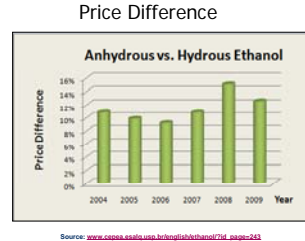
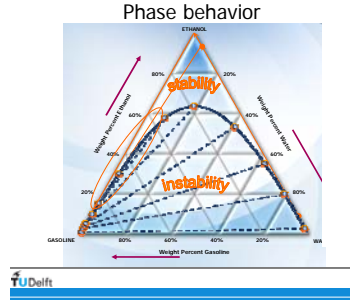


The effect of (hydrous) ethanol on the emission and performances of 2- and 4-stroke scooters

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The objectives of the present work are to investigate the limited and the unregulated emissions of a classical and modern 2-stroke and a typical 4-stroke scooter with different ethanol blend fuels. There was also comparison of two different ethanol fuels: pure ethanol (E) and hydrous ethanol (EH) which contains 3.9% water and is denaturated with 1.5% gasoline. Special attention is paid in this research to the hydrous ethanol, since the production costs of hydrous ethanol are much less than those for (dry) ethanol. The vehicles were with carburettor and without catalyst, which represents the most frequent technology in Eastern Asia and offers the information of engine-out emissions. Exhaust emissions measurements of three scooters with gasoline-ethanol blend fuels have been performed with fuels contained ethanol (E), or hydrous ethanol (EH) in the portion of 5, 10, 15 and 20% by volume. During the test systematical analysis of particle mass (PM) and nano-particles counts (NP) were carried out.



Added Value on Price:

- Cheaper ethanol
- Higher mileage
- CO₂ emission reduction
- No fuel tax on water
- Price delta:

12% of % ethanol content
3% overall at hE15 level
additional carbon credit in some countries

hE10 in the order of 4%
hE25 in the order of 6%
hE85 in the order of 10%

Investigated Hydrous Ethanol (EH): 3.9% water + 1.5% gasoline

Investigated Scooters

Piaggio Typhoon 2-S 50cc

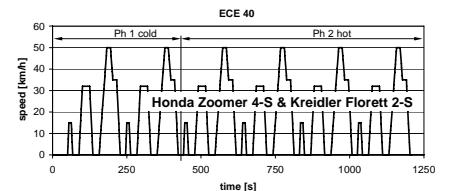
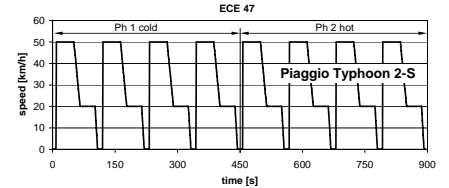
Kreidler Florett 2-S 50cc

Honda Zoomer 4-S 50 cc

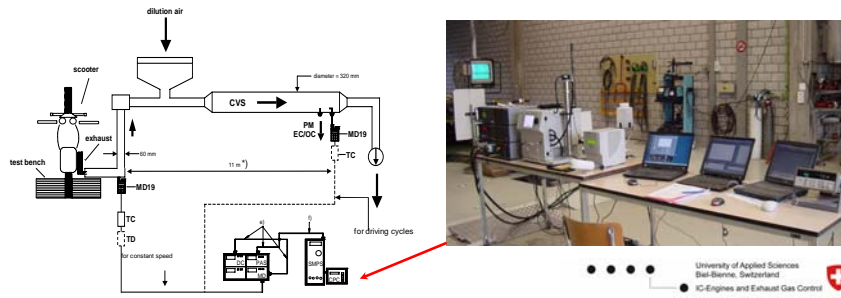


Driving Cycles

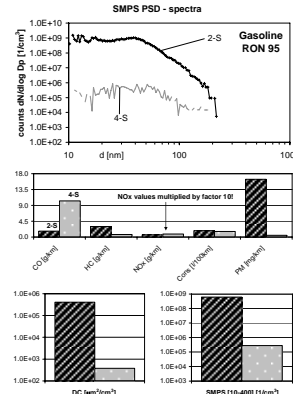
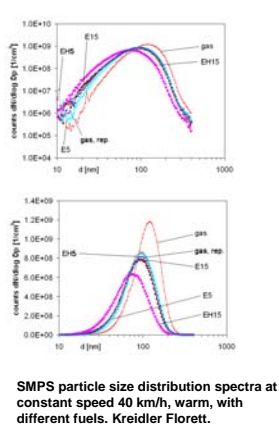
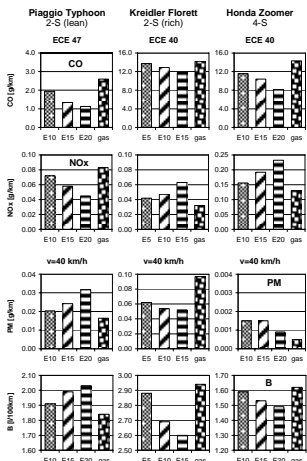
Driving cycles ECE 47 & ECE 40



Sampling & measuring set-up



Results / Comparisons



Comparison of emissions 2-S + 4-S at 40 km/h, warm.
2-S: Piaggio Typhoon, carb. no ox. cat.
4-S: Honda Zoomer, carb. no ox. cat.

Influences of ethanol on emission and fuel consumption of the investigated motorbikes.

The most important results are:

- there are no significant differences of results between the blends with pure ethanol (E), or hydrous ethanol (EH), except of some cases, where EH improves slightly the emissions (CO, HC, PM, NP) and reduces the fuel consumption,
- addition of ethanol to the gasoline provokes a leaner tuning of the engine operation,
- the operation of 4-S scooter was without problems, the leaning by ethanol caused:
lowering of CO, HC & fuel consumption, increase of NOx, no effect on PM and reduction of nanoparticles count concentrations especially at transient operation,
- for the investigated newer 2-S scooter with lean tuning the irregularities of combustion and loss of power were remarkable with higher ethanol content
(richer basic tuning of the newer 2-S scooter enabled a satisfactory driveability with E10),
- the older 2-S scooter showed good performances and reduction of CO and of fuel consumption up to E20, depending of vehicle type no impact on or reduction of (nano-)particles emissions.

The present investigations did not concern the durability of parts exposed to the chemical influences of ethanol. Also the cold start, particularly in extreme conditions and the lube oil dilution were not addressed.