



Bridging the Gap from Bio-Waste to High-Performance Polymers

Status Update: Intermediate Results after 18 months of project implementation



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Project Vision

POLYMERS-5B is pioneering the synthesis of bio-based and biodegradable polymers from renewable European biowastes.

By employing biocatalysis and green chemistry, the project is transforming industrial side-streams into high-value materials for the automotive, textile, furniture, and polymeric resin industries.

Applications Industries - Use Cases



Automotive industry: Air Vent Housing, Air Vent Lamellas, Interface Cluster (Bezel)



Textile industry: Kids' Swimwear, Outerwear, Accessories and Technical Fabrics



Furniture industry: Flat Lamination, Postforming and Wrapping, Thermoforming (Membrane Press), Edge Banding



Polymeric resins: Enzyme Immobilization for Biocatalysis and Selective Resource Recovery (Environmental)



Technical Progress & Intermediate Results



1) Feedstock Valorisation & Monomer Extraction (WP2)

M18 ACHIEVEMENT:

Successfully screened and identified dozens of bio-renewable monomers from both commercial EU sources and underexploited waste streams.

TARGETED SIDESTREAMS:

Processed agri-food residues (tomato and olive oil pomace) and industrial wood waste (birch/alder bark and lignin).

RESULT:

Established a comprehensive guide of bio-based building blocks—including aliphatic, aromatic, and unsaturated classes—ready for polymer synthesis.

3) Innovative Synthesis & Biocatalysis (WP4)

M18 ACHIEVEMENT:

Synthesised several dozen new building blocks and bio-based polymers (polyesters, polyamides, and copolymers).

GREEN SYNTHESIS:

Validated enzymatic polymerisation at low temperatures (below 50°C), reducing the energy intensity of the synthesis process.

PLATFORM DEVELOPMENT

Initiated the "P5B Platform" for bio-based thermoset polymers derived from Tall Oil Fatty Acids (TOFA) as sustainable alternatives to polyurethanes.

5) Safety and Sustainability by Design (WP6)

M18 ACHIEVEMENT:

Developed the framework and data structure for the SSbD scoring tool.

CIRCULAR INDICATORS:

Defined preliminary circularity and environmental impact indicators to ensure alignment with the EU Taxonomy and "Do No Significant Harm" (DNSH) principles.

LIFE CYCLE ASSESSMENT:

Completed the first iteration of the LCA, identifying environmental hotspots to guide eco-design in the next project phase.

2) AI-Driven Design & Digital Twin Development (WP3)

M18 ACHIEVEMENT:

Deployment of the P5B integrated data management platform architecture.

PREDICTIVE SUCCESS:

Developed equilibrium and kinetic models to optimise monomer extraction, significantly reducing laboratory trial-and-error.

MOLECULAR SIMULATION:

Initial molecular dynamics simulations completed for bio-polyesters, successfully predicting thermo-mechanical properties to match fossil-based benchmarks like PET.

4) Industrial Validation & "Plug-and-Play" Strategy (WP5)

M18 ACHIEVEMENT:

Completed technical benchmarking for all four target industrial sectors.

COMPATIBILITY:

Verified the "Plug-and-Play" feasibility, ensuring these novel materials can be integrated into existing manufacturing lines (e.g., for BMW, VW, and Porsche standards) without requiring heavy capital expenditure (CAPEX).

PROOF OF CONCEPT:

Finalised use-case selections for bio-resins, focusing on biocatalysis and rare-earth element recovery.

6) Impact for the Bio-Based Industries (WP7)

DECARBONISATION:

Transitioning from fossil-fuel precursors to bio-renewable monomers.

STRATEGIC AUTONOMY:

Reducing dependency on imported raw materials by valorising local European bio-waste.

MARKET READINESS:

Ensuring bio-based polymers meet the rigorous mechanical and aesthetic standards of the automotive and furniture industries.



Partners:



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Contacts: <https://polymers-5b.eu/>



- Project Coordinator, IST-ID/IBB, Prof. Luis Fonseca luis.fonseca@tecnico.ulisboa.pt
- WP7 leader, NSB, Riccardo Varotto r.varotto@nsbproject.com