HVO

Lab Scale | Bench Scale | Pilot Plant | Demonstration | Production

HVO, Hydrotreated Vegetable Oil

C_nH2_{n+2}

Hydrotreated Vegetable Oil, HVO, is a renewable diesel fuel that can be produced from a wide array of vegetable oils and fats. The term HVO is used collectively for these biogenic hydrocarbon-based renewable biofuels.

Primary area of use

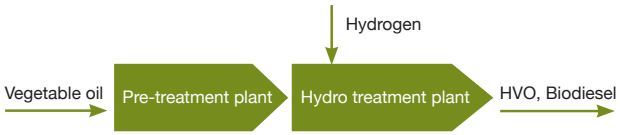
Hydrotreated vegetable oil, HVO, is used as an alternative fuel for diesel engine vehicles. HVO is an attractive alternative due to the fact that it is chemically equivalent to petroleum diesel and can be used in diesel engines without blend walls or modifications required for e.g. biodiesel.

HVO is free of aromatics and sulfur, has a high cetane number and low greenhouse gas emissions from a life cycle perspective. Through isomerization of the HVO, the cloud point of the fuel can be adjusted. This lowers the temperature at which wax in the fuel becomes solid (which can result in clogged fuel filters and injectors) in order to improve cold properties of the fuel.

The use of HVO in Sweden has increased rapidly. In 2011, 45 million litres of HVO were sold in Sweden as a low blend in diesel. In 2012, the Swedish Energy Agency reported an increase of more than 100% from 2011 reaching a volume of roughly 139 million litres. In 2013, the use of HVO increased further, with a consumption of roughly 391 million litres, exceeding the use of FAME.

Feedstock and production

HVO can be produced from many kinds of vegetable oils and fats. This includes triglycerides and fatty acids from vegetable oils, (e.g. rapeseed, soybean and corn oil), tall oil, (a co-product from the pulp and paper industry) in addition to the use of animal fats.



The simplified production process of HVO from vegetable oil.

HVO is produced through the hydrotreating of oils. In the reaction, the oils (triglycerides) are reacted with hydrogen under high pressure in order to remove oxygen. The hydrocarbon chains produced are chemically equivalent to petroleum diesel

Properties

Chemical formula:	**C_nH2_{n+2} (General formula of straight chain paraffinic hydrocarbons)**
Molecular mass:	**Corresponding to the fatty acid in the feedstock**
Heating value:	**44 MJ/kg**
Density at 15°C 1,013 bar:	**775-785 kg/m³**
Cetane number:	**>70**

fuel. Propane is typically produced as a by-product. Investment costs are much higher for HVO than biodiesel production, which requires large scale production plants to allow the production to be economic.

Raw materials for HVO production in Sweden are primarily of Swedish origin, but can be complemented with raw materials from European sources. All HVO must fulfill the sustainability criteria set out in the EU Renewable Energy Directive (RED). RED sets sustainability criteria for biofuels and bioliquids identical to the EU Fuel Quality Directive.

The HVO produced in Sweden is based mainly on crude tall oil and slaughterhouse wastes. The esterified tall oil used in production comes from SunePine in Piteå, and is hydrogenated to HVO at the Preem refinery in Gothenburg and blended with diesel and biodiesel. In 2013, roughly 101 million litres of HVO were produced in Sweden.

A large amount of HVO is produced in Europe, primarily at Neste Oil production sites in Porvo, Finland (roughly 219 million litres per year) and Rotterdam, the Netherlands, Europe's largest renewable diesel plant, producing roughly 1 billion litres per year. Additionally, roughly 1 billion litres HVO per year are produced by Neste Oil in Singapore.

Distribution system

HVO is a liquid fuel and distributed as low blends in fossil diesel that are sold at the fuel companies' filling stations. Since HVO can be blended with fossil diesel, investments in new transport or distribution system are not necessary.

Preem sells HVO in a blend with biodiesel and fossil diesel, which is marketed as Evolution Diesel. Besides Preem, fuel companies such as OKQ8 (DieselBio+), St1 (CityDiesel) and Statoil (Miles Diesel) provide HVO blends of diesel based on imported HVO mainly from Europe. The OKQ8 diesel, BioMax, with 100% HVO, is currently undergoing tests.

HVO projects

HVO is currently the third largest biofuel by volume in the world. As there are many advantages with the fuel, the production of HVO has seen a large increase in the past years, and the growth of the HVO market has overtaken the mature ethanol and biodiesel industries.

As mentioned above, Neste Oil is a major player on the global HVO market and owns and operates three HVO production plants. In the coming years, there are plans to further increase the production capacity to roughly 2.9 billion litres per year by 2015, and 3.3 billion litres per year by 2017. Neste Oil also has plans for a plant in Denmark to produce 500 million litres of HVO per year based on slaughterhouse wastes, in collaboration with OKQ8.

In Honeywell, USA, ConocoPhillips and Petrobas have developed HVO refineries. Furthermore, Dynamic Fuels LLC recently opened an HVO plant with a capacity of 283 million litres per year in Louisiana.