

What is biodiesel?

In 1900, Rudolf Diesel demonstrated his unique compression ignition engine at the World Exhibition in Paris. In that prototype engine he used peanut oil as the combustion fuel, the first ever biodiesel.

Vegetable oils were used to fuel compression engines until the 1920's when an alteration was made to engine design enabling them to use a residue of petroleum distillation – or petroleum diesel or petro-diesel.

Although the diesel engine gained worldwide acceptance, biodiesel did not. As a function of superior price, availability, and government subsidies, petro-diesel quickly became the fuel of choice for the diesel engine.

In the mid 1970s, artificial fuel shortages and price hikes revived interest in using renewable fuels such as biodiesel. However, as the petroleum market stabilised after a massive increase in Middle Eastern production, biodiesel was again relegated to a curiosity and 'alternative lifestyle' status.

Over the past few years, once again, with the advent of real reductions in conventional reserves of crude oil and declining refining capacity in the oil and gas sector, biodiesel is being seen as a legitimate alternative. This time its use is being reinforced by increasing concerns about the spiralling use of fossil fuel causing global climate change and declining air and water quality, as well as serious human health consequences arising from these trends. This has added to the drive for the re-introduction of biodiesel, as a renewable, cleaner burning diesel alternative.

Modern biodiesel is typically manufactured by enhancing the chemical composition of vegetable, seed or animal fats and oils. The most commonly used starting materials include canola, soy, palm or coconut oils as well as used cooking oils (UCO) or animal tallow, a by-product from the meat processing industry.

In the past, biodiesel could not compete economically with petro-

diesel. However, regulatory support programs, a decline in world vegetable oil and tallow prices, the development of new technology as well as increasing petroleum prices have made biodiesel production economically viable in recent times. It is expected that its viability will increase substantially with its adoption by fuel retailers and end users alike.

The simplest starting material for conversion to biodiesel is canola oil and this is most commonly used in Europe due to local government subsidies on its production. As this subsidy does not exist in Australia, canola oil is more expensive and consequently used cooking oil and tallow are used in combination with canola or as a direct substitute.

The process of converting vegetable or animal oils into biodiesel is known as transesterification. This involves the removal, via a catalytic reaction, of the glycerol component from the triglyceride (oil or fat) and replacing it with alcohol groups. Transesterification produces a low viscosity, mono-alkyl ester that serves as an ideal substitute for petro-diesel. This process yields another valuable product called glycerol or glycerine, used for animal feed, pharmaceuticals and as an additive for many other products.

Recently the uptake of biodiesel around the world has been significant. In Europe, biodiesel consumption has on average almost doubled every two years since 1991, while global consumption is now estimated at approximately three billion litres per annum. However, its market penetration is still very low – for instance North Americans consume around 300 billion litres of diesel every year making world production of biodiesel barely 1% of this one market.

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