

3-HP Upgrading Platform

Drop-in bio-based MMA feedstock technology for PMMA supply chain diversification

Value Proposition

This technology from Los Alamos National Laboratory, 3-HP Upgrading Platform, provides a novel, bio-based pathway to produce methyl methacrylate (MMA) by converting renewably producible 3-hydroxypropionic acid (3-HP) into a constituent substrate for normally petroleum-derived MMA (PMMA).

Technology Readiness Level 3

IP Information for S-193777

U.S. Patent pending

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Overview

By operating directly on fermentation-derived 3-HP, the process reduces the need for costly purification steps and improves overall production efficiency. It also introduces a novel chemical intermediate formed during the reaction, offering additional differentiation. For manufacturers, this approach enables a more sustainable and potentially lower-cost route to a high-demand chemical used in plastics, coatings, adhesives and medical materials—without requiring changes to existing products or end-use applications.

Advantages

- Bio-based production route reducing reliance on petroleum feedstocks
- Drop-in compatibility with existing MMA/PMMA applications and supply chains
- Direct use of fermentation streams, minimizing purification requirements



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- Improved process efficiency through integrated reaction and extraction
- Novel conversion pathway from 3-HP to MMA, including a unique intermediate
- Alignment with sustainability goals and growing demand for greener materials

Technology Description

This invention is a chemical process for upgrading 3-hydroxypropionic acid (3-HP) into methyl methacrylate (MMA) using an integrated reactive extraction approach. In this system, 3-HP produced through fermentation is directly converted within a solvent phase, where extraction and chemical transformation occur simultaneously. This design improves reaction selectivity and enables more efficient handling of aqueous fermentation streams compared to conventional multi-step methods. The process includes multiple novel reaction pathways—such as ester- and lactone-based routes—and generates a distinct intermediate during conversion. In addition to MMA production, the approach can be extended to other bio-based molecules, providing a broader platform for transforming biomass-derived feedstocks into industrial chemical intermediates.

The Opportunity:

The 3-HP Upgrading Platform presents licensees with an opportunity to enter or expand into the MMA market using a differentiated, bio-based production route that aligns with growing demand for sustainable materials. By

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Technology Description continued

enabling the conversion of renewably sourced 3-HP into a constituent substrate for normally petroleum-derived MMA, companies can reduce reliance on fossil feedstocks while maintaining compatibility with existing PMMA applications and supply chains. The process is particularly attractive for producers seeking to integrate upstream fermentation capabilities or diversify raw material inputs, offering a pathway to improve cost efficiency and supply resilience. As end markets increasingly prioritize lower-carbon and bio-based content—across automotive, electronics, construction and medical sectors—this technology positions licensees to capture value through sustainable product offerings without requiring changes to downstream manufacturing or product performance.

Market Applications

- **Automotive** (glazing, coatings, lightweight components)
- **Electronics & Displays** (screens, optical materials, housings)
- **Construction & Infrastructure** (panels, sealants, protective surfaces)
- **Medical & Healthcare** (devices, implants, coatings)
- **Adhesives & Coatings** (industrial coatings, finishes, bonding materials)
- **Consumer & Industrial Plastics** (transparent plastics, durable goods, 3D printing materials)