

# 14<sup>th</sup> World Bioenergy Congress and Expo

June 06-07, 2019 | London, UK

## Utilization of higher alcohols to CI engines – A review

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The alcohols which could be used for automotive fuels were methanol, ethanol, propanol and biobutanol. However, recently the utilization of long-chain alcohols such as pentanol, hexanol, octanol, dodecanol and phytol has recently received significant attention as alternative fuels for diesel engines because they emit less greenhouse gases and harmful pollutants. Pentanol (C<sub>5</sub>H<sub>11</sub>OH) is one of higher alcohol with five carbons in its structure and has big potential as a blending agent with diesel fuel because of its high energy density, high cetane number, better blend stability and less hygroscopic nature than other widely studied lower alcohols such as methanol, ethanol and butanol. For the chemical kinetic oxidation models for pentanol isomers, fourteen detailed kinetic mechanism were developed, and five reduced kinetic mechanisms were suggested. Binary blends such as diesel/pentanol and biodiesel/pentanol, ternary blends such as diesel/biodiesel/pentanol were widely studied in the conventional diesel engine. The pentanol/diesel blends coupled with EGR technology could simultaneously reduce NO<sub>x</sub> and soot emissions from CI engine. Further, diesel/pentanol blends generally produced higher CO and HC emissions than diesel fuel. However, CO and HC emissions were significantly reduced by mixing the cetane improver with the blends. Upto 45%~50% n-pentanol/diesel blends can be safely used in diesel engines without any engine modification or any additive. Very few information related to the application of pentanol to advanced CI engine is available in the literature. For ternary blends, diesel/biodiesel/pentanol blends were mainly studied by many investigators. The emission characteristics in CI engines in terms of CO, HC NO<sub>x</sub> and smoke opacity showed the different trend according to the pentanol proportion in ternary blends. Two different ways of hexanol such as co-surfactants and as blending agent include in the application of hexanol in diesel engine. Hexanol can replace diesel by up to 50% by volume and octanol can be used as neat octanol, octanol (up to 40%)/diesel blends, ternary blends and surfactants. Dodecanol upto 1.5% was employed as co-solvent to prevent the separation between ethanol or methanol and diesel phytol can be used as a blending agent by up to 20% in diesel engine. Fuel oil can be included in the higher alcohols because it is the mixture of mainly three alcohols of isopentanol, iso-butyl alcohol and ethyl alcohol. However, it will not be discussed here because it was used as a blend agent in SI engines.

## Biography

Soo-Young No has his expertise in atomization and sprays, combustion and emission characteristics in applying the liquid biofuels to internal combustion engines, particularly compression ignition engines. The review papers on liquid biofuels published by him include the biodiesel obtained from inedible vegetable oils, alcohols such as methanol, ethanol and butanol, bio-oil, straight vegetable oil, BTL diesel, hydrotreated vegetable oil. Further, the book titled on "Application of Liquid Biofuels to Internal Combustion Engines" written by him will be published on June 2019 at Springer.

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