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Research Paper

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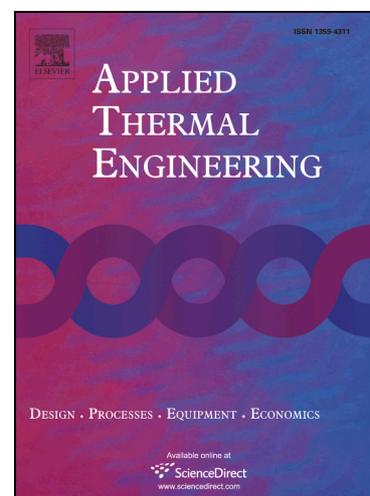
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## A comparative study of co-combustion process of diesel-ethanol and biodiesel-ethanol blends in the direct injection diesel engine

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### Abstract.

This paper presents the results of a comparative analysis of co-combustion of diesel and biodiesel fuels with hydrated ethanol. The engine tests were conducted for an on-cylinder natural aspirated compression ignition engine operated at a constant rotational speed of 1500 rpm. Experimental investigations were also conducted to evaluate the effects of using hydrated ethanol as additives to diesel or biodiesel fuels to enhance performance, emission and combustion characteristics of direct injection diesel engines. The test engine powered by a diesel-ethanol blend (DE) was compared to a biodiesel-ethanol (BE) blend, characterized by higher values of IMEP and ITE. In the case of the DE blend, the highest ITE value was obtained for 35% of the ethanol fraction (35%). As for the BE blend, similar ITE values (31%) were obtained over the entire range of the ethanol fuel fraction in the blend. In the case of pure B100 or D100 the ignition delay achieves near the same value equal to 17 deg. The lower unrepeatability of engine cycle obtained for the BE blend combustion did not exceed 10%. The highest NO<sub>x</sub> emissions were obtained for the DE blend with 30% of the EF fraction (5.5 g/kWh). Emissions of THC and NO<sub>x</sub> increase up to 35% of the EF fraction in blend.

**Keywords:** combustion, diesel engine, emission, blend, ethanol

### Highlights:

- Diesel/biodiesel ethanol co-combustion.
- Comparison of co-combustion effects of diesel and biodiesel blends.
- The effect of ethanol on emissions and combustion in co-combustion with diesel and biodiesel is investigated.
- Ignition delay increases and combustion duration decreases by ethanol addition.

### Abbreviations:

- CA – crank angle, deg,
- CD – combustion duration, deg,
- CI – compression ignition,
- COV – coefficient of variation, %,
- EF – ethanol fuel,
- FSR – full range of A/D converter,
- IC – internal combustion,
- ID – ignition delay, deg,
- IMEP – indicated mean effective pressure, bar,
- ITE – indicated brake thermal efficiency, %,
- LHV – lower heating value, MJ/kg,
- MFB – mass fraction burned, %,
- SFC – specific fuel consumption, g/kWh,
- TDC – top dead center,
- i – sequence number of engine cycle,

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