

ACEA Position

on the use of Pure vegetable Oils in compression-ignition engines

Introduction

ACEA, the European Automobile Manufacturer association, represents the 13 major European car, truck and bus manufacturers.

ACEA shares the opinion that the main challenges that the European Union is currently facing are the protection of the environment and improvement of air quality in urban areas, containment of the emission of greenhouse gases (GHG) with the aims of complying with the Kyoto protocol and ensuring the security of energy supply that today is highly dependant on crude oil.

Pure vegetable Oils are considered to be not suitable for use in compression-ignition engines

Vegetables oils have characteristics that have resulted in them being included in the list of potential alternatives to diesel fuel. But an in depth evaluation of the specific characteristics of pure vegetable oils shows that the direct use of pure vegetable oils in diesel engines **is not realistic**, especially in view of the evolution of the engine technology and the introduction of exhaust after-treatment systems in order to meet current and future emission requirements and emission durability requirements.

The vegetable oils most commonly available in Europe are those obtained from rape and sunflower seeds. These oils have complex molecules with a large number of carbon atoms (60 on average). The length of the carbon atom chain and the presence and location of double bonds between the carbon atoms confer its intrinsic characteristic to the vegetable oil. Rape-seed and sunflower-seed oils have higher density, higher viscosity, lower volatility and lower Cetane Number than conventional diesel fuel.

These characteristics have a direct impact on the spray formation and the combustion process. The start of combustion is delayed and combustion progresses at a slower rate. The heavy molecules, partially burned, give origin to deposits. Engine noise and particulate emissions increase.

At low temperatures the viscosity of the oil becomes excessive and engine starting becomes a problem.

The low volatility of vegetable oils promotes the dilution of the engine lubricant oil, especially at idle. This dilution has a negative impact on the engine life causing increased engine wear, cylinder wall scuffing and piston gumming.

The double links between carbon atoms lower the stability of the vegetable oils to oxidation when stored. Vegetable oils are also an excellent medium for microbial growth that can cause operational problems such as sediment build-up, premature filter plugging or tank corrosion.

Recent studies show that, when a modern diesel engine runs on pure rapeseed oil:

- CO emissions increase by a factor of 2.
- HC emissions increase by a factor of 4.
- NOx emissions are higher (+25%).
- PM emissions increase by 90% to 140%.
- PAH emissions also increase (by approximately 20%).

In addition, the following problems are often encountered:

- Unacceptable deposits on valves,
- Injector fouling which results in higher emissions,
- Deposits on pistons which reduce the lifetime of the engine

The energy content of vegetable oils is lower than that of diesel fuel. The use of vegetable oil will result in a loss in maximum power output.

A recent test programme carried out in Germany and involving 111 agricultural tractors equipped with engines less sophisticated than those installed on current heavy-duty commercial vehicles clearly highlights the consequences of using pure vegetable oils (rape-seed oil). Whilst modifications were implemented to adapt the engine to the use of the new fuel, during the programme:

- One tractor was declared no longer repairable,
- Eight tractors required repairs costing more than € 15,000,
- 36 tractors required repairs costing more than € 2,000,
- 35 tractors required repairs costing less than € 1,000,
- 31 tractors did not require any repair.

In conclusion:

Pure vegetable oils cannot be considered as an alternative fuel for the transport sector. ACEA advises heavy-duty vehicle and passenger car owners not to use pure vegetable oils or vegetable oil in blends with diesel fuel in their engines.

However, pure vegetable oils can be used in new refinery processes to produce high quality diesel fuel.