



FUELS TEAM

SUMMARY: IMPACT OF FUEL ETHERS ON EVAPORATIVE EMISSIONS



A SMART BLEND
WITH 22% ETBE
IMPROVES
EMISSION BY 35%
COMPARED TO A
SMART
BLEND WITH 10%
OF ETHANOL



Impact of fuel ethers on evaporative emissions

Volatile organic compounds (VOCs) are a major component of pollutant emissions from gasoline-fueled road transport. Beside the exhaust emissions originating from the combustion process, VOCs can also arise from the vehicle's fuel system (i.e. storage tank) and are called evaporative emissions. These occur as a result of fuel volatility combined with the variation in ambient temperature and temperature changes in the vehicle's fuel system.

The use of fuel ethers such as ethyl tert-butyl ether (ETBE) as gasoline components contribute to the

decrease of evaporative emissions. In contrast to alcohols such as ethanol (EtOH), ethers reduce the overall vapor pressure of gasoline and accordingly lower related evaporative emissions. To investigate the impact of fuel ethers on fuel permeation loss in comparison to ethanol blends, five different test fuels were analyzed in so-called EU Diurnal Shed Tests. Thereby, a BMW ULK Tank (mini) filled with test fuel to 40% of the rated capacity was stored at 40°C in vehicle position for three to four weeks. After the soaking period, the fuel was renewed. Before the diurnal procedure, the actual measurement of the permeation loss, could be performed, the fuel tank was stored at room temperature for at least six hours as required by the EU Diurnal test procedure. This time reflects the duration in which the car is supposed to return to room temperature. Afterwards the above-described process was repeated for another 17 weeks and further 29/30 weeks soaking time. Even though the performance obtained with the applied kind of fuel tank for storage (BMW ULK Tank) cannot be transferred to all EU fuel tanks, it can be considered as representative for modern EU6 fuel tanks.

Table 1: Emission losses of tested fuels blended with either ethanol or ETBE.

Test fuel	Reid vapor pressure (measured) [mbar]	Emission loss* [mg/d]
EU6 E10 splash blend (contains approximately 10 vol% EtOH)	635	183
EU6 E10 smart blend (contains approximately 10 vol% EtOH)	582	184
EU6 ETBE10 splash blend (contains approximately 10 vol% ETBE)	496	191
EU6 ETBE10 smart blend (contains approximately 10 vol% ETBE)	577	180
EU6 ETBE 22 smart blend (contains approximately 22 vol% ETBE)	548	121

* average of 17 and 29 soaking weeks results

Table 1 gives an overview of the results obtained via the described testing program. The following

- Table 1 gives an overview of the results obtained via the described testing program. The following
- conclusions can be drawn from the measurements
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- - Emission losses of all tested fuels are below the maximum target set point of 300 mg/d for an UKL EU tank.
- - Reid vapor pressures of ETBE blended fuels are lower than their ethanol blended counterparts.
- - E10 smart blend shows similar behavior as the representative for EU 6D certification fuel.
- - Compared to EU6 – E10 fuel, blending 10% ETBE has only a minor effect on the emission loss.
- - A smart blend with 22% ETBE improves the BMW UKL emission by 35% compared to a smart blend with 10% EtOH.

ABOUT FUEL ETHERS

FUEL ETHERS, INCLUDING MTBE, (BIO)-ETBE, TAME AND TAE, ARE KEY COMPONENTS FOR THE PRODUCTION OF HIGH OCTANE FUELS. THEY ARE THE CLEAN REPLACEMENT FOR COMPOUNDS THAT POSE A PROVEN RISK TO HEALTH AND THE ENVIRONMENT. WHETHER MANUFACTURED FROM TRADITIONAL HYDROCARBONS OR RENEWABLE BIOMASS, FUEL ETHERS ARE MORE ENERGY DENSE THAN ALCOHOLS. THEY THEREFORE INCREASE PETROL'S PERFORMANCE, WHILE REDUCING THE EMISSIONS OF AIR POLLUTANTS AND CO₂ ACROSS THEIR LIFE-CYCLE.

