

# Alternative fuel for a standard diesel engine

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**Abstract:** Alternative fuels have been developed for the commercial diesel products Mkl and EN590. Appropriate additives were selected from a broad range of oxygenates including alcohols, acetals, ethers, esters, and nitrates by a process of systematic elimination. The resulting fuels called Biodiesel 15 meet all existing standards in force for diesel fuel, are stable, and have similar performance characteristics to standard diesel. Significantly Biodiesel 15 is much cleaner than standard diesel with around 30 per cent or more reductions in particulate matter in the exhaust emissions. Carbon dioxide (CO<sub>2</sub>) emissions are much lower with Biodiesel 15 than with standard diesel products. Other regulated emissions are on a par with Mkl. The fuel consumption of Biodiesel 15 is 2 per cent lower than that of conventional Mkl.

**Keywords:** alternative diesel fuel, oxygenates, diesel engine performance, diesel engine emissions, particulate emissions

## 1 INTRODUCTION

Industry worldwide has a strong incentive to develop alternative motor fuels to protect the environment and adhere to tighter emissions requirements. In 1997 in Kyoto, representatives from 105 states signed the Kyoto Protocol [1], which is designed to reduce excess carbon dioxide (CO<sub>2</sub>) emissions produced when burning oil, mineral gas, coal, and related products.

The combustion of motor fuels adds considerably to the imbalance of CO<sub>2</sub> in the atmosphere. Nitrogen and sulphuroxides (NO<sub>x</sub> and SO<sub>x</sub>) are also formed and cause the acidification of lakes and other fresh water supplies, affecting the vital functions of humans, animals, and vegetation. Finally, solid particles, which are the products of incomplete combustion, cause cancers in humans and animals.

The use of motor fuel components derived from renewable raw materials, so-called bi-components, enables a reduction of the harmful impact of burning fuel on the environment. Accordingly in 2003 the European Commission passed a directive [2] to

member states promoting the use of bi-components in motor fuel starting from 2005. The European Commission has also defined requirements on the amount of harmful pollutants in exhaust emissions of internal combustion engines, specifically for SO<sub>x</sub>, NO<sub>x</sub>, and particulates.

The stipulations of the directive are such that by 2010 the amount of harmful pollutants in exhaust emissions will reach an entirely new level. Clearly, reaching such a reduced level of harmful pollutants will require considerable investment from motor fuel producers. The existing inventory of vehicles and machinery with standard engines prevents the use of motor fuels consisting completely of bi-components within the time frame set by the European Commission. So it is evident that in the years to come the role of mixed fuels produced partly from petroleum and partly from renewable raw materials will grow considerably. Gasoline-ethanol blends for spark ignition (SI) engines and diesel mixtures containing methyl ethers of higher fatty acids for use in diesel engines are examples of this type of fuel.

The development and marketing of a diesel fuel containing bi-components, a biodiesel, is complicated by the standards requirements [3] for diesel fuel, which impose substantial restrictions on potential

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