

# Producing Olefins for Use in Gasoline, Jet and Diesel Fuels from Chemicals Obtained from Levulinic Acid

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WARF: P100099US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a process and apparatus to produce hydrocarbons from aqueous solutions of lactones, hydroxyl-carboxylic acids, alkene-carboxylic acids or alcohols.

## **Overview**

Levulinic acid is a biomass-derived compound that can be obtained inexpensively in high yields from waste cellulose-containing materials. It has been identified as a top biomass-derived chemical due to its ease of production for both five and six carbon sugars and its useful functional groups, a ketone and a carboxylic acid. Levulinic acid can be used to form other, more valuable chemicals including gamma-valerolactone (GVL).

GVL is valuable as a renewable platform molecule with potential in developing both renewable energy and chemicals. GVL retains high energy content and performs comparably to ethanol as a fuel blending agent. However, characteristics such as high water solubility, blending limits for use in conventional combustion engines and lower energy density compared to petroleum-derived fuels have limited the use of GVL in the transportation sector. Therefore, a method is needed to convert lactones such as GVL into liquid alkenes or alkanes with molecular weights targeted for direct use in transportation.

## The Invention

UW-Madison researchers have developed a method and apparatus for producing olefins (unsaturated hydrocarbons) in the C<sub>8</sub> to C<sub>16</sub> range from GVL. The method involves two tubular flow reactors and an inter-stage separator in a single catalytic system. The chemical transformation proceeds via conversion of GVL to an n-butene, which is then introduced into a second reactor where the butene is converted via acid catalyzed oligomerization to higher molecular weight olefins ( $C_8$  and longer). High pressure  $CO_2$  is an additional byproduct of the reaction.

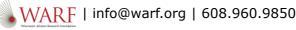
In addition to GVL, lactones, hydroxyl-carboxylic acids, alkene-carboxylic acids, alcohols or a mixture thereof can be reacted using this method to produce longer-chain olefins. The olefins produced with this method are of carbon chain-length and molecular weight suited for use in gasoline, jet and diesel fuels.

## **Applications**

• Olefins in suitable molecular weight range can be used in transportation fuels.

• High pressure CO<sub>2</sub> stream can be sequestered or used in further processing. We use cookies on this site to enhance your experience and improve our marketing efforts. By continuing to browse without changing your browser settings to block or delete cookies, you agree to the storing of cookies and related technologies on your device. See our privacy policy

**Key Benefits** 



- · Produces olefins from GVL obtained from biomass, an inexpensive and renewable resource
- · Converts GVL to olefins in an integrated system requiring no additional purification
- Synthesizes long-chain olefins (C<sub>8+</sub>) at high yields and selectivities

## Additional Information

### **Related Technologies**

For more information about producing liquid fuels from levulinic acid, see WARF reference number P09298US.

### Publications

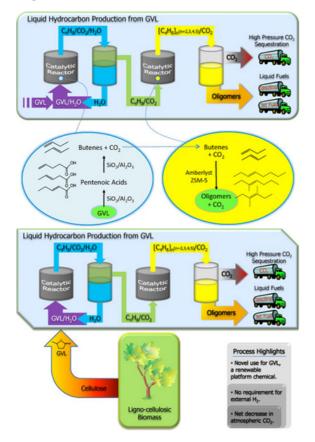
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- Bond J.Q., Martin-Alonso D., Wang D., West R.M. and Dumesic J.A. 2010. Integrated Catalytic Conversion of Gamma-Valerolactone to Liquid Alkenes for Transportation Fuels. Science 327, 1110-1114.
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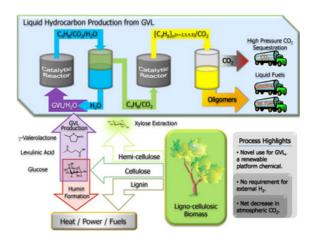
#### **Tech Fields**

<u>Clean Technology : Biobased & renewable chemicals & fuels</u>

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854

## **Figures**





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