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The properties of rewenable diesel bring further possibilities for emission reduction

Title of the dissertation	Alternative Fuels and Emission Control Methods in Compression Ignition Engines
Contents of the dissertation	The properties of modern renewable diesel (HVO) fuel differ from those of fossil diesel and traditional biodiesel. In contrast to biodiesel, close to 100% blend of renewable diesel can be used in modern diesel engines without operation problems. Typically, HVO lowers emission as such. However, further emission reductions can be achieved by tuning the parameters of the engine and its aftertreatment system to utilize HVO characteristics such as high ignitability. In the thesis, the effects of engine intake and exhaust valve timing changes with pure HVO were studied. Additionally, diesel oxidation catalyst (DOC) functioning and oil dilution during diesel particulate filter (DPF) regeneration by late post-injections were studied with biofuel blends. The research included engine tests, simulations and optical fuel spray measurements. Based on the research, significant optimization possibilities of engine and aftertreatment parameters with renewable diesel fuels were found. By changing the valve timings, up to ~50% nitrogen oxide (NOx) emission reductions with no adverse effects on particulate (PM) emissions or fuel consumption were achieved. Optionally, simultaneous over 30% reductions of both NOx and PM emissions could be reached. The oil dilution changes related to the post-injections were very similar with 30% HVO blend and standard fossil diesel. 30% blend of traditional biodiesel significantly increased the oil dilution. This was mainly attributed to distillation property differences of the fuels, as no significant fuel spray divergences were measured between the fuel blends. Additionally, with biodiesel blend, a need for higher LPI doses to achieve the required DPF regeneration temperature was observed.
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