

FURTHER INFORMATION ABOUT HIGH EVAPORATIVE EMISSIONS AND ITS
RELATION TO BLENDING OF ETHANOL INTO PETROL

Transmitted by the expert of Sweden

Regulation on evaporative emissions is a part of ECE R83 and also considered to be a part of WLTP. Evaporative emissions together with cold start emissions stand for an increasing proportion of the hydrocarbon emissions, while the proportion from hot emissions decreases. Today evaporative emissions account for one third of the emissions from road traffic in Sweden (not including refuelling emissions). In informal document GRPE-52-4 we reported about the problems with high evaporative emissions for the vehicles tested in the Swedish In Service Testing programme. Between 2002 and 2008 40 vehicles of 118 tested, or 34 percent, exceeded the limit of 2 grams in the type IV test. This can be compared to the results obtained in the corresponding programme in Germany where only 2 of the 19 vehicles tested (10 percent) failed to pass inspection. Based on these results and findings further investigations were started to analyse the evaporative emission of vehicles driven on Swedish roads.

One of the major differences between Sweden and Germany that could explain the results was the fuel quality. In Sweden the petrol contained 5 percent ethanol whereas in Germany the fuel didn't contain any ethanol at that time. A number of references point out the effect the ethanol has on both the capacity of charcoal canister and plastic materials. This suspicion was also proved to be right by results from some of the vehicle manufacturer's analysis. These showed high concentrations of ethanol in the charcoal canister.

A special project is also conducted where two similar vehicles are exposed for different fuel qualities. One of the vehicles uses the Swedish market fuel with 5 percent ethanol and the other uses reference fuel without ethanol. The vehicles are driven with the fuels up to 20 000 km. Evaporative emissions are measured in the beginning and in the end and charcoal canister capacity every 500 km.

During the Swedish In-service testing programme charcoal canister capacity was also measured. In most cases a low capacity could be connected to high evaporative emissions in the test. In some cases the capacity could however not explain the results. Also taking into account different tank materials gave better explanation of the results. Some tank materials show clear problems with permeation losses (see figure 1).

The permeation through the tank and pipes are influenced by the material. Factors influencing the charcoal canister capacity are size and geometry of canister and the quality of the carbon. Also the purge strategy is very important. Some vehicle types do hardly any purge during city driving and cold starts. This means that the system for preventing evaporative emissions does not work during conditions where it is most important for human health.

There are large global differences in the legislation on evaporative emissions. The US regulation includes durability testing, in service conformity and OBD for evaporative emission control. The European legislation does not contain anything of this. The only verification of the evaporative emissions control system in the European legislation is the type approval which, before the introduction of Regulation No. 715/2007, is done on reference fuel not containing any ethanol. The long term effects seen in this programme will not be prevented by going to a reference fuel containing ethanol during type approval. To prevent this either durability or in service conformity testing is needed.

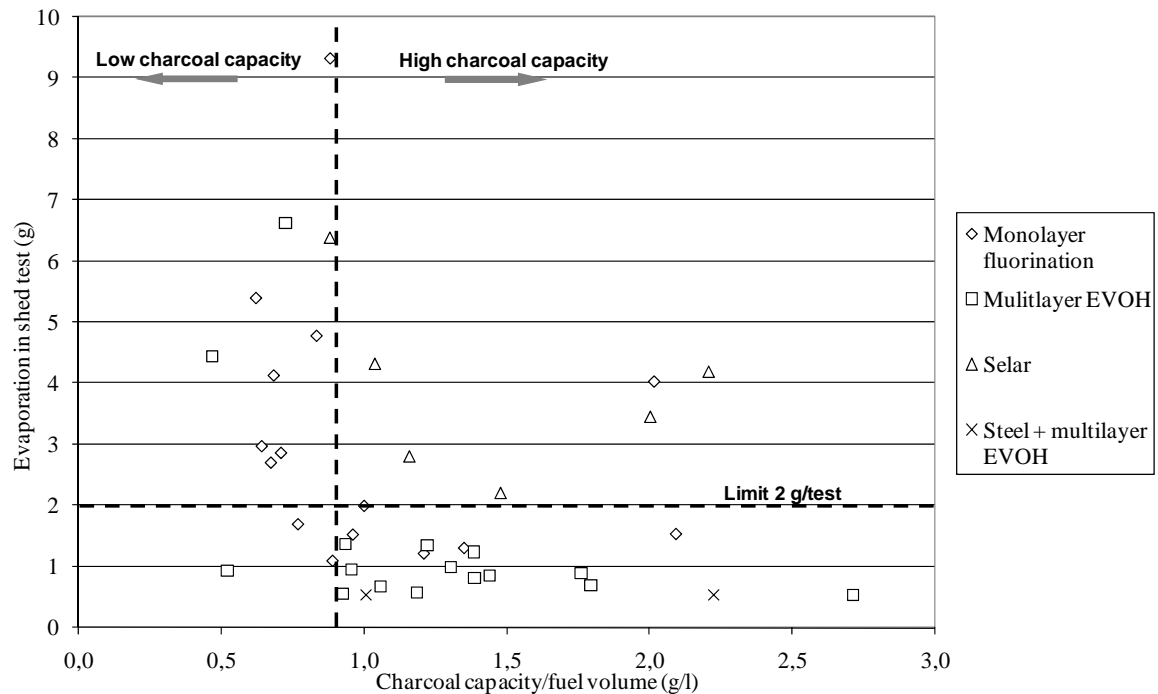


Figure 1 Results from the Swedish In-service testing programme 2006-2008. Measuring evaporative emissions during type IV test is done on reference fuel. According to the directive, before starting the measurement of evaporative emissions, the charcoal canister is purged with air until 300 bed volume exchanges are reached. After purging, the canister is weighed. Then the charcoal canister is loaded with a gas mixture composed of 50 % vol. butane and 50 % vol. nitrogen at a rate of 40 grams butane per hour till 2 grams of hydrocarbons breakthrough. After loading the canister it is weighed again. The difference of weight before and after loading gives the capacity of the charcoal canister to store hydrocarbons. The fuel volume is 40 percent of tank volume.
