Designer Bio-Esters from Renewable or Waste Feedstocks

400 W. Summit Hill Drive | UT Tower 961A
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The Problem:

Petroleum-based feedstocks are affected by undesirable cost fluctuations, supply volatility, and negative environmental impacts. Innovative “green” technologies that can effectively use bio-based, renewable, and sustainable feedstocks are needed to address the current challenges in ester manufacturing.

The Solution:

Researchers at the University of Tennessee have developed a fermentation-based method capable of producing a portfolio of designer esters from cellulosic biomass and organic wastes to replace petroleum-sourced esters. The technology enables microbial biosynthesis of targeted bio-esters by harnessing proprietary, robust, and efficient enzymes. The resulting esters have properties well suited for use as food flavoring, perfume fragrances, and eco-friendly solvents.

Benefits:

- Bio-based products from renewable and waste feedstocks.
- Alternative to petroleum-based products.
- The methods offers competitive prices and superior performance.
- Reduces supply volatility, market shortages, and reliance on imports.

INVENTOR

Dr. Cong Trinh

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Dr. Cong Trinh received his PhD from the University of Minnesota in 2008. His research interests include interdisciplinary areas of systems and synthetic biology, metabolic and biochemical engineering, computational biology, and cell physiology with a focus on industrial biocatalysis and antimicrobials.

Dr. Trinh’s awards and recognitions include:

- Ferguson Faculty Fellow since 2017
- DARPA YFA Director Fellowship
- TCE Teaching Fellow Award
- ASEE New Researcher Award
- NSF Career Award
- 2X CBE Outstanding Teaching Award

Patent Pending

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UTRF Reference ID: 21044

The University of Tennessee Research Foundation (UTRF) is a non-profit corporation that is responsible for commercializing University of Tennessee technologies and for supporting University research. At UTRF, we seek parties that are interested in learning more about our technologies and commercialization opportunities, and we welcome any inquiries you may have.

Methods for Rapid Determination of Alcohol Acyltransferase (AAT) Specificity for Ester Biosynthesis

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The Problem:

Petroleum-based feedstocks are affected by cost fluctuations, supply volatility, and negative environmental impacts. Innovative "green" technologies that effectively use bio-based, renewable, and sustainable feedstocks are needed to address the current challenges of designer ester manufacturing through microbial synthesis. One such challenge is identifying novel AATs with high specificity towards a target ester.

The Solution:

Researchers at the University of Tennessee have developed a high-throughput *in vivo* microbial screening platform for rapid identification of AATs for designer ester biosynthesis. This platform can probe the alcohol substrate specificity of native and engineered AATs to identify novel wildtype and engineered AATs. Additionally, this platform can identify beneficial mutations in engineered AATs for improved synthesis.

Benefits:

- High throughput and rapid identification of AATs
- Adjustable for different enzyme detection
- Scalable and compatible with automated microplate handling systems
- Green alternative to petroleum-based ester production for use in flavors, fragrances, solvents, and biofuels
- Reduces supply volatility, market shortages, and reliance on imports

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Methods for Producing Ethyl Butyrate, Butyl Acetate, and Butyl Butyrate with High Selectivity in Microorganisms

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The Problem:

Petroleum-based feedstocks are affected by cost fluctuations, supply volatility, and negative environmental impacts. Innovative “green” technologies that effectively use bio-based, renewable, and sustainable feedstocks are needed to address the current challenges in designer ester manufacturing. One such challenge is the production of butyryl-CoA derived esters with high selectivity.

The Solution:

Researchers at the University of Tennessee have developed a modular fermentation based anaerobic microbial biosynthesis platform capable of producing butyryl-CoA-derived designer esters with controllable and high selectivity from renewable feedstocks. Using these modular platforms, engineered bacterial strains demonstrated a significant increase in production of ethyl butyrate, butyl acetate, and butyl butyrate over the original strains with high selectivity.

Benefits:

- Butyryl-CoA derived esters production with controllable and high selectivity
- Anaerobic production method increases product yield and scalability
- Green alternative to petroleum-based ester production for use in flavors, fragrances, solvents, and biofuels
- Reduces supply volatility, market shortages, and reliance on imports

INVENTOR

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Patent Pending

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Microbial Biosynthesis of Isoamyl Acetate

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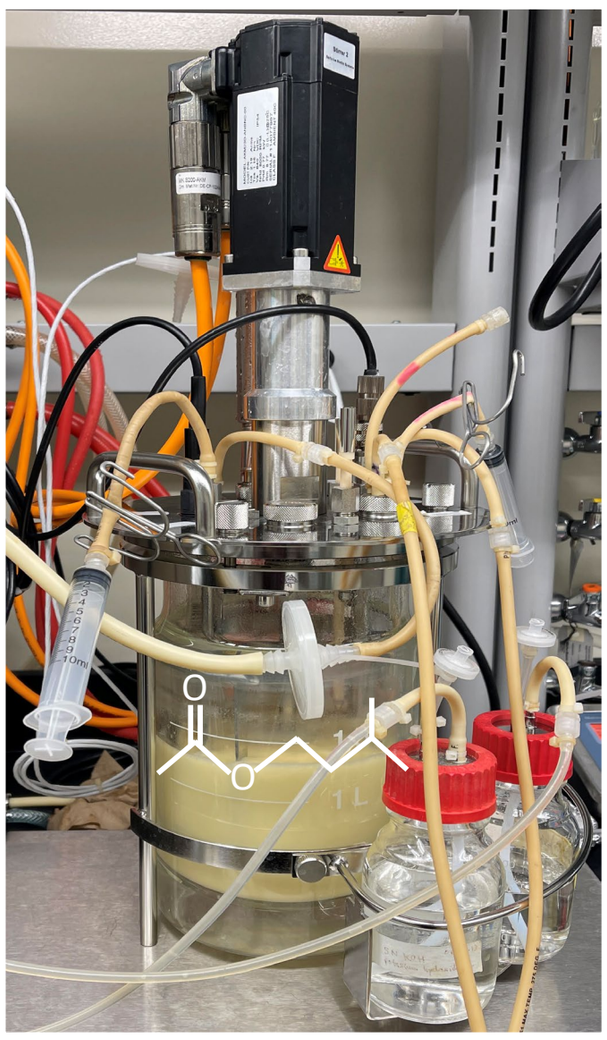
The Problem:

Petroleum-based feedstocks are affected by cost fluctuations, supply volatility, and negative environmental impacts. Innovative “green” technologies that effectively use bio-based, renewable, and sustainable feedstocks are needed to address the current challenges in designer ester biomanufacturing. One such challenge is controlling the efficient biosynthesis of isoamyl acetate.

The Solution:

Researchers at the University of Tennessee have developed engineered strains using a modular design approach to control proteome reallocation for selective microbial biosynthesis of branched-chain acetate esters, such as isoamyl acetate. These engineered strains have demonstrated isoamyl acetate production at 8.7 g/L (> 0.25 g/L toxicity limit), a yield of 0.21 g/g (59% of maximal theoretical value), and greater than 90% selectivity.



Benefits:

- Biosynthesis of isoamyl acetate with controllable and high selectivity.
- Green alternative to petroleum-based ester production for use in flavors, fragrances, solvents, and biofuels.
- Reduce supply volatility, market shortages, and reliance on imports.

INVENTOR

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