RENEWABLE FUELS

UOP Renewable Jet Fuel Process™

Solution for renewable feedstock processing

Honeywell UOP is dedicated to meeting the increased need for sustainable, high-quality renewable diesel and aviation fuel. The Renewable Jet Fuel Process utilizes UOP's extensive experience in hydroprocessing to hydrogenate natural oils and animal fats for conversion to Honeywell Green Jet Fuel™ and Honeywell Green Diesel™. Developed by UOP LLC through a U.S. government funded research project, the Renewable Jet Fuel Process leverages UOP's 100+ years of refining and petrochemical industry expertise.

Feedstocks

The Renewable Jet Fuel Process can convert a wide range of renewable feedstocks derived from oil seed crops (vegetable oils) or waste animal fats and greases, as well as second generation feedstocks such as algal oils. These oils and animal fats contain triglycerides and free fatty acids that are converted to hydrocarbons during the process.

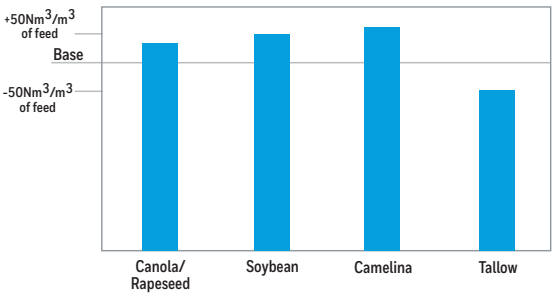
Yields

Typical yields from the Renewable Jet Fuel Process:

	Unit Yields	
Feed	**Jet Mode**	**Diesel Mode**
Vegetable oil or animal fat%	100	100
Hydrogen Wt%	2.5 - 3.8	2.5 - 3.8
Products		
Propane vol%	2 - 4	2 - 4
Naphtha vol%	15 - 25	4 - 10
Diesel, vol%	15 - 25	85 - 95
Jet, vol%	50 - 70	–

The Renewable Jet Fuel Process gives refiners the flexibility to produce jet fuel or diesel depending on market price and demand. The fuel yields and hydrogen consumption vary slightly according to the required product freeze and flash points. The hydrogen consumption will also vary between different feedstock types, as shown below.

Comparison of Hydrogen Consumption for Various Feedstocks





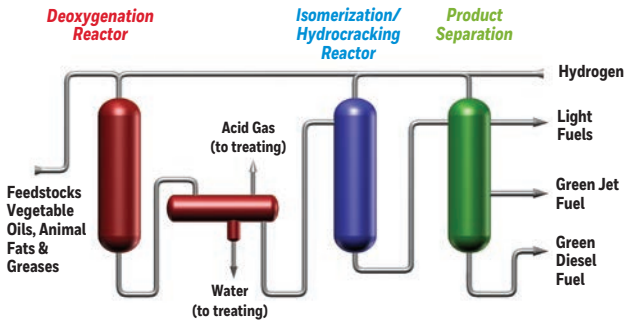
FEATURES & BENEFITS

The Renewable Jet Fuel Process produces high-quality renewable transportation fuels that meet or exceed the highest fuel quality standards and can utilize existing infrastructure for fuel delivery and use. The Renewable Jet Fuel Process can be implemented as a standalone plant or integrated within a petroleum refinery. In an integrated approach, for customers who want to incorporate renewable fuel production into a petroleum fuel facility, the Renewable Jet Fuel Process can utilize existing infrastructure, allowing licensees to drive down capital and operating costs, while meeting renewable fuel targets. The advantages can be even more significant for refiners who convert idled assets in a retrofit design to produce renewable fuel at a fraction of the cost of a new installation.

Process Overview

The UOP Renewable Jet Fuel Process is a two-stage hydroprocessing technology. In the first stage, feedstocks such as vegetable oils and animal fats are hydrogenated to remove the oxygen contained in the triglyceride and/or free fatty acid molecules to produce paraffinic hydrocarbons. In the second stage, the paraffins are isomerized and/or selectively hydrocracked to produce Honeywell Green Jet Fuel and/or Honeywell Green Diesel.

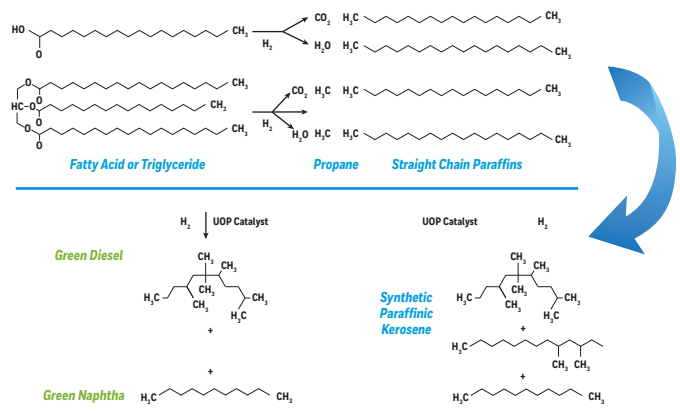
UOP Renewable Jet Fuel Process



Process Chemistry

In the triglyceride molecule, the carbon chain lengths, and the number of double bonds in the fatty acid portions of the molecules can vary, but they are consistent on average within a specific feed type (e.g. all palm oil has similar distribution). The carbon chain length of these natural oils fits directly into the jet and diesel fuel boiling ranges.

Key chemistry for the conversion of natural oils and fats to fuels is summarized in the figure below.



The final diesel and jet fuel (often referred to as Synthetic Paraffinic Kerosene or "SPK") products contain the same molecules as their petroleum-derived counterparts, and the final product is independent of the starting feedstock.

The Renewable Jet Fuel Process utilizes UOP's proprietary catalysts, which are specially developed for high conversion and maximum yields of high quality renewable diesel and jet fuel products.

Product Properties

Analysis of Renewable Jet Fuel Samples

Property	Jet A-1 Spec	Neat SPK	Blended SPK
Flash point, °C	38 min	45	46
Freeze point, °C	-47	-57	-57
Net heat of combustion, (MJ/kg)	42.8 min	43.9	43.6
Thermal Stability (JFTOT)			
Filter pressure drop, mmHg	25 max	0	0
Tube deposits	<3	<1	<1
Distillation (D86) 10%	205 max	175	177
End boiling point	300 max	273	272
Density, kg/m^3	775 - 840	761	778
Sulfur, ppm	0.3 max		<0.05

Testing and Certification

On July 1, 2011, renewable jet fuel was approved for use in commercial aircraft when used up to a 50% blend with traditional fuel. In 2016, AltAir Paramount LLC began using Honeywell UOP's proprietary renewable jet fuel process technology to convert a variety of sustainable feedstocks into Honeywell Green Jet Fuel at the world's first dedicated commercial-scale renewable jet fuel production facility. The plant has also produced Honeywell Green Diesel.

Life Cycle Analysis

UOP has completed a Life Cycle Analysis (LCA) for Honeywell Green Jet Fuel produced from various feedstocks. The results, when processing camelina-, jatropha-, tallow and soybean-based green jet fuel, show a 65-85% reduction in greenhouse gas emissions compared with petroleum-based aviation fuel.

Economics/Investment

Typical ISBL (Inside Battery Limits) erected capital cost estimates are between $100-130 million USD for a Renewable Jet Fuel Process unit with a capacity of 90 million gallons per year (~312,000 tonnes/year) of feedstock.

The Renewable Jet Fuel Process is also an ideal candidate for the revamp of distillate hydrotreating units, reducing capital investment significantly.

For more information

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