

Biodiesel – a proven fuel

Most of the rape oil which is produced for use as a transport fuel ends up in biodiesel (RME). Production of biodiesel in Europe increased by 35% for 2008 compared to the previous year, standing at 7,750 million tonnes. A further increase is expected for 2009 with figures expected to reach 21 million tonnes.

As a fuel, biodiesel is already well-suited to the demands of engines. As an admixture in diesel, we use it when we fill our tanks because of the biofuel quota regulation.

Some of the biodiesel which is produced is used as a pure fuel (B100). This is possible in traditional diesel engines without conversion. However, the approval of the vehicle manufacturer is required as biodiesel can act as a solvent, leading to problems with seals, synthetic and rubber components and paint coatings. In the case of a switch from diesel to RME, it is necessary to replace the fuel filters more frequently during the change-over period.

Advantages to the environment:

- almost no sulphur
- soot emissions 50% lower
- fewer pollutants (except for NOx +10%)
- no hazardous materials (water pollution class 1)
- biologically degradable
- positive energy balance (1:2 and 1:3 with straw)
- better lubricant properties in admixtures

It should be noted that pure plant oil (PPO) and biodiesel (B100) are not permitted as transport fuels in some European countries.

Characteristic		Diesel fuel	Refined rapeseed	Biodiesel
Calorific value	MJ/kg	40.6 – 44.4	37.6	37.2
Density at 20°C	kg/l	0.81 – 0.85	0.91	0.88
Vol. calorific value	MJ/l	35.2	34.4	32.7
Kin. viscosity at 20°C	mm ² /s	1.2 – 10	98	6.3 – 8.1
Ignitibility (centane number)	CN	>51	51	54

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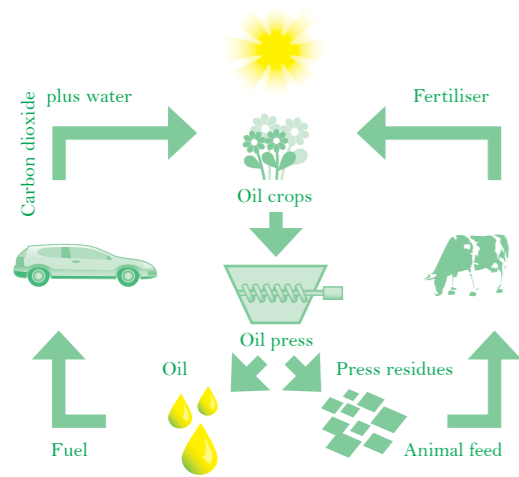
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Vegetable oil and Biodiesel

Fill up with the sun..... Vegetable oil and Biodiesel

Vegetable oil cycle

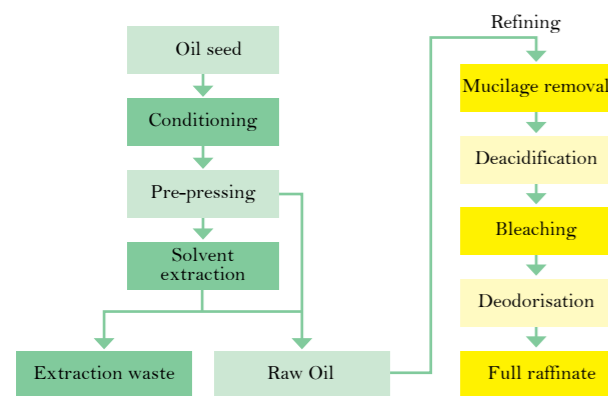


Bioenergy is a source of renewable energy, similar to sun energy, wind energy, hydroelectricity and geothermal energy. Through the energetic conversion of biomass, a CO₂-neutral energy source is tapped.

CO₂-neutral means that no more carbon dioxide is released than was taken up by the plant during the growth phase. As well as the issue of CO₂ reduction, another important factor is the finiteness of oil reserves as world demand continues to rise.

In the meantime European biodiesel production has risen to 7,750 million tonnes.

Oil production in (centralised) industrial oil mills



Source: TFZ, Use of rapeseed oil as fuel; 2008

Raw materials

Vegetable oils are extracted from the plants by pressing and it is mostly the seeds which have the highest oil content.

Well-known vegetable oils are rapeseed oil, sunflower oil, soybean oil, olive oil, jatropha oil, palm oil and peanut oil. The uses and the quality of vegetable oils are determined by the fatty acids that they contain, and not all vegetable oils are suitable for technical applications. The most important and productive vegetable oil plant in Europe is rapeseed (*Brassica napus* L.).

With rapeseed yields of 30 - 50 dt/ha and 40% oil content, about 1,600 litres of oil is produced for every hectare.

Rapeseed oil can be refined and purified for use as a fuel meeting specific quality requirements.

Manufacture

Two manufacturing procedures are available for the production of rapeseed oil: decentralised cold pressing which may take place on individual farms or cooperative enterprises, and centralised production in large industrial refineries.

Decentralised oil production (cold pressed)

There are two main stages in the processing of the rapeseed: the actual pressing of the cleaned rapeseed and the subsequent purification and filtering stage.

The water content of the seed should not exceed 7 - 8%.

Pressing takes place at a seed temperature of between 15 - 25°C, mainly in screw presses. In the decentralised process, output efficiencies of 75 - 85% can be achieved. In the next stage, the cloudy oil (with 0.5 - 6% solids by weight) is purified, either through sedimentation, filtration or centrifugation.

The press cake can be used on farms as a valuable protein feed.

Centralised oil production (refined)

The oilseed grains are cleaned and if necessary, dried, milled and thermally pretreated with steam so that the oil cells can be more readily broken.

By pre-pressing using a screw press, a large part of the oil can be obtained.

The so-called press cake left over after pressing still has a residual oil content of 10 - 25%. The subsequent chemical extraction process, at temperatures up to 80°C, is done using hexane, a light petrol, to enable the total extraction of more than 98% of the oil in the seed. After this, the oil is filtered and the hexane is separated and removed by distillation.

Because of the thermal treatment and chemical extraction, the oil contains some undesirable by-products. It is necessary to refine the oil to remove these by-products. The following processes are used: mucilage removal (for storage life and technical applications), deacidification (removal of free fatty acids), bleaching (removal of colourants) and deodorisation (removal of aromatic oils and flavours). The oil processed in this way is referred to as fully refined and has a number of applications, including as a fuel in suitably modified engines.

Biodiesel manufacture

For the manufacture of biodiesel from rapeseed, a further processing stage called esterification is needed in which methanol and catalysts are added to the raffinate. The term used to describe this - rapeseed methyl ester (RME) - gives an indication of the production process. Waste grease can also be used in this process and esterified to fatty acid methyl ester (FAME).

Glycerin is produced as a by-product.

Quality and properties

All transport fuels require a consistently high level of quality and the use of rapeseed oil fuel is no exception, if a trouble-free and environmentally-friendly engine performance is to be achieved. In contrast to the existing norm DIN EN 14214 for biodiesel (FAME), there is until now only the pre-norm (DIN 51605) which applies to rapeseed oil fuel.

PPO

(Pure Plant Oil), or straight vegetable oil, has clearly different properties to diesel fuel. Above all, the higher viscosity and higher flash point as well as the different combustion properties make it absolutely necessary to carry out an engine modification to existing vehicles in order to ensure a trouble-free performance.

Applications

Pure vegetable oil can only be used as a fuel in commercial vehicles following **engine modification**.

In general, mainly farm tractors and the vehicle fleets of large transport undertakings have converted to run on rape oil. For single-tank systems, the main modification is to the fuel delivery system (to enable cold starting). With dual-tank systems, the engine is started with diesel and only switches over to the rape oil fuel when it is operating at full load or is warmed up.

Advice on operating with rape oil:

- engine should run at full load as far as possible
- avoid long non-operating times
- shorter oil-change intervals
- proper storage of fuel

Typical problems with vegetable oil engines:

- defective injector pumps (injector nozzles)
- sticking valves because of depositions
- blocked filters because of poor rape oil quality
- soot deposits in air and exhaust pipes
- increased rape oil penetration in lubricating oil