

Biofuels ISOCONVERSION



Chevron Lummus Global

Overview

The Biofuels ISOCONVERSION process converts waste fats, oils, and greases into renewable diesel, jet, and naphtha. This process is unique in that it produces fuels that are virtually indistinguishable from their petroleum counterparts. The nearly identical chemistry results in jet and diesel fuels that are true “drop-in” fuels and do not require blending with petroleum products.

The Biofuels ISOCONVERSION technology was jointly developed by Chevron Lummus Global (CLG) and Applied Research Associates (ARA). ARA developed the Catalytic Hydrothermolysis (CH) process in 2006 for the purpose of converting renewable oils that contain triacyl glycerides into drop-in Sustainable Aviation Fuel (SAF) and Renewable Diesel (RD) known as ReadiJet® and ReadiDiesel®, respectively.

ARA and CLG developed the Biofuels ISOCONVERSION process based on ARA’s patented, novel Catalytic Hydrothermolysis process and CLG’s market-leading hydroprocessing technology.

CLG is the single point of contact for licensing and engineering of Biofuels ISOCONVERSION. ASTM International has approved Annex 6 to D7566 for the production pathway to Sustainable Aviation Fuel (SAF) called “Catalytic Hydrothermolysis Jet” or CHJ.

The Biofuels ISOCONVERSION process can significantly reduce greenhouse gas emissions when compared to conventional refining processes. In addition, the novel approach produces 100% drop-in fuels from renewable sources that meet petroleum specifications without blending.

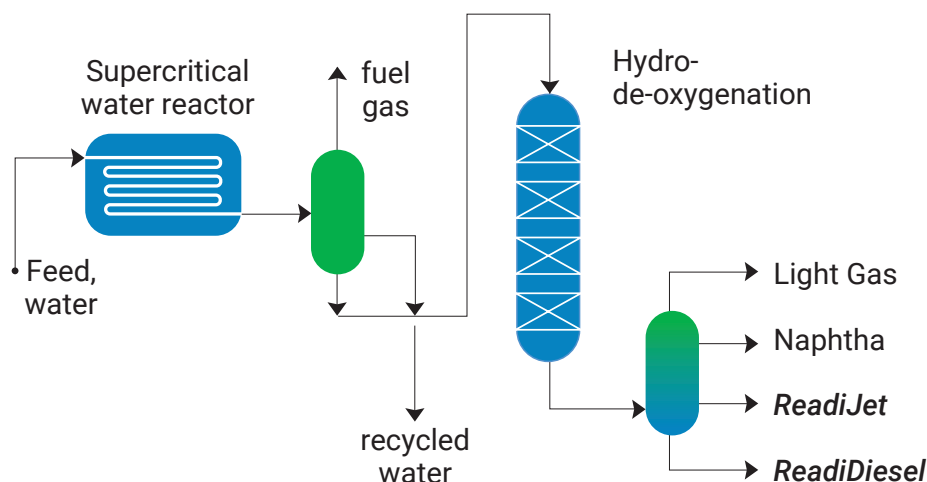
The CLG design maximizes distillate yield while achieving the specification requirements of the finished fuels.

CLG has been awarded licenses and provided designs for four Biofuels ISOCONVERSION clients. Renewable fuels produced from the Biofuels ISOCONVERSION process are currently being supplied for commercial use in Japan.

Technical Advantages

Process Features	Process Benefits
Enables Lowest Carbon Intensity Feedstocks	No requirement for liquid recycling to hydrotreating reactor
25-30% Lower Hydrogen Consumption	Uniquely aromatic saf – ReadiJet® meets astm d7566 – a6.1 specifications
5-6% Higher Energy Density Fuels	Compatible with conventional jet engine technology
High Yield of Transportation Fuels	Combination of ReadiJet® and ReadiDiesel®, and renewable naphtha

Process Flow Diagram



Process Description

The first conversion step in the Biofuels ISOCONVERSION process is Catalytic Hydrothermolysis (CH). In the CH process, water is combined with the renewable feedstock, pressurized, and heated in excess of supercritical water conditions. At these conditions, feedstock and water become one phase.

Triglycerides are immediately hydrolyzed into glycerin and the corresponding fatty acids. Then water mediates the conversion of oils and fats into hydrocarbons that are ideal for aviation turbine and diesel fuels. In addition to the formation of normal and branched paraffins, high-density cycloparaffin and aromatic molecules are formed in a single step without the need for catalytic reforming, dewaxing, or cracking.

The CH reaction is controlled in a manner to minimize coking and excessive or undesirable cracking reactions. Product yields and composition are controlled by adjusting the process variables, which include the reaction temperature and residence time. A characteristic of the CH process is a very short residence time – less than 2 minutes.

The second conversion step is required to remove residual oxygenates and to saturate olefins that were present or formed during CH conversion. The hydroprocessed product is a hydrocarbon mixture of naphtha, kerosene, and diesel boiling-range hydrocarbons. This product is then fractionated by conventional distillation into specification fuels.

Key reactions that occur during CH conversion include, but are not limited to:

1. Hydrolysis of triglycerides and cracking of glycerin
2. Cracking of long chain fatty acids into lower molecular weight acids and hydrocarbons
3. Cyclization of fatty acids into alkyl cyclohexane compounds
4. Cyclization of fatty acids into alkyl benzene compounds
5. Dehydrogenation of naphthenic compounds into aromatic compounds
6. Decarboxylation of fatty acids
7. Skeletal isomerization of intermediate and product compounds

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