TECH OFFER

Scalable and Cost-Efficient Next-Gen L-PGA Biopolymer

KEY INFORMATION

TECHNOLOGY CATEGORY:
Chemicals - Polymers
Chemicals - Bio-based
Life Sciences - Industrial Biotech Methods & Processes
Personal Care - Cosmetics & Hair
Materials - Bio Materials

TECHNOLOGY READINESS LEVEL (TRL): TRL4
COUNTRY: JAPAN
ID NUMBER: TO175425

OVERVIEW

The growing challenge of plastic waste and non-biodegradable absorbent materials is driving demand for bio-based alternatives that deliver performance without utilisation of petrochemicals. Poly-γ-L-glutamic acid (L-PGA) stands out as a biodegradable, biocompatible biopolymer with exceptional water retention and film-forming properties, making it highly relevant to applications requiring such functionalities. As part of the wider class of biodegradable biopolymers, it offers a sustainable pathway toward reducing plastic dependence. Commercial adoption has been limited as most commercial PGA is DL-PGA (a racemic polymer with lower stereoregularity and less predictable chemistry) while the preferred L-PGA grade remains scarce and costly under the single supplier archaea-based production route.

This technology offers a cost-efficient and scalable platform for L-PGA production. Using proprietary microbial strains, it can

produce consistent, ultra-high molecular weight L-PGA with stable quality and stereoregular purity. The resulting stereoregular L isomer material enables early adoption in cosmetics/personal care and medical materials, with the potential to expand into bio-based superabsorbent polymers (SAPs) and bioplastics as production capacity increases. The platform's capability demonstrates the scalability of biodegradable biopolymers in industrial applications, setting new standards in sustainable material innovation through this advanced biopolymer technology.

To accelerate market adoption and tailor application-specific L-PGA grades, the technology owner seeks co-development and scale-up partners for this L-PGA technology (current readiness is at bench-scale, with next steps focused on jar-bioreactor scale-up and standardized testing).

TECHNOLOGY FEATURES & SPECIFICATIONS

- Strain engineering (plasmid□free): Genome□integrated L□PGA pathway in GRAS Bacillus subtilis, with targeted metabolic/regulatory edits for robustness and titer
    - Delivers ultra□high□molecular□weight L□PGA and supporting long□run stability.
- Cost□optimised synthetic medium: Chemically defined, low□cost medium that maintains product purity and simplifies downstream processing
    - Achieves a material reduction in cultivation□medium cost versus archaea□based production
- Product format & suitability: Homochiral L□isomer polymer supplied as water□clear solutions; suited to hydrogels/adhesives, cosmetic ingredients, and bioplastics/coatings.
    - Samples and prototypes can be co□developed with partners for grade□specific validation

Scale□up and process development are advancing through two complementary approaches. Conventional liquid culture is advancing toward pilot for process and product validation. In parallel, an energy□efficient route—engineered filamentous cells immobilised on a thin□filter carrier—is under R&D. This design aims to overcome viscosity limits, improve oxygen transfer, and support high-density continuous production with reduced aeration and agitation energy requirements.

POTENTIAL APPLICATIONS

- Cosmetics and Personal Care

As a biodegradable, biocompatible moisturising/film□forming ingredient, L□PGA can be used in serums, creams, sheet masks and hair/scalp care.

- Medical materials

Serves as a platform for wound□healing hydrogels and tissue adhesives/surgical glues, as well as drug□delivery or regenerative scaffolds.

- Hygiene products

L-PGA can be used as bio□based SAP grades for diapers and feminine/personal hygiene, offering high water uptake and salt□tolerant absorbency with the added advantage of biodegradability.

- Bioplastics & coatings/films

L□isomer stereoregularity supports tougher, more predictable networks for bioplastic resins, barrier coatings, and flexible films

that can reduce reliance on petroleum-derived additives.

UNIQUE VALUE PROPOSITION

- High quality L-PGA – consistently produces the all-L isomer with predictable chemistry and superior performance
- Cost-competitive – the proprietary microbial platform lowers production costs significantly
- Scalable and industrially ready – this technology is compatible with standard bioprocesses, advancing to pilot scale with parallel R&D in continuous, energy-efficient cultivation.