-based plastics with bespoke properties from recycled monomers.
- Demonstrate the environmental benefits of the PHA production from recycled material
- Prepare the exploitation of the results.

ainia

ainia

SATISPHACTION

OUR APPROACH



PHA bioplastics

Produced by bacteria

Fully biodegradable

BUT

Expensive

Not currently recycled

Difficult to process into packaging

PHA formulations present:
Low PHA content
Additives of concern

SATISPHACTION PROJECT
#satisphaction

PHA waste recycling

Chemical and living cells upcycling routes

Computer-assisted development

Safe and Sustainable by Design

new PHA formulations:
PHA content > 80% **No additives of concern**
Accelerated degradation

3 packaging use cases:
Thermoformed trays **Flexible thermosealable sachets**
Biodegradable labels

Cost reduction

Circular and local PHA production

Reduction of fossils dependency and GHG emissions

NO microplastics and harmful chemicals pollution

ainia

SATIS PHA CTION

PHA UPCYCLING STRATEGY

Depolymerisation

Repolymeration

Formulation and compounding

Processing into packaging

Chemical depolymerisation

Alcoholysis process to selectively break down PHA polymers into its constituent monomers under mild conditions.

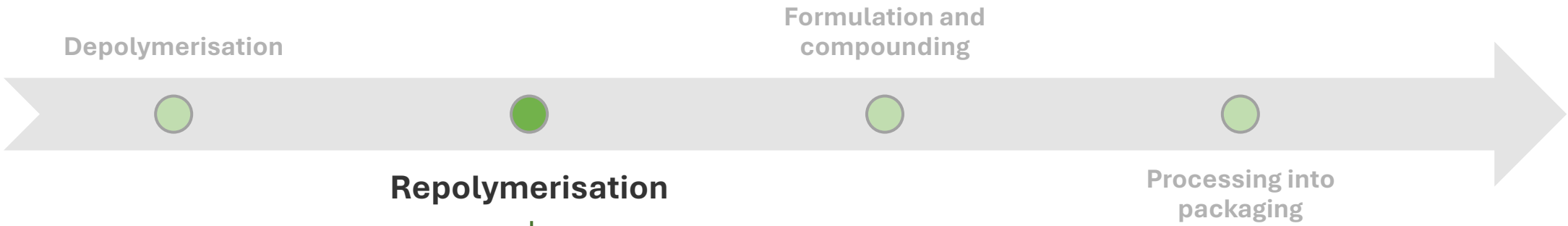
Biotic depolymerisation

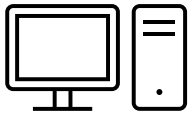
Development of a one-pot living-cell system to depolymerise PHA waste into 3-hydroxy acids.

ainia

SATIS PHA CTION

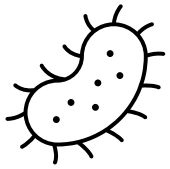
PHA UPCYCLING STRATEGY





Chemical synthesis of digitally-designed iPHAs

Innovative organocatalytic systems will be used to obtain iPHA polymers with controlled length and crystallinity. Computational tools will be leveraged to predict mechanical performance, processability and end-of-life of the polymers. The structure-property data will be used to train generative AI models for **AI-assisted iPHA discovery**.



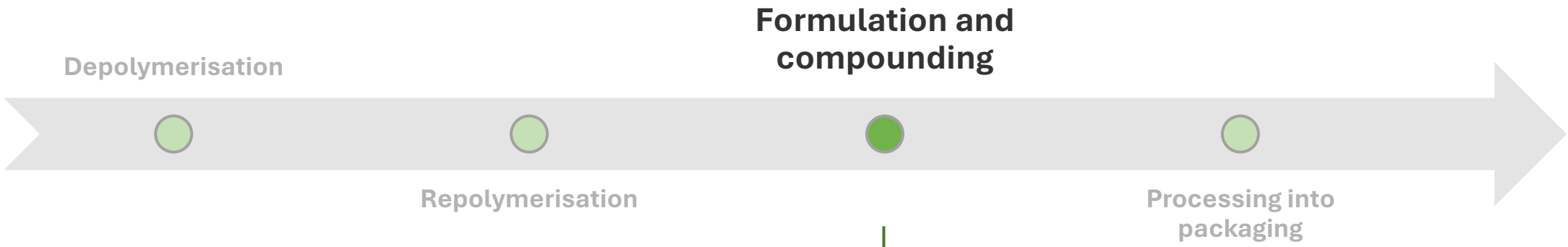
Biotic repolymerisation

Open mixed microbial cultures will be used to repolymerise the 3-HAs stream into PHA with tuned monomeric composition and well-defined structures for improved and consistent mechanical and thermal properties.

ainia

SATIS(PHA)CTION

PHA UPCYCLING STRATEGY



PHA formulations for thermoforming and flexible packaging
Recycled PHA formulas with 0% additives of concern and >80% PHA content.

PHA-based bio-adhesives
iPHA blends for application on cellulose-based substrates.

Incorporation of enzymes for accelerated self-degradation.
Enzyme-protectant capsules containing thermoset depolymerases will be added in plastic formulations for water-activated release.

ainia

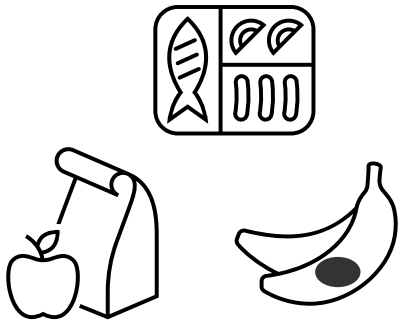
PHA UPCYCLING STRATEGY

Depolymerisation

Repolymerisation

Formulation and compounding

Processing into packaging



Demonstration of the PHA upcycling strategy in 3 plastic-based products

- Thermoformed trays
- Flexible thermosealable sachets
- Biodegradable adhesives for labelling fruits and vegetables. 24-P00905

ainia

SATISPHACTION

CONSORTIUM

Scientific expertise

Universities and **R&D centres**

CSIC Consejo Superior de Investigaciones Científicas

Cib Margarita Salas

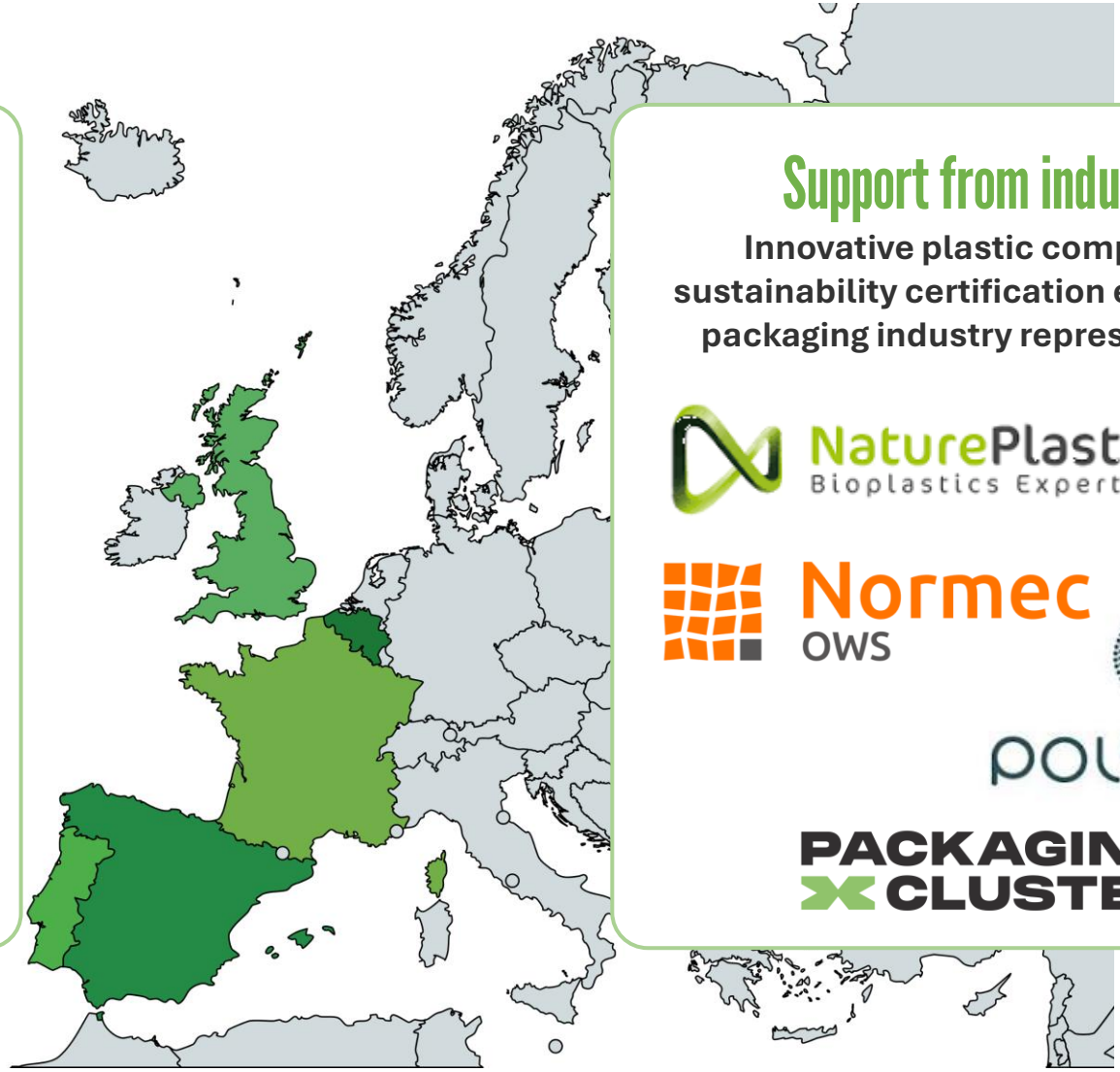
King's College London

NOVA ID Associação para a Inovação e Desenvolvimento na NOVA School of Science and Technology

NAITEC Automotive and Mechatronics Technology Centre

Coordinated by:

ainia



Support from industry

Innovative plastic companies, sustainability certification experts and packaging industry representatives

NaturePlast Bioplastics Expert

Normec OWS

polykey

PACKAGING X CLUSTER

ainia

FOLLOW US

Stay up to date with the project's progress

And visit our website

https://satisphaction.eu

ainia

online

Thank you for your kind attention

Andrés Sala Gascón

asala@ainia.es

Advanced Materials Researcher

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union, European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.