# The Effects of MVCO Injections and Conventional Fuel Injections in a High Speed Direction Injection Engine

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## Abstract

Modifications to the KIVA code are introduced to the code for better capability with biodiesel simulations for an optically accessible engine. These include the extended Z'eldovich mechanism for describing the formation of nitrogen oxide. The Hiroyasu model and the Nagle-Strickland-Constable model are combined for evaluating soot emissions. The Shell model, with adjustment appropriate for biodiesel simulations, is used for low temperature combustion. Blended fuels are simulated using a multi-component model. The fuel library is also expanded to include properties of soybean biodiesel using BDProp. The operations of a small bore high speed direct injection (HSDI) engine with a MVCO injector with various blends of biodiesel and diesel fuels is studied. The modified KIVA code is shown to predict the major combustion characteristics include the peak combustion temperature, heat release rate and ignition timing, so is nitrogen oxide emission, using a conventional common rail fuel injector very well for all the fuels considered. The fuel blends tend to have lower emission, consistent with the general observation for the later. Due to the longer ignition delay for the initial injection of the cylinder, the cylinder is under lower temperature upon main injection with biodiesel and its blends. This might explain the lower nitrogen oxides emissions by biodiesel.

Key words: Biodiesel, MVCO, $NO_x$ emission, Soot emissions, Variable angle.