Producing Methyl Vinyl Ketone from Levulinic Acid

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to convert inexpensive biomass-derived carboxylic acids such as levulinic acid into methyl vinyl ketone, a valuable industrial compound.

OVERVIEW

Levulinic acid is a biomass-derived compound that can be obtained inexpensively in high yields from a variety of 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. There are several possible reactive pathways for levulinic acid to form other, more valuable reactive chemicals including methyl vinyl ketone. Methyl vinyl ketone is valuable for many industrial processes because it contains two useful functional groups, an olefin and a ketone. It also is used to produce polymers and other chemical production pathways.

Previously, research has focused on dehydrogenation and hydrogenation reactions of levulinic acid as methods to produce these intermediate chemicals. Unfortunately, these methods to produce methyl vinyl ketone require expensive starting materials, catalysts and reactive conditions. More recent work has been focused on producing chemicals from levulinic acid without the addition of hydrogen, which could decrease costs associated with catalysts and reactive conditions. An inexpensive, commercially viable method to produce methyl vinyl ketone from levulinic acid is needed.

THE INVENTION

UW–Madison researchers have developed an efficient method to convert levulinic acid to methyl vinyl ketone. The method involves performing a reaction with an aqueous solution comprising levulinic acid over an acid catalyst, preferably a solid acid catalyst, at a temperature from 500 to about 900 Kelvin and without added molecular hydrogen. The reaction can be performed in either a batch or continuous reactor, although a continuous reactor is preferred. The reaction produces methyl vinyl ketone at higher yields from less expensive starting material compared to current methods.

THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.

APPLICATIONS

- Conversion of levulinic acid to methyl vinyl ketone in a single reactor
- Coupling with the industrial production of levulinic acid through inexpensive routes, for example the Biofine process, to convert renewable lignocelluloses resources

KEY BENEFITS

- Produces methyl vinyl ketone at yields greater than 90 percent
- Converts an inexpensive, renewable resource (levulinic acid) into useful intermediate methyl vinyl ketone in one step

ADDITIONAL INFORMATION

Related Technologies

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

Publications

Kunkes E.L., Simonetti D.A., West R.M., Serrano-Ruiz J.C., Gärtner C.A. and Dumesic J.A. 2008. Catalytic Conversion of Biomass to Monofunctional Hydrocarbons and Targeted Liquid-Fuel Classes. Science 322, 417-421.

Tech Fields

Clean Technology - Energy & resource efficiencies
Materials & Chemicals - Synthesis

CONTACT INFORMATION

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