ABSTRACT

Increasing emissions of particulate matter and ozone move the combustion of fuels with less pollution to the public agenda. Climate protection and decreasing resources demand savings of fossil fuels. In the last decades it could be demonstrated, that mixing fuel with water can reduce the amount of pollutants. However, most of these compound fuels were based on instable emulsions with short shelf lives, which, as a result, did not become accepted. A new, promising approach to overcome this problem is the use of microemulsions, whose main feature is their thermodynamically stability. Therefore, this work deals with the development of one phase diesel- and btl-microemulsions with bicontinuouse microstructures by systematically studying their phase behaviour. In particular, mixtures of a non-ionic ethoxilated fatty alcohol and ionic ammonia oleate fuel-microemulsions, which exhibit high temperature stability, were generated. The combustion of microemulsions with water ratios up to 45 % was analyzed at several engine test benches, employing diverse motors from a simple Hatzmotor up to modern VW-TDI and Deutz motors. The surprising result of the combustion experiments was the discovery of a more efficiency combustion of fossil fuel and as such a reduction of the CO_2 output of about 10 %. Concurrent the emissions of NO_x were decreased from 20 to 60 %. The carbon particulate matter was reduced dramatically up to the point of soot free combustion. Other measures to reduce pollutants of combustion result in a soot-NO_x-trade-off. By contrast, the simultaneous decrease of carbon particulate matter and NO_x found in this study is an exciting result. The technical applicability of the microemulsions could be demonstrated in first on-road tests. Thus, the use of fuel-microemulsions could contribute to sustainable developments inglobal climate protection and, on a local scale, the prevention of air pollution.