

BUTTERFLIES PROJECT REACHES MILESTONE, ADVANCING SUSTAINABLE 3D PRINTING WITH BIOPOLYMERS AND ARTIFICIAL INTELLIGENCE

BUTTERFLIES is setting new standards in sustainable additive manufacturing. As the consortium reaches project milestones, researchers are demonstrating progress in harnessing biopolymers to replace conventional petroleum-based plastics in the medical and bioengineering sectors.

The collaborative initiative focuses on advancing highly optimised, chitin and chitosan-based materials that are meticulously tailored for advanced Binder Jetting and Two-Photon Polymerization 3D printing technologies.

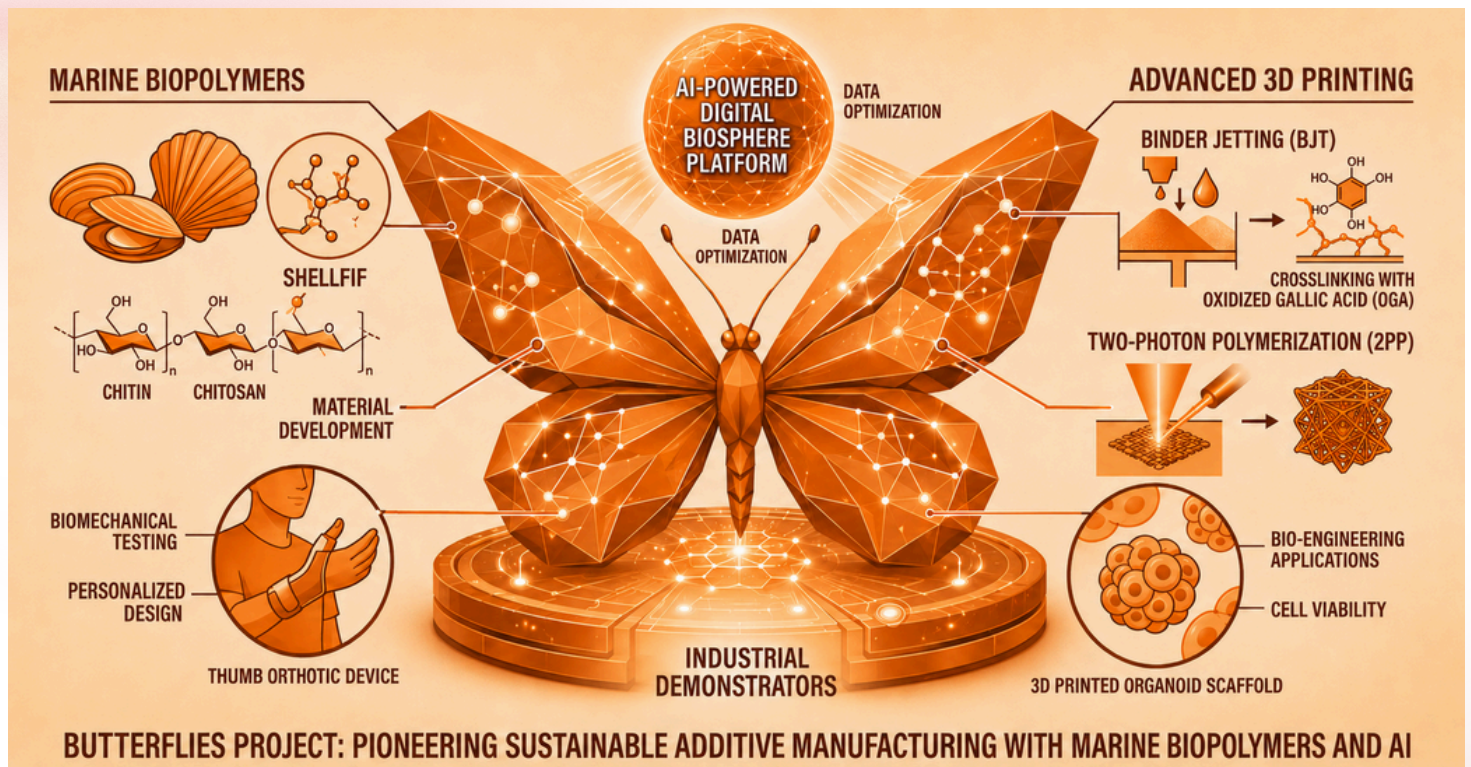
Through rigorous research and development, the BUTTERFLIES team has achieved significant material breakthroughs in both non-reactive and reactive binder formulations. By utilizing Oxidized Gallic Acid (OGA) as a reactive crosslinker, the team has not only improved the mechanical strength of chitin powder composites by approximately 30%, but also significantly enhanced their moisture stability and mitigated excessive shrinkage during the drying process.

Simultaneously, for 2PP printing applications, researchers have successfully grafted chitosan with Methacrylic acid at room temperature. **This specific process achieved an 8.5% functionalization rate, resulting in a water-soluble, photo-curable biopolymer that exhibits the desired stability and rapid curing properties required for high-resolution printing.**

To physically realise these advancements, the project is preparing for the installation of a specialised Vital Light 3D printer at the MTC facility, targeted for July 2026, which will enable detailed manufacturing trials using the newly supplied chitosan materials.

To accelerate and streamline the development of these advanced materials, the BUTTERFLIES project has introduced a dedicated Digital Biosphere Platform. **This system leverages state-of-the-art Artificial Intelligence and Machine Learning techniques to optimise the biopolymer additive manufacturing processes.** Utilising advanced architectures like TabPFN-3, the AI modules are designed to predict the optimal adhesives by analysing complex datasets.

These datasets include empirical formulations, tensile strength measurements, elongation at break, and advanced ink rheology experiments such as temperature and shear rate sweeps.



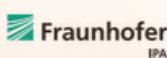
By shifting the final optimisation target toward printhead-validated quality labels, the platform ensures that the machine-generated binder recommendations will jet cleanly and reliably during the actual printing process.

The transformative impact of BUTTERFLIES lies in its commitment to environmental sustainability, which is rigorously quantified through comprehensive Life Cycle Assessments (LCA) and Life Cycle Costing (LCC) models.

Researchers are **actively building a robust Life Cycle Inventory** to directly compare the environmental and economic impacts of the innovative chitin-based BJT route against conventional orthotic production methods, such as Polyamide (PA12) Multi Jet Fusion.

By carefully analysing process-specific data—including printing power demand profiles, material streams, and end-of-life scenarios like bacterial bio-valorisation and energy recovery—the project ensures that the materials offer a genuinely greener footprint than mainstream industrial plastics.

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